NEVADA REGIONAL HAZE STATE IMPLEMENTATION PLAN

A Plan for Implementing
Section 308 (40 CFR § 51.308)
of the Regional Haze Rule

State of Nevada
Division of Environmental Protection
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NOTE TO READERS

Nevada's Regional Haze State Implementation Plan (SIP) 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. The SIP is based on data that existed as of January 5, 2009 with one exception. In response to public comments, Nevada re-evaluated the Best Available Retrofit Technology emission limits for SO_2 at NV Energy's Reid Gardner facility. The limits were lowered based on 2009 data. This document is the initial step in a sequential planning effort working toward achieving the national goal of returning to natural visibility conditions in mandatory Class I areas by 2064.

Nevada's Regional Haze SIP 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.wrapair.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 SIP. 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.

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The supporting technical information in this plan was assembled with the assistance of the WRAP staff, member states and their consultants, the Western Governor's Association, and the Western States Air Resources Council. In addition, NV Energy, Southern California Edison and Nevada Cement provided BART analyses for their sources.

EXECUTIVE SUMMARY

REGULATORY HISTORY

In 1977, Congress amended the Clean Air Act (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 United States Environmental Protection Agency (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, only one area was designated: the Jarbidge Wilderness Area (Jarbidge WA) in the northeast corner of the state.

On December 2, 1980, USEPA promulgated regulations to address visibility impairment that is “reasonably attributable” to a single source or small group of sources. These regulations represented the first phase in addressing visibility impairment; action on regional haze was deferred. In 1990, the act was amended to require that regional haze issues be addressed. Subsequently, USEPA adopted phase II visibility rules, or the Regional Haze Rule (RHR), thereby establishing a comprehensive visibility protection program for Class I federal areas.

The intent of the RHR is to improve visibility over the next 55 years 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. This document is Nevada’s *Regional Haze State Implementation Plan* (RH SIP) and has been prepared to meet the requirements of the federal RHR as codified in Title 40 of the Code of Federal Regulations (CFR) Part 51 Section 308.

REGIONAL HAZE STATE IMPLEMENTATION PLAN REQUIREMENTS

The RHR covers a long period, broken into several planning phases to ultimately meet the national visibility goal by the year 2064. The approach taken in preparing this RH SIP is to set the initial planning period (2008 through 2018) as the “foundational plan” for the subsequent planning periods. Though national visibility goals are to be achieved by the year 2064, this plan meets the requirements of improving visibility for the most impaired days and ensuring no degradation in visibility for the least impaired days for the period ending in 2018, the first planning period in the federal rule.

Nevada’s RH SIP has been prepared by the Nevada Division of Environmental Protection (NDEP) and contains strategies and elements related to each requirement of the federal rule. The SIP is based on data that existed as of January 5, 2009 with one exception. In response to public comments, Nevada re-evaluated the Best Available Retrofit Technology (BART) emission limits for SO_2 at NV Energy's Reid Gardner facility. The limits were lowered based on 2009 data.

The appendices at the end of this document provide additional information, including new Nevada Administrative Code (NAC) associated with this plan and evidence of public participation, along with public comments and NDEP responses to those comments. Technical support documents and reference material (technical analyses and reports) prepared by the Western Regional Air Partnership (WRAP), the Regional Planning Organization (RPO) designated by USEPA to assist western states in the development of regional haze plans, and other sources are linked in the text to the web site where they are publicly available.

A brief summary, organized according to the regional haze program requirements in 40 CFR 51.308, of how Nevada has fulfilled the requirements of the RHR for the first planning period and how Nevada intends to fulfill future requirements follows.

Reasonable Progress Goals and Calculations of Baseline and Natural Visibility Conditions

The RHR at 40 CFR 51.308(d)(1) requires the state, for each mandatory Class I area within the state, to establish reasonable progress goals that will achieve the national goal of a return to natural visibility conditions by 2064. 40 CFR 51.308(d)(2) requires the state to calculate baseline, current and natural visibility conditions, which in turn are used to calculate the uniform rate of progress (URP) per year necessary to achieve natural conditions by 2064. States are directed to show graphically what would be the URP for each mandatory Class I area within the state. To develop the URP, or glidepath, states must determine baseline visibility conditions for the period 2000 through 2004 and natural background visibility conditions in 2064.

Visibility conditions and the glidepath for the Jarbidge WA are presented in Chapter Two. The baseline visibility condition for the period 2000 through 2004 for the 20 percent worst days is 12.07 deciviews (dv) and 2.56 dv for the 20 percent best days. The natural background visibility condition at Jarbidge is estimated to be 7.87 dv for the 20 percent worst days and 1.14 dv for the 20 percent best days. The URP value for the planning period ending in 2018 for Jarbidge WA is 11.09 dv.

Analysis of baseline period monitoring data at Jarbidge WA shows that organic matter carbon (OMC) and elemental carbon (EC) extinction account for more than 45 percent of the total average annual reconstructed extinction for the 20 percent worst days. Coarse and fine particle mass (CM and SOIL) extinction account for an additional 30 percent. Approximately 20 percent of the annual extinction budget results from the formation of ammonium sulfate (sulfate) and ammonium nitrate (nitrate) due to emissions of sulfur oxides (SO_x) and nitrogen oxides (NO_x) from predominantly anthropogenic sources. Based on these findings, NDEP concludes that windblown dust and natural fire emissions contribute significantly to visibility impairment at the Jarbidge WA. The data suggest that visibility improvement due to emissions reductions of SO_x and NO_x from anthropogenic sources may be overwhelmed by emissions from natural sources, in particular seasonally variable OMC and CM, as well as EC and SOIL.

Visibility modeling was used to determine the expected 2018 visibility improvements resulting from existing federal and state air quality regulations in effect by 2018. This modeling included a limited assessment of the impacts of applying BART to BART-eligible coal-fired electric generating units to achieve the presumptive limits for sulfur dioxide (SO_2). The modeling results are presented in Chapter Four. Modeling shows that as a result of regulatory requirements at the local, state and federal levels during the planning period of this SIP, emission reductions will result in greater visibility improvement than the URP value for the Jarbidge WA in 2018.

The demonstration of reasonable progress requires setting goals for the 20 percent worst and the 20 percent best days in each Class I area, based on an evaluation of how BART and other regional haze strategies will reduce emissions and improve or protect visibility. Chapter Six of this plan describes the reasonable progress demonstration in detail. Nevada has determined that implementation of BART and the federal, state and local programs included in the 2018 visibility modeling represents reasonable progress in Nevada for the initial regional haze planning period. Nevada actually exceeds URP requirements for the Jarbidge WA in 2018 and meets its share of emission reduction obligations at out-of-state Class I areas. It is not necessary to consider additional emission controls on non-BART Nevada sources at this time. It is appropriate to evaluate additional reductions in the future for later planning periods in order to sustain a consistent glidepath toward the 2064 goal.

Long-term Strategy for Regional Haze

The RHR at 40 CFR 51.308(d)(3) requires the state to submit a long-term strategy that addresses regional haze visibility impairment at all mandatory Class I areas that may be impacted by emissions from the state. The strategy must include enforceable emissions limitations, compliance schedules and other measures as necessary to achieve the state's reasonable progress goals. As part of the technical basis for the long-term strategy, the state must identify its baseline emissions inventory and all anthropogenic sources of visibility impairment. This SIP covers long-term strategies for visibility improvement between baseline conditions and visibility conditions projected for 2018.

Chapter Three describes Nevada's baseline and 2018 emissions inventories and analyzes the sources of visibility impairment by source category. Total emissions for all visibility impairing pollutants in 2018 are projected to be 1,336,811 tons. Of that total, 27 percent are from anthropogenic sources; 73 percent are from natural sources. Emissions from natural sources are considered uncontrollable. Of the eight visibility impairing pollutants analyzed, anthropogenic sources are important contributors to three of them: SO_x, NO_x, and NH_3. SO_x emissions in Nevada come predominantly from point and area sources, 61 and 31 percent, respectively. NO_x emissions come predominantly from point sources, approximately 50 percent; mobile sources account for another 27 percent. NH_3 emissions come predominantly from area sources, 59 percent, with another 23 percent from on-road mobile sources. Volatile organic compounds (VOC), primary organic aerosol (POA), EC, PM fine and PM coarse emissions are dominated by natural source categories, and those source categories are not controllable.

Chapter Four presents the results of visibility and source apportionment modeling, which show that the Jarbidge WA will meet the URP value for 2018. The modeling results and technical analyses indicate that, although Nevada sources contribute to visibility impairment at the

Jarbidge WA and Class I areas located in adjacent states, sources outside the State of Nevada have the greatest impact on regional haze at Jarbidge WA. Furthermore, regional weighted emissions potential analyses show the significant role of emissions from windblown dust, fugitive dust and natural fire in visibility impairment at the Jarbidge WA.

The 2018 Particulate Matter Source Attribution Tracking modeling demonstrates that “Outside Domain,” or boundary conditions, emissions comprise almost 44 percent of the total sulfate at Jarbidge WA -- four times greater than any other regional source. Nevada’s contribution is less than six percent. Sulfur oxide emissions from point, area and natural fire sources each contribute approximately one third to visibility impairment at Jarbidge WA. For nitrate, Idaho is the largest regional source contributor; about 30 percent. Nevada contributes approximately 13 percent. Point, mobile and area source emissions contribute the most to nitrate, with a much smaller portion from natural fire emissions.

Nevada evaluated its contribution to visibility impairment at Class I areas in adjacent states: Arizona, California, Idaho, Oregon and Utah. Nevada calculated the visibility reductions needed at these Class I areas to achieve the 2018 URP; the percentage of the needed reduction achieved; Nevada’s emissions reduction share; the contribution of Nevada emissions to sulfate and nitrate extinction; the percentage change in Nevada’s emissions from baseline to 2018; and the percentage change in Nevada’s weighted emission potential from baseline to 2018. The percentage of Nevada’s state-wide emissions reductions exceeds the percentage of Nevada’s contribution to visibility impairment at all impacted Class I areas. Therefore, the state meets its share of emission reduction obligations necessary for achieving reasonable progress in each mandatory Class I area it affects.

Nevada’s long-term strategy is presented in Chapter Seven and comprises all of the “on-the-way” and “on the books” control programs and federal, state and local rules discussed in Chapter Six together with additional control programs discussed in Chapter Seven and the BART requirements found in Chapter Five. In developing this strategy, Nevada considered ongoing control programs, measures to mitigate construction activities, source retirement and replacement schedules, smoke management techniques for agriculture and forestry and enforceability of specific measures as required by 40 CFR 51.308(d)(3).

Nevada has numerous existing emission control programs to improve and protect visibility in Class I areas. Generally, Nevada considers its New Source Review (NSR) and Prevention of Significant Deterioration (PSD) programs meet the long-term strategy requirements for preventing future visibility impairment from proposed major stationary sources or major modifications to existing facilities. Nevada’s continued implementation of NSR requirements, with FLM involvement for Class I area impact review, will protect the least impaired days from further degradation and will assure that no Class I areas with a potential to be impacted by Nevada emissions will experience degradation from a new source or a major modification of an existing source.

As noted above, for the planning period of this SIP, visibility modeling shows that emission reductions resulting from the implementation of regulatory requirements at the local, state and federal levels will provide greater visibility improvement than the URP for the Jarbidge WA in

2018. Furthermore, Nevada is meeting its share of emission reduction obligations at mandatory Class I areas that it affects in neighboring states. The RHR requires an evaluation every five years of reasonable further progress. Nevada will evaluate reasonable further progress for the Jarbidge WA on this schedule and, if necessary, revise its long-term strategy as appropriate.

Monitoring Strategy, Emission Inventory, Recordkeeping and Reporting

The RHR at 40 CFR 51.308(d)(4) requires the state to develop a monitoring strategy for measuring, characterizing and reporting regional haze visibility impairment that is representative of all mandatory Class I areas within Nevada. This strategy must also coordinate with the monitoring strategy required in 40 CFR 51.305 for reasonably attributable visibility impairment, as well as provide for a variety of other requirements designed to evaluate reasonable progress toward meeting national visibility goals.

Nevada's monitoring strategy is presented in Chapter Eight. Visibility conditions in mandatory Class I areas throughout the United States are presently measured by the Interagency Monitoring of Protected Visual Environments (IMPROVE) monitoring network, which is operated and maintained through a formal cooperative relationship between USEPA and Federal Land Manager (FLM) agencies. Nevada's regional haze monitoring strategy relies on information generated through the IMPROVE network for the Class I area at the Jarbidge WA. Nevada commits to continue using the IMPROVE monitoring data and to update Nevada's emissions inventory periodically, as required by the RHR. The inventory updates will be used for state tracking of emission changes and trends, to provide input into the evaluation of whether reasonable progress goals will continue to be achieved at Jarbidge WA and for other regional analyses.

40 CFR 51.305 requires states to develop a strategy for monitoring reasonably attributable visibility impairment in its Class I areas. To satisfy this requirement, Nevada is subject to a federal visibility protection plan (visibility FIP). Nevada's regional haze monitoring strategy will coordinate with Nevada's visibility FIP by continuing to use the data collected by the IMPROVE program and will promote reasonable progress toward the national visibility goal.

The RHR at 40 CFR 51.308(d)(4)(v) requires a statewide emission inventory of pollutants that are reasonably anticipated to cause or contribute to visibility impairment in any mandatory Class I area. Several emission inventories were prepared by the Regional Modeling Center for the WRAP as part of the regional haze effort. Chapters One and Three discuss the development of these inventories and the baseline and projected emissions for SO_x (particulate and gaseous phases), SO_2 (gas phase only), NO_x, VOC, POA, EC, PM fine, PM coarse and NH_3 in Nevada.

Nevada commits to continue developing emission inventory data to allow for tracking emission increases or decreases as related to regional haze as funding and resources allow. Information collected will be made available periodically, as required by the RHR.

Best Achievable Retrofit Technology

The RHR at 40 CFR 51.308(e) requires states to determine BART and compliance schedules for each BART-eligible source in the state that emits any air pollutant that may reasonably be anticipated to cause or contribute to impairment of visibility in any mandatory Class I federal area. Section 169A(b) of the CAA defines BART-eligible sources as sources in 26 specific source categories, in operation within a 15-year period prior to enactment of the 1977 PSD rules. States must determine BART according to five factors set out in section 169A(g)(2) of the CAA. Emission limitations representing BART and schedules for compliance with BART for each source subject to BART must be included in the state's long-term strategy.

Nevada's RH SIP fulfills the requirements of 40 CFR 51.308 (e)(1); Chapter Five describes the BART determination in detail. The BART analyses conducted by Nevada were based, in part, on an assessment of many of the same factors (including the 4-factor analysis) that must be addressed in establishing the reasonable progress goal. Four facilities, comprising 10 units, are subject to BART: NV Energy's generating stations at Tracy (units 1, 2 and 3), Ft. Churchill (units 1 and 2) and Reid Gardner (units 1, 2 and 3); and Southern California Edison's generating station at Mohave[1] (units 1 and 2). The control requirements imposed by Nevada's BART determinations satisfy the reasonable progress goal-related requirements for source review in the first planning period.

A substantial reduction in NO_x, SO_2 and PM_{10} emissions are anticipated upon installation of Nevada BART controls. Emissions reductions resulting from the installation and operation of BART at these sources are estimated to be greater than 20,000 tpy for NO_x, greater than 40,000 tpy for SO_2 and greater than 4,000 tpy for PM_{10}. Nevada will not require non-BART sources to install and operate new emissions controls in the first planning period of the RHR.

Periodic Revisions and Reports; Adequacy Determination

The RHR at 40 CFR 51.308(f)-(h) requires RH SIP revisions every ten years, reports describing progress towards the state's reasonable progress goals every five years and a determination of the adequacy of the SIP along with the five year reports. In Chapter Nine, Nevada commits to fulfill each of these requirements and each of the elements therein, as funding and resources allow.

State and Federal Land Manager Coordination

The RHR at 40 CFR 51.308(d)(1)(iv) and (d)(3)(i) requires states to coordinate with other states during the development of reasonable progress goals and emission management strategies. Nevada has met these requirements through participation in the WRAP and commits to continue to coordinate via the WRAP or other means in Chapter Nine. In the WRAP process, Nevada participated in various forums and workgroups to help develop a coordinated emissions inventory and analysis of the impacts that sources have on regional haze in the west. Coordination and evaluation of monitoring data and modeling processes were also overseen by WRAP participants. Although not a formal member, Nevada has been an active participant in

[1] On June 10, 2009, after the cutoff date for incorporating new information into this SIP (January 5, 2009), the owners of the Mohave Generating Station announced the decision to decommission the station and remove the generating facility from the site. This new information is noted at relevant places in the SIP, but the SIP has not been revised to incorporate this information.

the WRAP since its inception, and in the forums, workgroups and committees that were formed to address many elements of the SIP.

40 CFR 51.308(i) further requires states to coordinate with FLMs in developing the RH SIP. States must provide a contact to whom FLMs can submit recommendations on the implementation of the RHR; provide FLMs an opportunity for consultation at least 60 days prior to holding any public hearing on the SIP; provide a public record of how the state addressed any FLM comments; and provide procedures for continuing consultation with FLMs on the implementation of the state's RH SIP.

Chapter Nine describes Nevada's coordination and consultation with FLMs for this SIP and our commitment to continued coordination. Again, participation in the WRAP fulfills a significant portion of the consultation requirements with FLMs. This included an opportunity to discuss their assessment of visibility impairment at the Jarbidge WA and to provide recommendations on reasonable progress goals and the development and implementation of visibility control strategies. A draft of Nevada's RH SIP was provided to the FLMs with a 60-day comment period prior to the public hearing on the SIP. FLM comments and Nevada's responses are found in Appendix C. Additional FLM comments and other public comments on the RH SIP submitted during the public comment period are included in Appendix D, together with NDEP's responses.

Nevada commits to continued participation with the WRAP as long as it exists and to coordinating future plan revisions with other states in addressing regional haze. Involvement with the WRAP will contribute significantly to Nevada's inter-state coordination for future SIP revisions and progress reports.

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Acronyms, Abbreviations and Terms

Anthropogenic	Caused or produced by humans
BACT	Best Available Control Technology
BART	Best Available Retrofit Technology
Base02	2002 actual baseline emissions
Base18	2018 base case emissions
CAA	Clean Air Act
CAIR	Clean Air Interstate Rule
CAMD	Clean Air Markets Division
CAM_x	Comprehensive Air Quality Model with Extensions
CENRAP	Central Regional Air Planning Association
CFR	Code of Federal Regulations
CIRA	Cooperative Institute for Research in the Atmosphere
CM	Coarse matter
CMAQ	Community Multi-Scale Air Quality model
CO	Carbon monoxide
COHA	Causes of Haze Assessment
dv	Deciview; a measure of light extinction
EC	Elemental carbon
EDMS	Emissions Data Management System
EGAS	Economic Growth Analysis System
EGU	Electric generating unit
EI	Emissions Inventory
EIA	Energy Information Administration
FETS	Fire Emissions Tracking System
FGR	Flue gas recirculation
FIP	Federal Implementation Plan
FLM	Federal Land Manager
Glidepath	The linear rate of improvement sufficient to attain natural conditions by 2064
HI	Haze index
IMPROVE	Interagency Monitoring of Protected Visual Environments
IWG	Implementation Work Group
JARB1	IMPROVE monitoring site at Jarbidge Wilderness Area
lb/MMBtu	Pounds per million British thermal units

LNB	Low NO_X Burners
LTS	Long term strategy
MACT	Maximum Achievable Control Technology
Mm^{-1}	Inverse mega meter; a measure of particle extinction
MM5	Meteorological Mesoscale 5
MW	Megawatt
NAC	Nevada Administrative Code
NDEP	Nevada Division of Environmental Protection
NEI	National Emission Inventory
NH_3	Ammonia
NMHC	Non-Methane Hydrocarbons
NOAA	National Oceanic and Atmospheric Administration
NO_3	Ammonium nitrate or NH_4NO_3
NO_x	Nitrogen oxides
NSR	New source review
NTEC	National Tribal Environmental Council
O_3	Ozone
OMC	Organic matter carbon
Plan02	2000 through 2004 typical baseline emissions
PM	Particulate matter
PNG	Pipeline natural gas
POA	Primary organic aerosol
ppm	Parts per million
PRP	Preliminary Reasonable Progress
PRP18	2018 Preliminary Reasonable Progress Emissions
PSAT	Particulate Matter Source Attribution Tracking
PSD	Prevention of significant deterioration
RHR	Regional Haze Rule
RMC	WRAP's Regional Modeling Center
ROFA	Rotating over fire air
RPG	Reasonable progress goal
RPO	Regional Planning Organization
RRF	Relative Response Factors
SCC	Source Classification Code
SIP	State implementation plan

SNCR	Selective non-catalytic reduction
SOA	Secondary organic aerosols
SOIL	Fine soil
SO_2	Sulfur dioxide
SO_4	Ammonium Sulfate or $(NH_4)_2SO_4$
SO_x	Sulfur oxides
TSS	Technical Support System
TSSA	Tagged Species Source Apportionment
URP	Uniform rate of progress
USEPA	United States Environmental Protection Agency
VOC	Volatile organic compound
WA	Wilderness Area
WEP	Weighted emissions potential
WESTAR	Western States Air Resources Council
WGA	Western Governor's Association
WRAP	Western Regional Air Partnership

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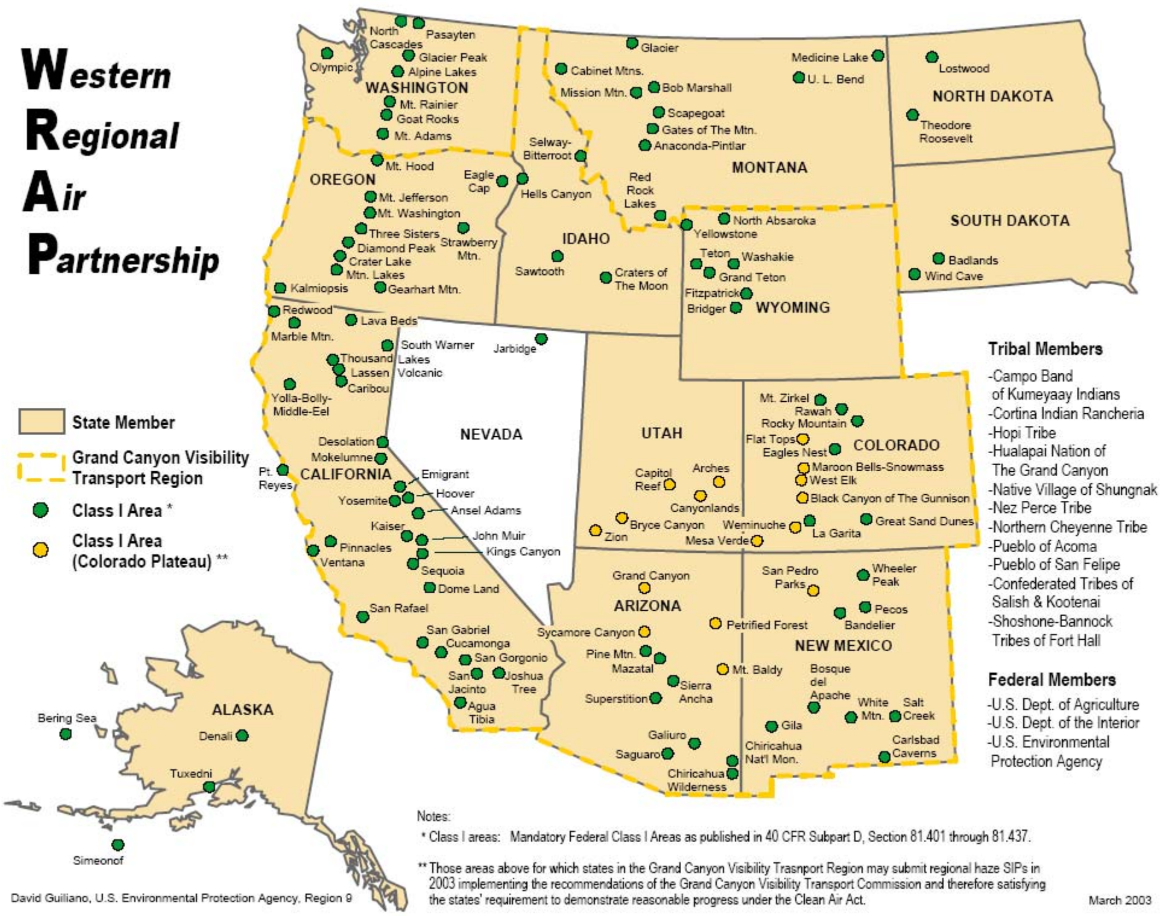
1.1 NEVADA'S CLASS I AREA – JARBIDGE WILDERNESS AREA

Nevada has one mandatory Class I Area, the 113,167 acre Jarbidge Wilderness Area (Jarbidge WA), located within the Humboldt National Forest in the northeastern portion of Nevada, as shown on Figure 1-1.

FIGURE 1-1

LOCATION MAP SHOWING MANDATORY CLASS I AREAS
IN THE WRAP REGION

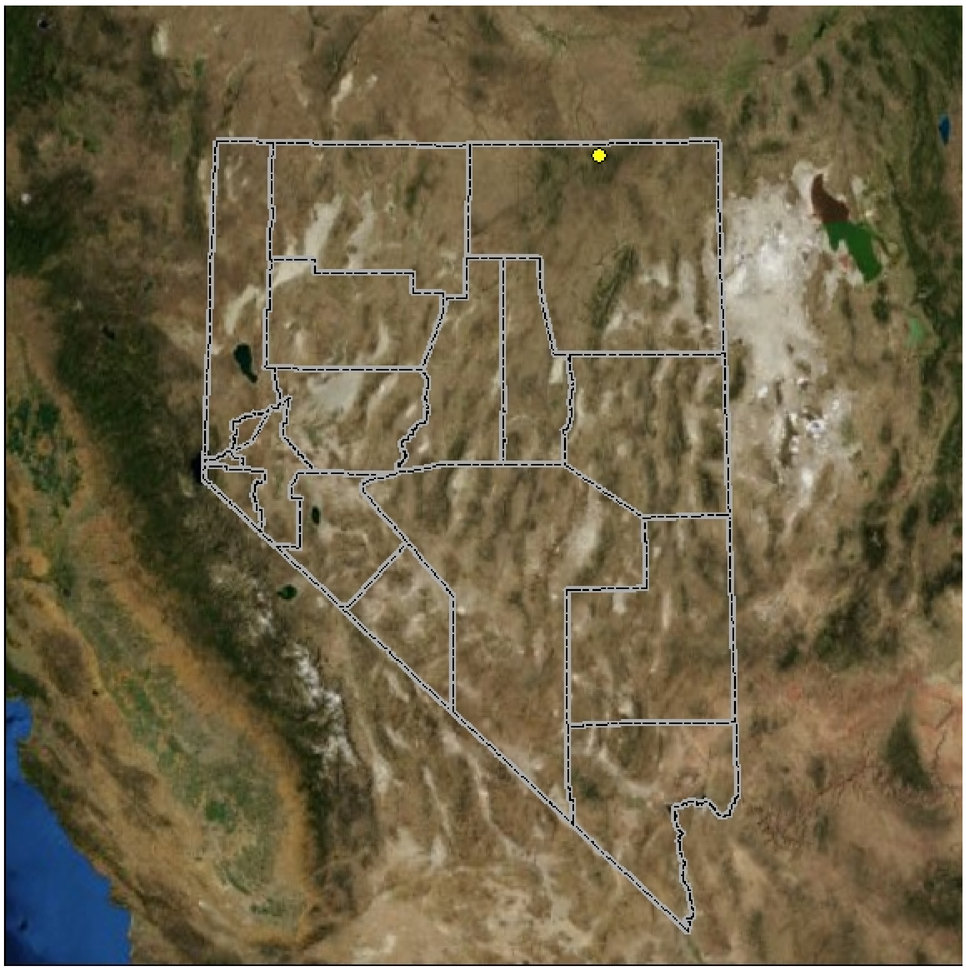


1.1.1 Geographic and Physiographic Setting

Much of the following discussion regarding the physiographic and geologic setting of Nevada is paraphrased from Stewart (1980). Nevada lies almost entirely within the Great Basin portion of the Basin and Range physiographic province. The Basin and Range is characterized by a series of generally north-trending mountain ranges separated by alluvial valleys as shown on Figure 1-2. A small portion along the western part of the state lies within the mountainous Sierra Nevada province, and an area of moderate elevation and low relief along the northern border of the state is part of the Owyhee Upland adjacent to the Snake River Plain of Idaho.

FIGURE 1-2

LOCATION MAP OF NEVADA AND PORTIONS OF ADJACENT STATES



The mountain ranges in Nevada are generally 5 to 15 miles wide and rise 1,000 to 5,000 feet above the adjoining valleys, which are about as wide as the mountain ranges. The mountain ranges are typically elongate with many extending more than 50 miles in a north or north-east direction. The Basin and Range topography is the result of extension block faulting and the basins have trapped continental sediments derived from the adjacent highlands.

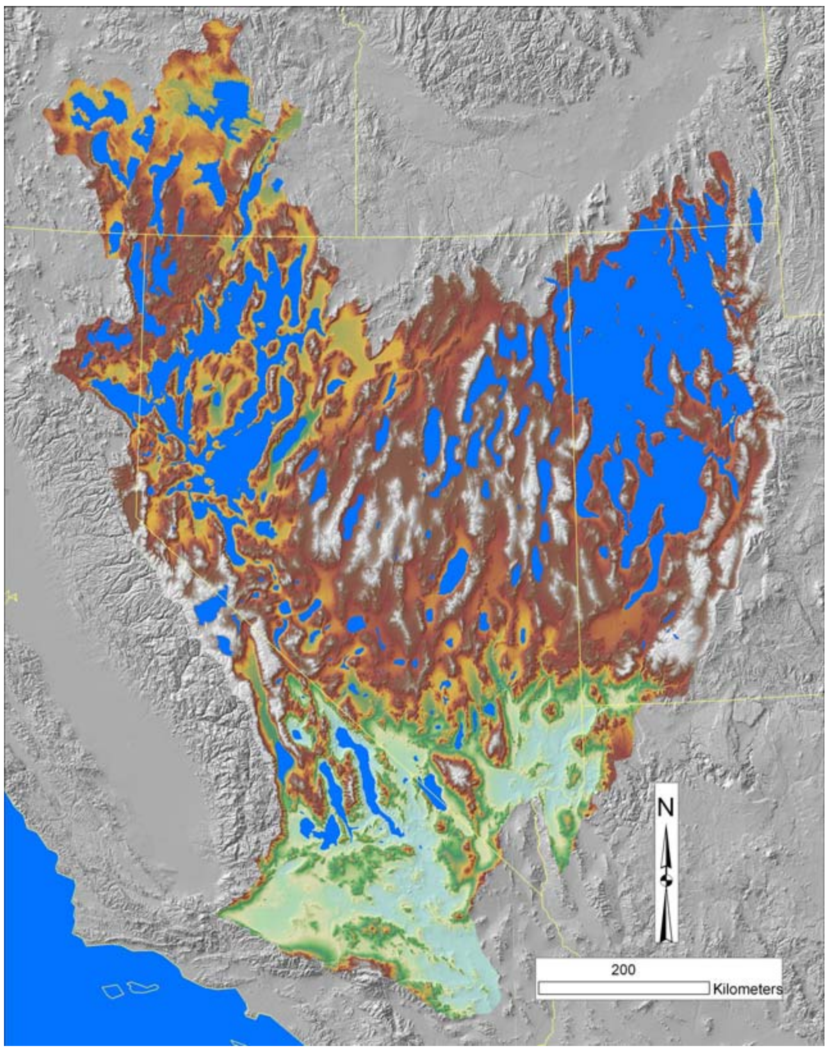
Much of Nevada is an area of internal drainage. The largest river within the Great Basin, the Humboldt, heads in the northeastern part of the state, traverses westward and then southward to terminate in the Humboldt and Carson Sinks in the western part of the state. Many of the basins in Nevada are floored by flat mud-surfaced playas that are flooded by runoff from the mountains during times of high precipitation. Playas are shown on Figure 1-2 by the whitish areas in the western and southern portions of the state.

Most of the unconsolidated sedimentary material less than six million years old forms widespread alluvial fan, stream terrace, flood plain, valley flat and playa deposits. These units grade from coarse gravel near the mountains or ranges to fine silt and clay in the valley and on the playas. Other sedimentary material in this age span forms landslide, morainal, lacustrine, shoreline and eolian (i.e., carried, deposited or eroded by the wind) sand dune deposits.

During the Pleistocene, large inland lakes occupied many of the present day broad valleys of Nevada as shown on Figure 1-3 by the blue tint. Most of the playa deposits of Nevada represent part of the little-modified bottom sediments of these lakes. Wave-cut terraces and sand and gravel beach and bar deposits occur along what were the shores of these lakes. The sandy lake margin deposits provided sand for many of the dune areas of the state.

FIGURE 1-3

EXTENT OF PLEISTOCENE LAKES IN THE GREAT BASIN



Map from Ken Adams, Desert Research Institute, 2008

The Snake River Plain, a section of the Columbia Plateau, follows the Snake River across Idaho, stretching roughly 400 miles from the Wyoming border to eastern Oregon (see Figure 1-4). The Snake River Plain is characterized by plains and low hills considerably lower and less rugged than surrounding physiographic regions. Agriculture is the main land use of the Snake River Plain, with irrigated croplands, widespread livestock grazing and locally important feedlot and dairy operations. Note the proximity of this vast agricultural area to the Jarbidge WA, shown by the yellow symbol in Figure 1-2.

FIGURE 1-4

LOCATION MAP OF SNAKE RIVER PLAIN

The following discussion of Nevada's climate is paraphrased from NOAA (1985). Nevada's principal climatic features are bright sunshine, small annual precipitation, (averaging nine inches in the valleys and deserts) heavy snowfall in the higher mountains, clean, dry air, and exceptionally large daily ranges of temperature Wide local variations of temperature and rainfall are common. The average annual number of days with precipitation of 0.01 inch or more varies considerably; Las Vegas averages 23, Reno 49, Winnemucca 67, Ely 72 and Elko 78.

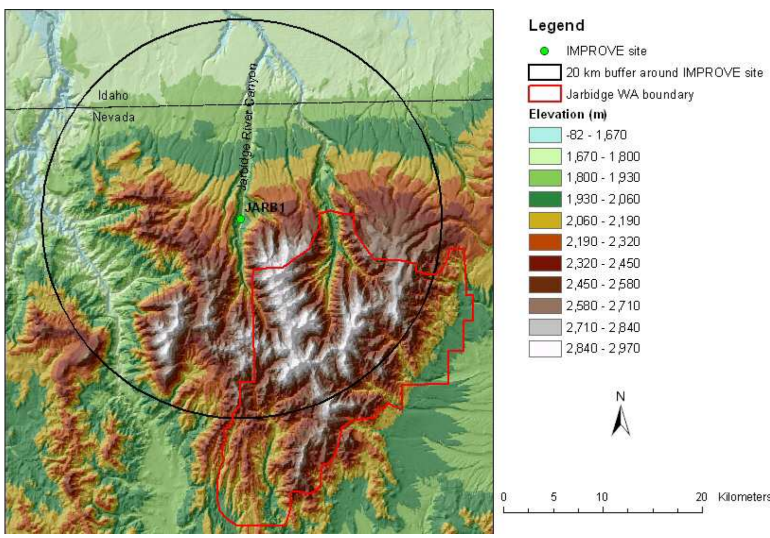
Nevada lies on the eastern, lee side of the Sierra Nevada Range, a massive mountain barrier that markedly influences the climate of the state. The prevailing winds are from the west, and as the warm moist air from the Pacific Ocean ascends the western slopes of the Sierra Range, the air cools, condensation takes place and most of the moisture falls as precipitation. As the air descends the eastern slope, it is warmed by compression, and very little precipitation occurs. The effects of this mountain barrier are felt not only in the west but throughout the state, with the result that the lowlands of Nevada are largely desert or steppes.

Jarbidge WA lies near the Idaho border 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 consists of 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. The Jarbidge River Canyon, which comprises the upper main headwaters of the Jarbidge River proper, is oriented south to north, with its mouth several miles to the north where it drains into the Bruneau River.

The area illustrates Nevada's typical basin and range topography (see Figure 1-5) with elevations ranging from 2,100 m (6,900 ft) where the Jarbidge River East Fork exits the wilderness into Idaho's Snake River Plains to eight peaks over 3,000 m (~10,000 ft) high along the Jarbidge Mountain crest, which includes the highest peak, Marys River Peak at 3,170 m (10,398 ft). The varied terrain is cut by deep canyons with steep slopes and supports a range of vegetation zones from sagebrush flats to glaciated alpine basins.

FIGURE 1-5

JARBIDGE WILDERNESS AREA AND VICINITY



1.1.2 Visibility Impairment

Regional haze is pollution from disparate sources that impairs visibility over a large region, including national parks, forests and wilderness areas. Of all the federal Class I areas, visibility was determined to be an important value at 156. These 156 mandatory class I areas are the subject of the Regional Haze Rule (RHR). Regional haze is caused by sources and activities emitting fine particles and their precursors. Those emissions are often transported over large regions. Particles affect visibility through the scattering and absorption of light, and fine particles – particles similar in size to the wavelength of light – are most efficient, per unit of mass, at reducing visibility. Fine particles may either be emitted directly or formed from emissions of precursors, the most important of which are sulfur dioxide (SO_2) and nitrogen oxides (NO_x). Reducing fine particles in the atmosphere is generally considered to be an effective method of reducing regional haze, and thus improving visibility. It is also generally considered that fine particles also adversely impact human health, especially respiratory and cardiovascular systems.

Most visibility impairment occurs when pollution in the form of small particles scatter or absorb light. Air pollutants come from a variety of natural and anthropogenic sources. Natural sources include windblown dust and smoke from wildfires. Anthropogenic sources include motor vehicles, electric utility and industrial fuel burning, and manufacturing operations. Higher concentrations of pollutants result in more absorption and scattering of light, which reduce the clarity and color of a scene. Some types of particles, such as sulfates, are more effective at scattering light, particularly during humid conditions. Other particles like elemental carbon from combustion processes are highly efficient at absorbing light. Commonly, the receptor is the human eye and the object may be a single viewing target or a scene.

In the 156 mandatory Class I areas across the country, visual range has been substantially reduced by air pollution. In the West, visual range has decreased from an average of 140 miles to 35-90 miles. Much of the visibility impairment in the West can be attributed to natural emissions of smoke and dust with significant contributions resulting from international emissions from beyond the boundaries of the United States, including Canada and Mexico.

Some haze-causing particles are directly emitted to the air. Others are formed when gases emitted to the air form particles as they are carried many miles from the source of the pollutants. Some haze forming pollutants are also linked to human health problems and other environmental damage. In addition, particles such as nitrates and sulfates contribute to acid deposition potentially making lakes, rivers and streams unsuitable for some forms of aquatic life and impacting flora in the ecosystem. These same acid particles can also erode materials such as paint, buildings or other natural and manmade structures.

1.1.3 Observed Haze Events

Nevada regularly experiences regional haze events due to natural emissions of smoke and dust. The Nevada Division of Environmental Protection (NDEP) staff has witnessed numerous haze events due to fire and wind. The text below provides some anecdotal evidence and images of the significance of these haze events.

1.1.3.1 Windblown Dust Events

Observed windblown dust events occur during at least two different meteorological conditions: unstable, well-mixed atmosphere with high winds; and unstable, highly-convective atmosphere with very low winds. Examples are provided below.

Both of these windblown dust events occurred in the vicinity of Mill City, Nevada in Humboldt County along the Humboldt River. Mill City is roughly mid-way between Lovelock and Winnemucca on I-80, or approximately 30 miles southwest of Winnemucca. The upper image of

Figure 1-6 (looking northeast) shows a large plume of dust originating at the surface with a truck stop in the near background, while the lower image shows the plume mixing higher into the atmosphere. This truck stop is shown near the lower center of Figure 1-7 (i.e., adjacent to the Highway 95 marker shown on the image). Note the textured area extending to the north and west of the highway across the Humboldt River valley. This is an area of active to semi-active sand dunes demonstrating eolian transport of sediments parallel to the highway and is the source of the windblown dust shown in the figure. Figure 1-6 was taken on August 8, 2008 in the early evening.

FIGURE 1-6

AUGUST 2008 DUST EVENT NEAR MILL CITY, NEVADA

FIGURE 1-7

SOURCE AREA FOR OBSERVED DUST EVENT

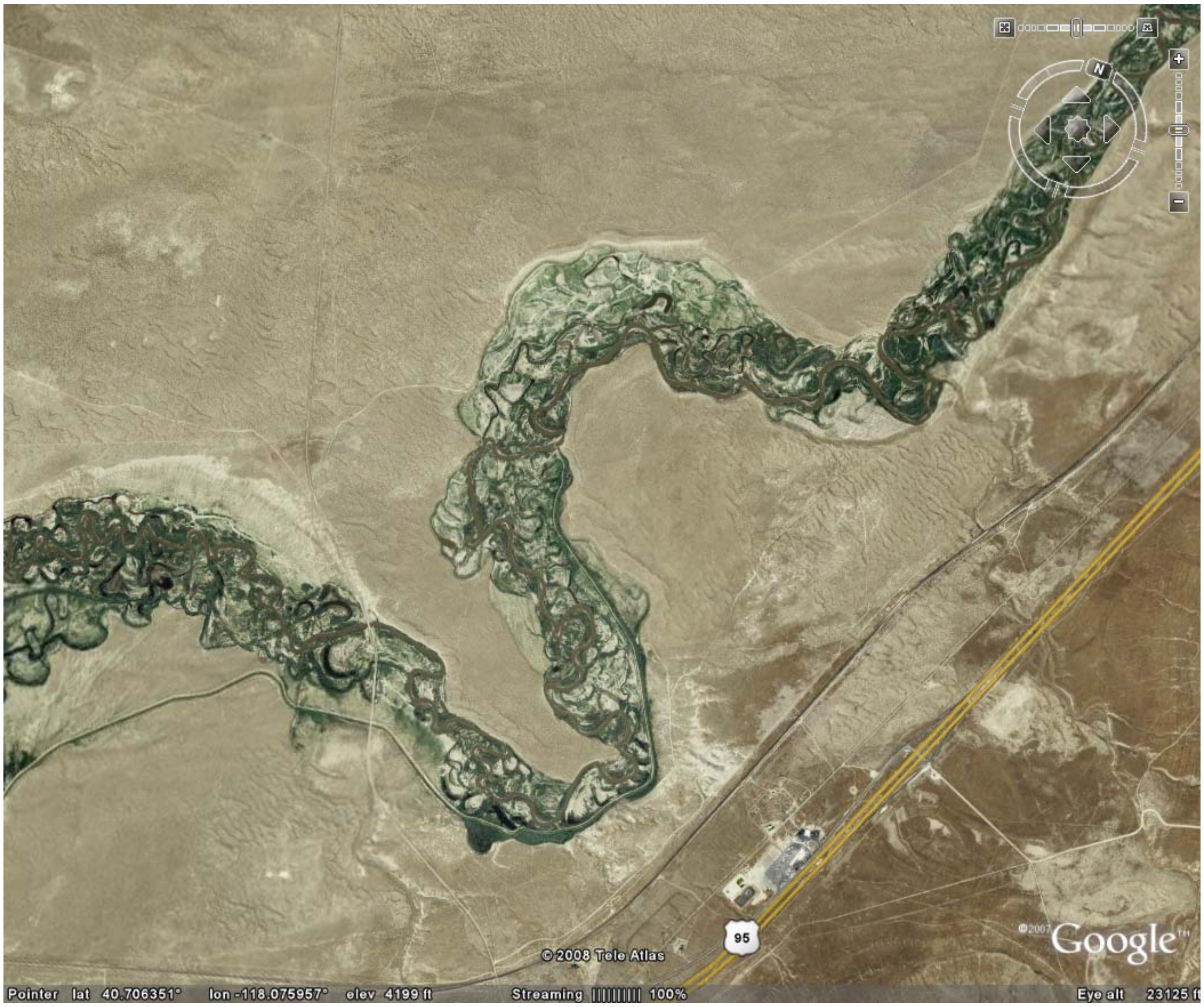


Figure 1-8 looks west and was taken midday August 17, 2008. This image shows a group of dust devils originating from an area of sand dunes adjacent to the Humboldt River approximately 10 miles north of the truck stop shown in the previous figure. The larger of these dust devils appears to be transporting dust some distance into the atmosphere. The relative significance of the contributions from this type of event to visibility impairment is not well documented or understood.

The dune fields supplying material to these two dust events are an extensive mosaic of active, semi-active and stabilized sand dunes extending much of the distance between Lovelock and Winnemucca along the sandy margins of a large Pleistocene inland lake (see Figure 1-3).

FIGURE 1-8

AUGUST 2008 CONVECTIVE DUST EVENT NEAR MILL CITY, NEVADA

In addition to the dust events described above, NDEP staff also observed a regional dust event while driving from Twin Falls, Idaho to Wells, Nevada on the morning of May 28, 2007. During this event strong northwest winds across the Snake River Plain resulted in regional transport of particulate matter, possibly from local sources as well as the Bureau Dune Field (Smith, 1982), located approximately 80 miles north of the Jarbidge WA near Mountain Home, Idaho. As the winds picked up during the morning, visibility progressively and noticeably deteriorated over the Jarbidge Mountains and the area of the Jarbidge WA visible from Highway 93 until the mountains were no longer visible. The distance from the highway to the Jarbidge WA is approximately 35 miles.

These anecdotal examples of dust events suggest the importance of natural emissions contributions to visibility impairment in the West.

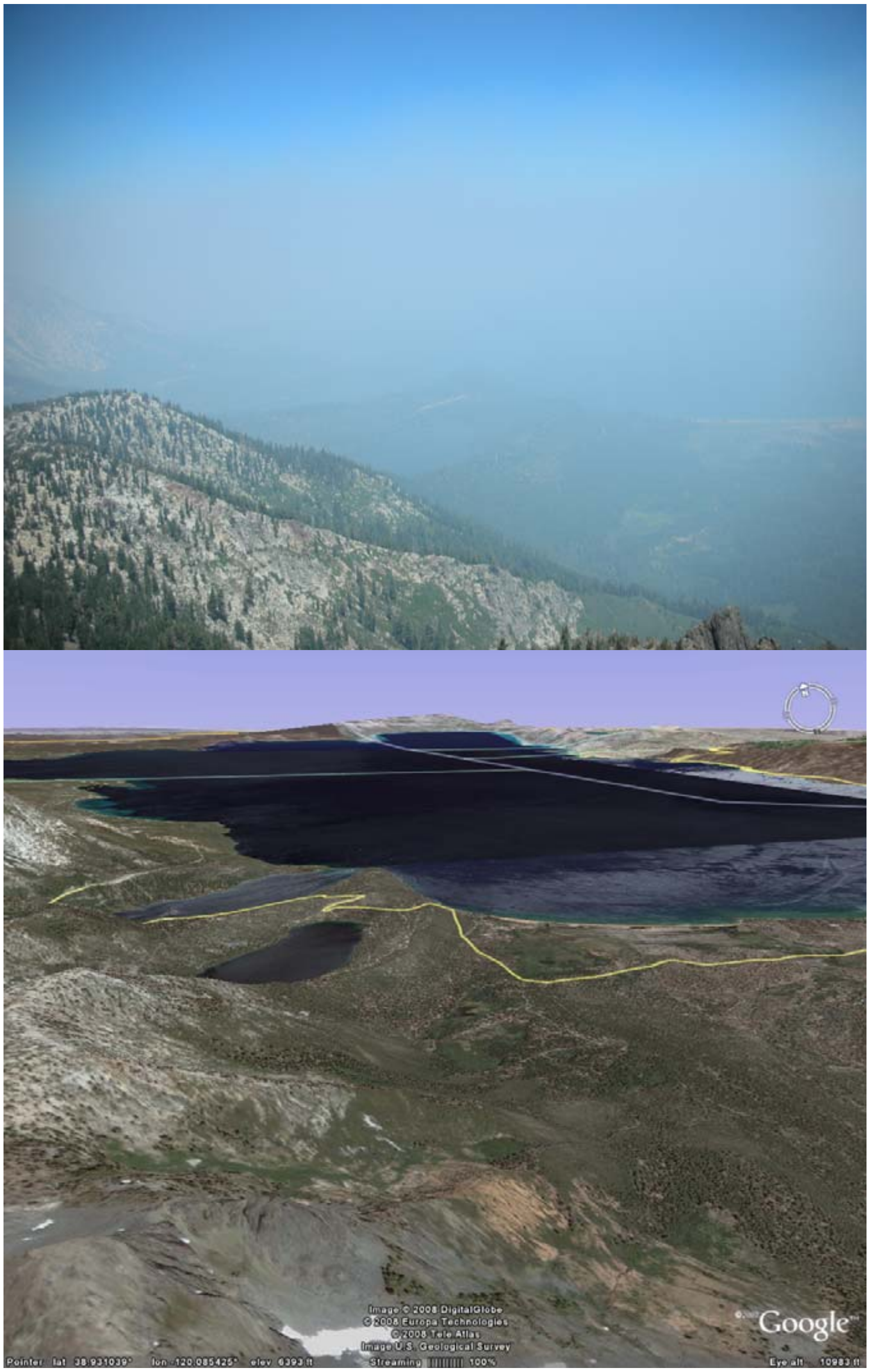
1.1.3.2 Natural Fire Events

Emissions from natural fire events are common contributors to visibility impairment at Class I areas throughout the West. The summer of 2008 was a particularly bad fire year in northern California, when lightning storms started numerous fires in early summer. The upper image on Figure 1-9 is a smoke-obscured view of Lake Tahoe from Mount Tallac, located within the Desolation Wilderness Area just over four miles from the mouth of Emerald Bay and approximately 6 miles from the BLIS1 Interagency Monitoring of Protected Visual Environments (IMPROVE) monitor representing the Desolation Wilderness Area.

The lower image presents a similar view of Lake Tahoe from Mount Tallac created using Google Earth technology. Note the top of Mount Tallac in the lower left corner, the location of Cascade Lake in the near foreground, with Lake Tahoe and Emerald Bay in the mid-background.
The BLIS1 monitor is located approximately two miles north of Emerald Bay near the shore of Lake Tahoe. The image was captured midday July 27, 2008, one of many smoke-obscured days experienced during the summer of 2008 on the east slope of the Sierra due to California wildfires. This haze event was attributed to wild fires near Yosemite National Park approximately 100 miles to the south southeast.

FIGURE 1-9

OBSERVED JULY 2008 LAKE TAHOE SMOKE EVENT



A similarly intense smoke event was also observed near the Nevada/Utah border while driving west between Delta, Utah and Ely, Nevada on Highway 50 in the vicinity of Great Basin National Park. While approaching the Nevada border from the east on September 17, 2007, the Snake Range, approximately 30 miles distant, was partially obscured by smoke as shown by the upper image in Figure 1-10, which was taken from inside a vehicle. The lower image was recreated using Google Earth technology. The highest point visible in the lower image is Wheeler Peak, which is barely visible in the upper image.

FIGURE 1-10

SEPTEMBER 2007 REGIONAL SMOKE EVENT EASTERN NEVADA

At Sacramento Pass, where Highway 50 crosses the Snake Range, visibility across Spring Valley was completely obscured and there was a strong smell of wood smoke. This event was related to wildfires in southern California approximately 350 miles to the southwest.

This anecdotal evidence of visibility impairment from wildfires emphasizes the role of natural fire in visibility impairment, both from local and distant sources.

1.2 THE WESTERN REGIONAL AIR PARTNERSHIP AND NEVADA

USEPA funded five Regional Planning Organizations throughout the country to coordinate regional haze rule-related activities between states in each region. Nevada participates in the Western Regional Air Partnership (WRAP), the consensus organization of western states, tribes, and federal agencies, which oversees analyses of monitoring data and preparation of technical reports regarding regional haze in the western United States.

The WRAP was formed in September 1997 as the successor organization to the Grand Canyon Visibility Transport Commission. It is administered jointly by the Western Governors Association (WGA) and the National Tribal Environmental Council (NTEC). The mission of the WRAP is to identify regional or common air management issues and to develop and implement strategies to address these issues. The WRAP is a partnership of states and tribes as well as federal agencies and was designated by USEPA to assist western states in the development of regional haze plans. It provides a coordination mechanism with regard to science and technology support for policy and programmatic uses in the western United States.

WRAP member states include Alaska, Arizona, California, Colorado, Idaho, Montana, New Mexico, North Dakota, Oregon, South Dakota, Utah, Washington, and Wyoming. Federal participants are the Department of the Interior (National Park Service and Fish & Wildlife Service,) the Department of Agriculture (Forest Service) and USEPA. Although Nevada is not a formal member, Nevada has been an active, cooperative participant in the WRAP and in the forums, workgroups and committees that were formed to address many elements of this Regional Haze State Implementation Plan (RH SIP).

Work by WRAP committees, forums and workgroups is accomplished by the staff time contributed by state, tribal, Federal Land Manager (FLM), USEPA and environmental, industry and public representatives, with the support of WRAP staffing through WGA and NTEC. WRAP work is also handled through contracts to environmental consulting firms, to analyze air pollution data collected by states and tribes in their regulatory programs as well as to prepare data and analyses for natural and/or uncontrollable air pollution sources.

The WRAP established stakeholder-based technical and policy oversight committees to assist in managing the development of regional haze work products. Working groups and forums were established to develop technical tools and work products the states and tribes needed to develop their implementation plans. Much of the WRAP's effort focused on regional technical analysis, which is the basis for developing strategies to meet the RHR requirement to demonstrate reasonable progress towards natural visibility conditions in Class I areas. This includes the compilation of emission inventories, air quality modeling and ambient monitoring and data analysis.

The WRAP has developed a regionally-consistent and comparable body of technical data and analysis tools that has been invaluable in addressing regional haze in west. These data and tools are provided for use and evaluation through a transparent and open network of interrelated data support web systems and a technical decision support system:

WRAP Technical Data Support Centers

- Visibility Information Exchange Web System (http://vista.cira.colostate.edu/views/): VIEWS provides on-line access to monitoring data, research results and special studies related to visibility.
- Causes of Haze Assessment (http://www.coha.dri.edu/): COHA provides a detailed analysis of ambient monitoring data for regional haze in the WRAP region.
- Fire Emissions Tracking System (http://www.wrapfets.org/): FETS is a database with a web interface for tracking and managing planned and unplanned fire events. Users can view fire data on-screen with a mapping tool and query the database for downloads of data.
- Regional Modeling Center (http://pah.cert.ucr.edu/aqm/308/): The WRAP's RMC at the University of California Riverside provides state and tribal agencies with sophisticated modeling of regional haze and other air quality parameters in the western United States.
- Emissions Data Management System (http://wrapedms.org/default_login.asp): EDMS is an emission inventory data warehouse for states and tribes. The system provides a consistent, complete and regional approach to emissions data management and tracking.

WRAP Technical Decision Support System

- Technical Support System (http://vista.cira.colostate.edu/tss/): TSS integrates a number of different data support resources under one web-based decision support umbrella for regional haze planning and implementation.

In addition to these technical tools and work products, the WRAP has provided a forum for coordination and consultation with other states, tribes and FLMs. The major amount of interstate consultation in the development of this SIP was through the Implementation Work Group (IWG) of the WRAP. Nevada participated in the IWG, which took the products of the WRAP technical analysis and consultation process and developed a process for establishing reasonable progress goals in the western Class I areas. Chapter Nine of this document discusses the process that Nevada participated in to address the consultation requirements with FLMs, tribes and other WRAP states during the development of this plan and Nevada's commitments for future consultation.

1.3 TECHNICAL SUPPORT BACKGROUND

1.3.1 Regional Haze Monitoring Network

In response to the 1977 Clean Air Act Amendments, the IMPROVE program was established in 1985 to aid the creation of federal and state implementation plans for the protection of visibility in Class I areas. Air monitoring devices at these locations are operated and maintained through a formal cooperative relationship between the USEPA and the National Park Service, U.S. Fish and Wildlife Service, Bureau of Land Management and U.S. Forest Service, collectively called the FLMs. In 1991, several additional organizations joined the effort: State and Territorial Air Pollution Program Administrators/Association of Local Air Pollution Control Officials (recently renamed National Association of Clean Air Agencies), Western States Air Resources Council, Mid-Atlantic Regional Air Management Association and Northeast States for Coordinated Air Use Management.

The IMPROVE program implemented an extensive long-term monitoring program to establish the current visibility conditions, track changes in visibility and determine causal mechanism for the visibility impairment in the national parks and wilderness areas. The data collected at the IMPROVE monitoring sites are used by land managers, industry planners, scientists, consultants, public interest groups and air quality regulators to better understand and protect the visual air quality resource in Class I areas. IMPROVE documents the visual air quality in wilderness areas and national parks throughout the United States.

1.3.1.1 Overview of the IMPROVE Monitoring Network

The IMPROVE network focuses on rural areas in the western Unites States. Other visibility and aerosol monitoring networks, such as that of the National Weather Service Airport Visibility Data, may focus on different air sheds and have different data collection objectives. In 1988, IMPROVE began with 20 monitoring sites. After publication of the regional haze rule in 1999, the first step in the implementation process was the upgrade and expansion of the IMPROVE network to 110 sites nationally. Figure 1-11 shows the current IMPROVE monitoring network throughout the United States.

FIGURE 1-11

MAP OF IMPROVE MONITORING NETWORK IN THE UNITED STATES

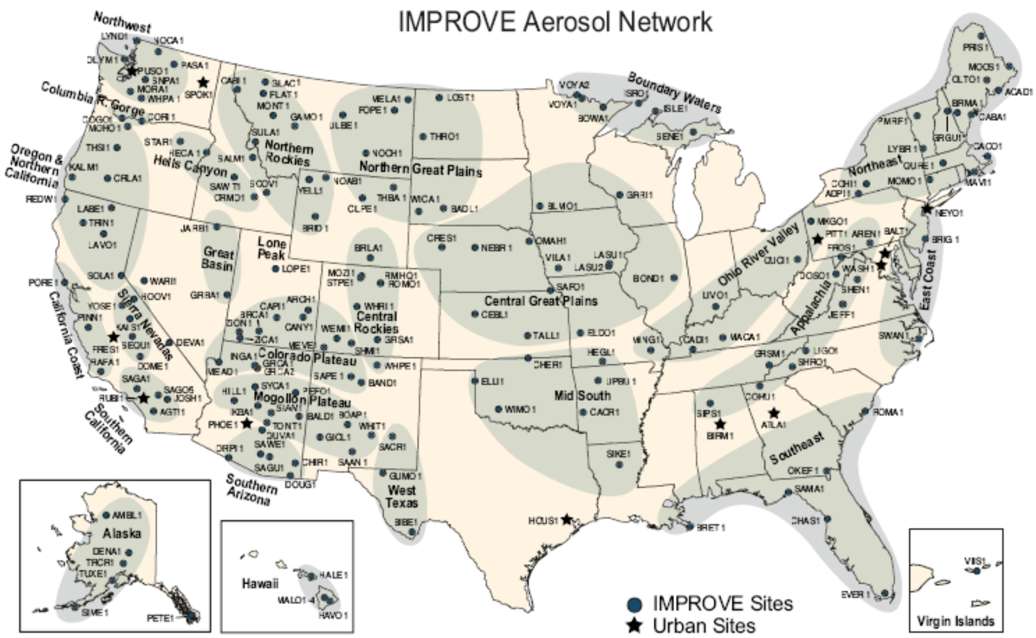


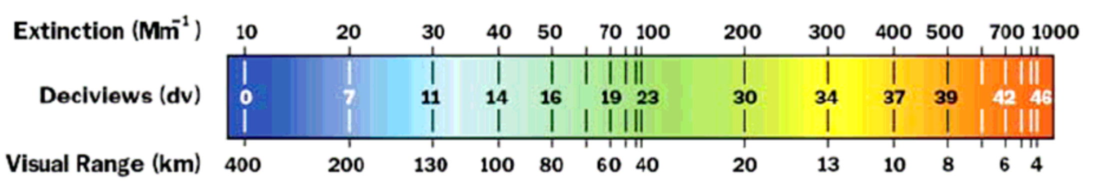
Figure S.1. The locations current and discontinued IMPROVE and IMPROVE protocol monitoring sites as of December 2004. The IMPROVE regions used for grouping the sites in some analyses in this report are indicated by green shading and bold text. Urban sites included in the IMPROVE network for quality assurance purposes are identified by stars.

The IMPROVE network consists of aerosol and optical samplers. Every IMPROVE site deploys an aerosol sampler to measure speciated fine aerosols and coarse mass. Select sites also deploy a transmissometer and nephelometers to measure light extinction and scattering respectively, as well as automatic camera systems to visually measure the scene. Particulate concentration data are obtained every third day over a 24-hour collection period and converted into reconstructed light extinction through a complex calculation using the IMPROVE equation that may be viewed at: http://vista.cira.colostate.edu/improve/Tools/ReconBext/reconBext.htm. Light extinction, the impairment of visibility, occurs due to particles and gases that reflect and absorb light.

Reconstructed light extinction (denoted as b_{ext}) is expressed in units of inverse megameters (1/Mm or Mm^{-1}). The RHR requires the tracking of visibility conditions in terms of the Haze Index (HI) metric expressed in the deciview unit (40 CFR 51.308(d)(2)). The relationship between light extinction in Mm^{-1}, Haze Index in dv and visual range in km is indicated by the scale in Figure 1-12.

FIGURE 1-12

LIGHT EXTINCTION-HAZE INDEX-VISUAL RANGE SCALE



The deciview is a unit of measurement of haze that is designed so that uniform changes in haziness correspond approximately to uniform incremental changes in perception across the entire range of conditions, from pristine to highly impaired. More information regarding tracking visibility conditions is found in USEPA's *Guidance for Tracking Progress Under the Regional Haze Rule* at: http://www.epa.gov/ttn/oarpg/t1/memoranda/rh_tpurhr_gd.pdf.

The IMPROVE data undergo extensive quality assurance and control procedures and analyses by its contractors and the National Park Service before it is released. The aerosol and optical data are made publicly available approximately nine months after collection. In addition, seasonal and annual data reports, special study data reports, technical publications and other data and analysis reports are prepared. IMPROVE program resources are available at: http://vista.cira.colostate.edu/Improve.

1.3.1.2 IMPROVE Monitor JARB1

Two operating IMPROVE monitoring sites are located in Nevada, one at Great Basin National Park and the other at the Jarbidge WA. The Walker River Paiute Tribe, a third monitoring site in Nevada, operated from June 2003 to November 2005. The IMPROVE monitor representing the air quality at the Jarbidge WA is identified as JARB1.

JARB1 was among the first 20 IMPROVE sites to start operation in 1988 and is sponsored by the U. S. Forest Service. Generally, JARB1 is expected to be representative of aerosol characteristics in the Jarbidge WA especially when the atmosphere is well mixed and regionally homogeneous. However, the site is at a low elevation in the Jarbidge River Canyon that is separate from the Jarbidge WA and upper East Fork of the Jarbidge River. Consequently, the monitoring site may at times be isolated from wilderness locations and potentially impacted by different local emission sources. Figure 1-4 shows the location of the JARB1 monitoring site by a bright green dot.

As does every IMPROVE site, JARB1 deploys an aerosol sampler to measure speciated aerosols and coarse mass. Along with other selected sites, JARB1 also has an automatic camera system to obtain a visual record, a transmissometer to measure light extinction, and a nephelometer to measure light scattering. Data from these sampling devices are used to determine the visibility status at the Jarbidge WA.

1.3.2 Emissions Analyses and Projections

USEPA's RHR requires statewide emission inventories of pollutants that are reasonably anticipated to cause or contribute to visibility impairment in any mandatory Class I area. Nevada's inventories are presented in Chapter Three. These emissions inventories are available from the WRAP TSS (http://vista.cira.colostate.edu/TSS/Results/Emissions.aspx). The TSS webpage has links to many references that describe in detail the emissions methods used in developing the point, area, mobile, dust, offshore and fire emission inventories.

Emissions scenarios used in the development of this SIP represent actual baseline emissions (Base02), typical baseline emissions (Plan02), and projected emissions (Base18 and PRP18). The baseline period includes 2000 through 2004, represented by 2002, while the projected inventories denote 2018 emissions, as discussed below. The projected inventories take into account growth, "on-the-books" and "on-the-way" controls and regulations and the application of regional haze strategies. The year 2018 was selected as it represents the first milestone date for demonstrating reasonable progress. These inventories were used for visibility and source apportionment modeling.

The pollutants examined are SO_2, sulfur oxides (SO_x), NO_x, volatile organic compound (VOC), primary organic aerosol (POA), elemental carbon (EC), fine particulate (PM fine), coarse particulate (PM coarse) and ammonia (NH_3). It is important to note that each of these pollutants have characteristics that differ in terms of ability to affect visibility. Assuming one emission unit of PM fine, for example, the same unit of SO_2 or NO_x would be about three times more effective at impairing visibility. Organic carbon is about four times more effective and elemental carbon about ten times more effective at impairing visibility. (Organic carbon is discussed in Chapter Four as part of the weighted emissions potential analysis.) Conversely, PM coarse is about half as effective as PM fine. Both VOC and NH_3 affect visibility only after certain chemical reactions occur and, therefore, cannot be compared in this manner.

1.3.2.1 Preparation of Baseline Emissions Inventories

2002 Base Case (Base02) Inventory

The Base02 inventory used actual data reported by states, locals, tribes and USEPA databases, which evolved from states' actual emissions data submitted to USEPA for the 2002 National Emission Inventory. The WRAP Stationary Sources Joint Forum contracted with Eastern Research Group (ERG) and subcontractors ENVIRON International Corporation and Alpine Geophysics to improve upon the 2002 WRAP emissions inventory, particularly for oil and gas area sources and for large point sources on selected tribal lands. The documents describing this project can be reviewed in detail by selecting the following links:

- http://www.wrapair.org/forums/ssjf/documents/Pivot_Tables/2006-01_REPORT_QA_of_the_2002_WRAP_Stationary_Sources%20EI.pdf
- http://wrapair.org/forums/ssjf/documents/eictts/OilGas/WRAP_Oil&Gas_Final_Report.122805.pdf
- http://www.wrapair.org/forums/fejf/documents/WRAP_2002_PhII_EI_Report_20050722.pdf.

The purpose of the Base02 scenario is to represent the actual conditions in calendar year 2002 with respect to ambient air quality and the associated sources of visibility-impairing air pollutants. The Base02 emissions inventories were used to validate the air quality model and associated databases and to demonstrate acceptable model performance with respect to replicating observed particulate matter air quality. Version "a" of the 2002 base case inventory, Base02a, was developed based on preliminary 2002 modeling which can be reviewed in detail at http://pah.cert.ucr.edu/aqm/308/reports/final/2002_MPE_report_main_body_FINAL.pdf. Improved 2002 emissions data for the United States, Mexico and Canada were used to create a final base 2002 annual emissions database, Base02b, for use in the Community Multi-Scale Air Quality (CMAQ) model and the Comprehensive Air Quality Model with Extensions (CAMx) model performance evaluations. Actual 2002 fire emissions data were included in this Base02b inventory.

2000 Through 2004 Baseline-Period (Plan02) Inventory
The 2000 through 2004 baseline period planning case emissions scenario is referred to as "Plan02". As with the Base02 inventories, Plan02 has undergone a number of revisions and enhancements to arrive at the final versions used in visibility and source apportionment modeling. The Plan02 series of inventories was developed to represent baseline period emissions patterns based on average, or "typical" conditions. The Plan02 inventory was developed from the Base02 emissions modeling scenarios by incorporating:

1. Replacement of actual 2002 fire emissions inventories with the baseline typical fire emissions inventories;
2. Replacement of the temporal profiles for large stationary point sources with profiles developed from an average of several years surrounding 2002; and
3. Corrections to the off-road mobile, on-road mobile, offshore Pacific shipping lane and WRAP oil and gas inventories.

The inventory series Plan02a, Plan02b and Plan02c provided a basis for comparison with the future year 2018 projected emissions, as well as for gauging reasonable progress with respect to future year visibility. The Plan02d emission inventory was based on the minor changes to the Plan02c emission inventory. These revisions to the Plan02c emission inventory included:

1. Updating the current status of point sources related to the BART requirements under the regional haze rule; and
2. Correcting erroneous or missing Standard Industrial Classification and/or source classification codes (SCC).

The Plan02c inventory was used for source apportionment modeling, whereas the Plan02d inventory was used for visibility modeling and weighted emission potential (WEP) analyses, as discussed in section 1.3.3.1 below.

1.3.2.2 Projected 2018 Emissions Inventories

2018 Base Case (Base18) Inventory

The 2018 future-year base case emissions scenario is referred to as "2018 Base Case" or "Base18". The Base18 emissions scenario is used to represent conditions in 2018 with respect to sources of visibility-impairing air pollutants, taking into consideration growth and controls. The Base18b inventory contained summaries of 2018 stationary point and area source emission inventories projected from the Plan02c inventory and was initially completed by ERG in January 2006. ERG's report is available at http://www.wrapair.org/forums/ssjf/documents/eictts/docs/WRAP_2018_EI-Version_1-Report_Jan2006.pdf.
This inventory was used for source apportionment modeling. Modeling results based on this emission inventory are used to define the future year ambient air quality and visibility metrics.

The projection methodology included the following steps:

1. Permit Limits: Adjusting projected emissions downward in cases where the projected emissions may have inadvertently exceeded an enforceable emission limit.
2. *Section §309 Flags:* Point sources in the Grand Canyon Visibility Transport states whose 2002 facility-level SO_2 emissions were at least 100 tons/year were assigned section §309 flags.
3. *Retirement and Replacement Rates:* Effects of retirement were estimated using annual retirement rates based on expected equipment lifetimes. Retired equipment was replaced by lower-emitting new equipment. Unit lifetimes were examined for natural gas-fired electric generating units (EGUs). No retirements were assumed for coal-fired EGUs.
4. *Control factors:* Emission reductions due to known (on-the-books) controls, consent decree reductions, SIP control measures and other relevant regulations that have gone into effect since 2002, or will go into effect before the end of 2018 (on-the-way). These controls do not include impacts from any future control scenarios that have yet to be determined.
5. *Growth Factors:* SCC-specific growth factors developed from the Economic Growth Analysis System (EGAS) projection factor model were included.
6. *Adjustments:*
   (a) Emissions for new facilities that have come on-line since 2002,
   (b) Corrections for facilities that retired in 2003 or 2004 and will not return to operation in the future, and
   (c) Other (i.e., ratios to correct certain PM_{10} and $PM_{2.5}$ emission factors/SCCs for combustion of natural gas)

2018 Preliminary Reasonable Progress (PRP18) Inventory

Several enhancements and corrections were subsequently made to the 2018 Base18b inventory resulting in the PRP18a inventory. The WRAP region 2018 point and area source inventory projections were updated from the 2018 Base18b inventory with information from individual state air agencies. The PRP18a inventory was created to establish the most representative source-specific emissions projections data as the basis for preparing regional haze plans. The PRP18a inventory was used for visibility modeling. Development of the PRP18a inventory is

documented in a technical memo available at
http://www.wrapair.org/forums/ssjf/documents/eictts/Projections/PRP18_EI_tech%20memo_061607.pdf.

The PRP18a inventory revisions included the following elements:

1. Presumptive BART emission limits were applied to BART-eligible coal-fired EGUs for SO_2 only and not for NO_x.
2. Specific BART limits for all coal-fired EGU sources subject to BART in Colorado, North Dakota and Utah, as well as one facility in Oregon.
2. Based on state and local agency comments, SCC codes were corrected and source information was updated based on new sources, inactive sources and facility name changes.
3. For EGU facilities reporting to USEPA's Clean Air Markets Division's acid rain database, EGU facility IDs were corrected and missing EGU source records were added.
4. Revised EGU projections of future coal-fired EGU construction: used Energy Information Administration projections of 2018 energy requirements; determined existing WRAP region capacity to identify total new requirements; added existing state and local agency EGU permits; added 11 new "Model" 500MW EGU units operating at BACT levels. Of the 11 proposed future coal-fired EGU plants, one is in Nevada.
5. Revisions to the WRAP Oil and Gas point and area source emission inventory were incorporated based on work done by ENVIRON in 2007 (http://www.wrapair.org/forums/ogwg/documents/2007-10_Phase_II_O&G_Final)Report(v10-07%20rev.s).pdf).
6. Updates to the 2018 SO_2 emission projections for Non-Utility Point sources were incorporated based on work done by Pechan and Associates in 2006 (http://wrapair.org/forums/ssjf/documents/eictts/Projections/Report-WRAP_SO2-oct11_Final.pdf).

The Base18b inventory was used for source apportionment modeling, whereas the PRP18a inventory was used for visibility modeling and weighted emission potential (WEP) analyses, as discussed in section 1.3.3.1 below.

1.3.2.3 WRAP's Technical Support System

Air quality and visibility modeling in support of regional haze planning in the WRAP region is the responsibility of the WRAP Modeling Forum's RMC. The RMC uses the air pollution emissions data as described and displayed in the TSS Emissions Section to simulate historic air quality conditions and estimate the benefit of emissions reductions programs in the future. The RMC uses regional gridded dispersion models for these simulations. The RMC website (http://pah.cert.ucr.edu/aqm/308/) provides modeling inputs and data results for review and download, using pre-set data processing, visualization and download capabilities. The TSS provides key summary air quality and visibility modeling data through enhanced analysis and display tools.

1.3.3 Air Quality Modeling

The sources of $PM_{2.5}$ are difficult to quantify because of the complex nature of their formation, transport and removal from the atmosphere. This makes it difficult to simply use emissions data to determine which pollutants should be controlled to most effectively improve visibility. Photochemical air quality models offer opportunity to better understand the sources of $PM_{2.5}$ by simulating the emissions of pollutants and the formation, transport and deposition of $PM_{2.5}$. If an air quality model performs well for an historical episode, the model may then be useful for identifying the sources of $PM_{2.5}$ and helping to select the most effective emissions reduction strategies for attaining visibility goals. Although several types of air quality modeling systems are available, the gridded, three-dimensional, Eulerian models provide the most complete spatial representation and the most comprehensive representation of processes affecting $PM_{2.5}$, especially for situations in which multiple pollutant sources interact to form $PM_{2.5}$.

The WRAP RMC utilized two regulatory air quality modeling systems to conduct all regional haze modeling. A brief discussion of each of these models is provided below.

Community Multi-Scale Air Quality Model
USEPA initially developed the CMAQ modeling system in the late 1990s. The model source code and supporting data can be downloaded from the Community Modeling and Analysis System Center (http://www.cmascenter.org/), which is funded by USEPA to distribute and provide limited support for CMAQ users. CMAQ was designed as a "one atmosphere" modeling system to encompass modeling of multiple pollutants and issues, including ozone, PM, visibility and air toxics. This is in contrast to many earlier air quality models that focused on single-pollutant issues (e.g., ozone modeling by the Urban Airshed Model). CMAQ is a Eulerian model -- that is, it is a grid-based model in which the frame of reference is a fixed, three-dimensional grid with uniformly sized horizontal grid cells and variable vertical layer thicknesses. The number and size of grid cells and the number and thicknesses of layers are defined by the user, based in part on the size of the modeling domain to be used for each modeling project. The key science processes included in CMAQ are emissions, advection and dispersion, photochemical transformation, aerosol thermodynamics and phase transfer, aqueous chemistry, and wet and dry deposition of trace species. CMAQ offers a variety of choices in the numerical algorithms for treating many of these processes, and it is designed so that new algorithms can be included in the model. CMAQ offers a choice of three photochemical mechanisms for solving gas-phase chemistry: the Regional Acid Deposition Mechanism version 2 (RADM2); a fixed coefficient version of the SAPRC90 mechanism; and the Carbon Bond IV mechanism (CB-IV).

Comprehensive Air Quality Model with Extensions
The CAMx model was initially developed by ENVIRON in the late 1990s as a nested-grid, gas-phase, Eulerian photochemical grid model. ENVIRON later revised CAMx to treat PM, visibility and air toxics. While there are many similarities between the CMAQ and CAMx systems, there are also some significant differences in their treatment of advection, dispersion, aerosol formation, and dry and wet deposition.

In support of the WRAP regional haze air quality modeling efforts, the RMC developed air quality modeling inputs including annual meteorology and emissions inventories for a 2002 actual emissions base case, a planning case to represent the 2000 through 2004 regional haze baseline period using averages for key emissions categories, and a 2018 base case of projected emissions determined using factors known at the end of 2005. All emission inventories were developed using the Sparse Matrix Operator Kernel Emissions (SMOKE) modeling system. Each of these inventories has undergone a number of revisions throughout the development process to arrive at the final versions used in CMAQ and CAMx air quality modeling. The development of each of these emission scenarios is documented under the emissions inventory sections of the TSS. In addition to various sensitivities scenarios, the WRAP performed air quality model simulations for each of the emissions scenarios.

Initial conditions are specified by the user for the first day of a model simulation. For continental-scale modeling using the Regional Planning Organization (RPO) Unified 36-km domain, the initial conditions can affect model results for as many as 15 days, although the effect typically becomes very small after about 7 days. A model spin-up period is included in each simulation to eliminate any effects from the initial conditions. For the WRAP modeling, the annual simulation is divided into four quarters, and included a 15-day spin-up period for the quarters beginning in April, July and October. For the quarter beginning in January 2002, a spin-up period covering December 16-31, 2001, using meteorology and emissions data developed for Central Regional Air Planning Association (CENRAP) were used.

Boundary conditions specify the concentrations of gas and PM species at the four lateral boundaries of the model domain. Boundary conditions determine the amounts of gas and PM species that are transported into the model domain when wind flow is into the domain. Boundary conditions have a much larger effect on model simulations than do initial conditions. For some areas in the WRAP region and for clean conditions, the boundary conditions can be a substantial contributor to visibility impairment.

For this study, boundary conditions data generated in an annual simulation of the global-scale GEOS-Chem model that was completed by Jacob et al. (http://www-as.harvard.edu/chemistry/trop/geos/) for calendar year 2002 were applied. Additional data processing of the GEOS-Chem data was required before using them in CMAQ and CAMx. The data first had to be mapped to the boundaries of the WRAP domain, and the gas and PM species had to be remapped to a set of species used in the CMAQ and CAMx models. This work was completed by Byun and coworkers (http://www-as.harvard.edu/chemistry/trop/geos/meetings/2005/ppt/Expanding_Model_Capabilities/GEOS-CMAQ_april_4_Byun.ppt).

The CMAQ model options and configuration used for the WRAP 36-km model simulations are described in Tonnesen et al. (2006) (http://pah.cert.ucr.edu/aqm/308/reports/final/2002_MPE_report_main_body_FINAL.pdf). The RMC prepared a white paper describing the air quality modeling preformed for WRAP, available at http://vista.cira.colostate.edu/docs/wrap/Modeling/AirQualityModeling.doc. The white paper provides detailed information regarding the modeling software, data sources, development and results of various model simulations, model performance evaluation, visibility projections, PM source apportionment using Particulate Matter Source Attribution Tracking (PSAT) and model sensitivity simulations.

1.3.3.1 Visibility Modeling

The RHR goals include achieving natural visibility conditions at 156 federally mandated Class I areas by 2064. In more specific terms, that goal is defined as visibility improvement toward natural conditions for the 20 percent of days that have the worst visibility (termed "20 percent worst" visibility days), and no worsening in visibility for the 20 percent of days that have the best visibility ("20 percent best" visibility days). One component of the states' demonstration to USEPA that they are making reasonable progress toward this 2064 goal is the comparison of modeled visibility projections for 2018 with what is termed a uniform rate of progress (URP) from baseline to natural conditions by 2064.

Preliminary 2018 visibility projections have been made using the Plan02d and PRP18a CMAQ 36-km modeling results, following USEPA guidance that recommends applying the modeling results in a relative sense to project future-year visibility conditions (U.S. EPA, 2001, 2003a, 2006). Projections are made using relative response factors (RRFs), which are defined as the ratio of the future-year modeling results to the current-year modeling results. The calculated RRFs are applied to the baseline observed visibility conditions to project future-year observed visibility. These projections can then be used to assess the effectiveness of the simulated emission control strategies that were included in the future-year modeling. The major features of USEPA's recommended visibility projections are as follows (U.S. EPA, 2003a,b, 2006):

- Monitoring data should be used to define current air quality.
- Monitored concentrations of PM_{10} are divided into six major components; the first five are assumed to be $PM_{2.5}$ and the sixth is $PM_{2.5\text{-}10}$.
    - SO_4 (sulfate)
    - NO_3 (particulate nitrate)
    - OC (organic carbon)
    - EC (elemental carbon)
    - OF (other fine particulate or soil)
    - CM (coarse matter).
- Models are used in a relative sense to develop RRFs between future and current predicted concentrations of each component.
- Component-specific RRFs are multiplied by current monitored values to estimate future component concentrations.
- Estimates of future component concentrations are consolidated to provide an estimate of future air quality.
- Future estimated air quality is compared with the goal for regional haze to see whether the simulated control strategy would result in the goal being met.
- It is acceptable to assume that all measured sulfate is in the form of ammonium sulfate [$(NH_4)_2SO_4$] and all particulate nitrate is in the form of ammonium nitrate [NH_4NO_3].

RRFs calculated from modeling results can be used to project future-year visibility. For the current modeling efforts, RRFs are the ratio of the 2018 modeling results to the 2002 modeling results and are specific to each Class I area and each PM species. RRFs are applied to the Baseline Condition observed PM species levels to project future-year PM levels, which are then used with the IMPROVE extinction equation listed above to assess visibility. The following six steps are used to project future-year visibility for the 20 percent best and 20 percent worst visibility days (the discussion below is for 20 percent worst days but also applies to 20 percent best days):

1. For each Class I area and each monitored day, daily visibility is ranked using IMPROVE data and IMPROVE extinction equation for each year from the five-year baseline period (2000-2004) to identify the 20 percent worst visibility days for each year.
2. Use an air quality model to simulate a base-year period (ideally 2000-2004, but in reality just 2002) and a future year (e.g., 2018), then apply the resulting information to develop Class-I-area-specific RRFs for each of the six components of light extinction in the IMPROVE aerosol extinction equation.
3. Multiply the RRFs by the measured 24-h PM data for each day from the 20 percent worst days for each year from the five-year baseline period to obtain projected future-year (2018) 24-h PM concentrations for the 20 percent worst days.
4. Compute the future-year daily extinction using the IMPROVE aerosol extinction equation and the projected PM concentrations for each of the 20 percent worst days in the five-year baseline from Step 3.
5. For each of the 20 percent worst days within each year of the five-year baseline, convert the future-year daily extinction to units of deciview and average the daily deciview values within each of the five years separately to obtain five years of average deciview visibility for the 20 percent worst days.
6. Average the five years of average deciview visibility to obtain the future-year visibility Haze Index estimate that is compared with the 2018 progress goal.

For all of the WRAP Class I areas, the RMC performed preliminary 2018 visibility projections and compared them to the 2018 URP using the Plan02d and PRP18a CMAQ modeling results and the old and new IMPROVE equations.

1.3.3.2 Source Apportionment Modeling

Impairment of visibility in Class I areas is caused by a combination of local air pollutants and regional pollutants that are transported long distances. To develop effective visibility improvement strategies, the WRAP member states and tribes need to know the relative contributions of local and transported pollutants, and which emissions sources are significant contributors to visibility impairment at a given Class I area.

A variety of modeling and data analysis methods can be used to perform source apportionment of the PM observed at a given receptor site. One method is to implement a mass-tracking algorithm in the air quality model to explicitly track for a given emissions source the chemical transformations, transport and removal of the PM that was formed from that source. Mass-tracking methods have been implemented in the CAMx air quality model as PSAT.

Source apportionment for regional haze planning was conducted using various modeling techniques. The SO_x/NO_x Tracer and Organic Aerosol Tracer were performed using the regional PSAT air quality model. The WEP analysis included the synthesis of emissions data and meteorological back trajectories. The PMF Receptor Modeling and Causes of Dust analysis were complex statistical exercises involving IMPROVE monitoring data. Not all source apportionment techniques were applied to all pollutants.

Particle Source Apportionment Tracking

The main objective of applying CAMx/PSAT is to evaluate the regional haze air quality for conditions typical of the 2000 through 2004 baseline period (Plan02c) and future-year 2018 (Base18b) conditions. These results are used:

- To assess the contributions of different geographic source regions (e.g., states) and source categories to current (2000-2004) and future (2018) visibility impairment at Class I areas, in order to obtain improved understanding of the causes of the impairment and which states are included in the area of influence of a given Class I area.
- To determine which source categories contributing to the area of influence for each Class I area are changing, and by how much, between the 2000 through 2004 and 2018 base cases. by varying only controllable anthropogenic emissions between the 2 PSAT simulations; and
- To identify the source regions and emissions categories that, if controlled to lower emissions rates than the 2018 base case levels, would produce the greatest visibility improvements at a Class I area.

The PSAT performs source apportionment based on user-defined source groups. A source group is the combination of a geographic source region and an emissions source category. Examples of source regions include states, nonattainment areas and counties. Examples of source categories include mobile sources, biogenic sources and elevated point sources; PSAT can even focus on individual sources. The user defines a geographic source region map to specify the source regions of interest. He or she then inputs each source category as separate, gridded low-level emissions and/or elevated-point-source emissions. The model then determines each source group by overlaying the source categories on the source region map. PM source apportionment modeling was performed for aerosol SO_4 and aerosol NO_3 and their related species (e.g., SO_2, NO, NO_2, HNO_3, NH_3, and NH_4). The PSAT simulations include 9 tracers, 18 source regions (see Table 1-1) and 6 source groups (see Table 1-2).

TABLE 1-1

WRAP CAMx/PSAT SOURCE REGIONS

Source Region ID	Source Region Description[1]	Source Region ID	Source Region Description[1]
1	Arizona (AZ)	10	South Dakota (SD)
2	California (CA)	11	Utah (UT)
3	Colorado (CO)	12	Washington (WA)
4	Idaho (ID)	13	Wyoming (WY)
5	Montana (MT)	14	Pacific off-shore & Sea of Cortez (OF)
6	Nevada (NV)	15	CENRAP states (CE)
7	New Mexico (NM)	16	Eastern U.S., Gulf of Mexico, & Atlantic Ocean (EA)
8	North Dakota (ND)	17	Mexico (MX)
9	Oregon (OR)	18	Canada (CN)

[1]The abbreviations in parentheses are used to identify source regions in PSAT receptor bar plots.

TABLE 1-2

WRAP CAMx/PSAT EMISSIONS SOURCE GROUPS

Emissions Source Groups	Low-level Sources	Elevated Sources
1	Low-level point sources (including stationary off-shore)	Elevated point sources (including stationary off-shore)
2	Anthropogenic wildfires (WRAP only)	Anthropogenic wild fires (WRAP only)
3	Total mobile (on-road, off-road, including planes, trains, ships in/near port, off-shore shipping)	
4	Natural emissions (natural fire, WRAP only, biogenics)	Natural emissions (natural fire, WRAP only, biogenics)
5	Non-WRAP wildfires (elevated fire sources in other RPOs)	Non-WRAP wild fires (elevated fire sources in other RPOs)
6	Everything else (area sources, all dust, fugitive ammonia, non-elevated fire sources in other RPOs)	

The source apportionment model results are typically presented in two ways:

- *Spatial plots* showing the area of influence of a source group's PM species contributions throughout the model domain, either at a given hourly-average point in time or averaged over some time interval (e.g., monthly average).
- *Receptor bar plots* showing the rank order of source groupings that contribute to PM species at any given receptor site. These plots also can be at a particular point in time or averaged over selected time intervals—for example, the average source contributions for the 20 percent worst visibility days.

The primary products of the WRAP PSAT modeling were receptor bar plots showing the emission source groups that contribute the most to the model grid cells containing each IMPROVE monitoring site and other receptor sites identified by WRAP.

Two annual 36-km CAMx/PSAT model simulations were performed: one with the Plan02c typical-year baseline case and the other with the Base18b future-year case. It is expected that the states and tribes will use these results to assess the sources that contribute to visibility impairment at each Class I Area and to guide the choice of emission control strategies. The RMC web site includes a full set of source apportionment spatial plots and receptor bar plots for both Plan02b and Base18b. These graphical displays of the PSAT results, as well as additional

analyses of these results are available on the TSS under
http://vista.cira.colostate.edu/TSS/Results/SA.aspx.

Additional information related to the CAMx air quality model and PSAT apportionment algorithm can be found at
http://vista.cira.colostate.edu/docs/wrap/attribution/PSATMethods.doc.

Weighted Emissions Potential

The WEP was developed as a screening tool for states to decide which source regions have the potential to contribute to haze formation at specific Class I areas, based on both the 2002 and 2018 emissions inventories. This method does not produce highly accurate results because, unlike the air quality model and associated PSAT analysis, it does not account for chemistry and removal processes. Instead, it relies on an integration of gridded emissions data, back trajectory residence time data, a one-over-distance factor to approximate deposition and a normalization of the final results. Residence time over an area is indicative of general flow patterns, but does not necessarily imply the area contributed significantly to haze at a given receptor. Therefore, users are cautioned to view the WEP as one piece of a larger, more comprehensive weight of evidence analysis.

The emissions data used were the annual, 36km grid SMOKE-processed, model-ready emissions inventories provided by the WRAP RMC. The analysis was performed for nine pollutants (maps were generated for all but the last three):

- Sulfur oxides
- Nitrogen oxides
- Organic carbon
- Elemental carbon
- Carbon monoxide
- Fine particulate matter
- Coarse particulate matter
- Ammonia
- Volatile organic carbon

The following source categories for each pollutant were identified and preserved through the analysis:

- Biogenic
- Natural fire
- Point
- Area
- WRAP oil and gas
- Off-shore
- On-road mobile
- Off-road mobile
- Road dust
- Fugitive dust
- Windblown dust
- Anthropogenic fires.

The back trajectory residence times were provided by the WRAP COHA. The COHA project used NOAA's HYSPLIT model to generate eight back trajectories daily for each WRAP Class I area for the entire five-year baseline period (2000 through 2004). From these individual trajectories, residence time fields were generated for one-degree latitude by one-degree longitude grid cells. Residence time analysis computes the amount of time (e.g., number of hours) or percent of time an air parcel is in a horizontal grid cell. Plotted on a map, residence time is shown as percent of total hours in each grid cell across the domain, thus allowing an interpretation of general air flow patterns for a given Class I area. The residence time fields for the 20 percent worst and best IMPROVE-monitored extinction days were selected for the WEP analysis to highlight the potential emissions sources during those specific periods. Additional information regarding back trajectory modeling can be found at http://vista.cira.colostate.edu/docs/wrap/Modeling/BackTrajectoryModeling.doc.

The WEP analysis consisted of weighting the annual gridded emissions (by pollutant and source category) by the worst and best extinction days residence times for the five-year baseline period. To account for deposition along the trajectories, the result was further weighted by a one-over-distance factor, measured as the distance in km between the centroid of each emissions grid cell and the centroid of the grid cell containing the Class I area monitoring site under investigation. (The "home" grid cell of the monitoring site was weighted by one fourth of the 36km grid cell distance, or one-over-9km, to avoid a large response in that grid cell.) The resulting weighted emissions field was normalized by the highest grid cell to ease interpretation.

The WEP is not a rigorous, stand-alone analysis, but a simple, straightforward use of existing data. As such, there are several caveats to keep in mind when using WEP results as part of a comprehensive weight of evidence analysis:

- This analysis does not take into account any emissions chemistry.
- While actual emissions may vary considerably throughout the year, this analysis pairs up annual emissions data with 20 percent worst/best extinction days residence times – this is likely most problematic for carbon and dust emissions, which can be highly episodic.
- Coarse particle and some fine particle dust emissions tend not to be transported long distances due to their large mass.
- The WEP results are unitless numbers, normalized to the largest-valued grid cell. Effective use of these results requires an understanding of actual emissions values and their relative contribution to haze at a given Class I area.

Additional information regarding WEP analysis can be found at http://vista.cira.colostate.edu/docs/wrap/attribution/WEPMethods.doc.

1.4 REFERENCES

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Chapter Two – Baseline and Natural Visibility Conditions and Uniform Rate of Progress

2.1 INTRODUCTION

2.2 BASELINE CONDITIONS FOR THE JARBIDGE WILDERNESS AREA

2.3 NATURAL CONDITIONS FOR THE JARBIDGE WILDERNESS AREA

2.4 UNIFORM RATE OF PROGRESS GLIDEPATH TO NATURAL CONDITIONS IN 2064

2.5 HAZE IMPACTING PARTICLES – BASELINE PERIOD

- 2.5.1 Aerosol Composition for the Jarbidge Wilderness Area
  - 2.5.1.1 Summary of Aerosol Composition
  - 2.5.1.2 20 Percent Worst Days
  - 2.5.1.3 20 Percent Best Days
  - 2.5.1.4 All IMPROVE Sample Days
- 2.5.2 Comparison of Baseline Extinction for Best and Worst Days
- 2.5.3 Aerosol Pollutant Trends

2.6 REFERENCES

2.1 INTRODUCTION

The goal of the Regional Haze Rule (RHR)(64 FR 35714) is the restoration of natural visibility conditions in the 156 mandatory Class I areas identified pursuant to the 1977 Clean Air Act Amendments. Federal visibility regulations detail how to establish goals to restore visibility to natural conditions by the year 2064 for the Class I areas. These regulations also require states to calculate baseline, current, and natural visibility conditions, which in turn are used to calculate the uniform rate of progress per year to achieve natural conditions by 2064.

Natural visibility is determined by estimating the natural concentrations of visibility impairing pollutants and then calculating total light extinction. Baseline visibility is the starting point for the improvement of visibility conditions. The baseline for this regional haze state implementation plan (SIP) is the years 2000 through 2004. Current conditions are assessed every five years as part of the SIP review, where actual progress in reducing visibility impairment is compared to the reductions committed to in the SIP.

The baseline and current visibility conditions for the Jarbidge Wilderness Area are based on measurements of particulate air pollution at the JARB1 Interagency Monitoring of Protected Visual Environments (IMPROVE) monitoring site, as discussed in Chapter One. The revised IMPROVE algorithm was used to calculate the Haze Index for the Jarbidge Wilderness Area.

This chapter presents and interprets the IMPROVE monitoring data to identify the role of individual components in visibility impairment at JARB1. The following chapters will present and interpret the emissions data and modeling results that, with this chapter, are the technical basis for determining Nevada's reasonable progress. The following paragraphs present a synopsis of the analyses of the IMPROVE monitoring data.

Analyses of the JARB1 monitor data have identified a baseline visibility condition of 12.07 deciviews (dv) and natural visibility conditions of 7.87 dv for the 20 percent worst days. The comparison of the initial baseline conditions to natural visibility conditions indicates the amount of improvement necessary to attain natural visibility by 2064. The uniform rate of progress glidepath indicates a uniform rate of progress value of 11.09 dv for 2018 worst days leading to restoration of natural visibility conditions by 2064.

Organic matter carbon and elemental carbon extinction account for more than 45 percent of the total average annual reconstructed extinction at the JARB1 monitor for the 20 percent worst days of the baseline. In addition, coarse and fine particle mass extinction account for an additional 30 percent of the average annual extinction at JARB1. Approximately 20 percent of the annual extinction budget is due to the formation of ammonium sulfate and ammonium nitrate due to emissions of sulfur dioxide (SO_2) and nitrogen oxides (NO_x) from predominantly anthropogenic sources. These conclusions support the observations of Nevada Division of Environmental Protection (NDEP) staff, presented in Chapter One, regarding the significant contribution of windblown dust and natural fire emissions to visibility impairment at the Jarbidge Wilderness Area.

2.2 BASELINE CONDITIONS FOR THE JARBIDGE WILDERNESS AREA

Baseline visibility is the annual average of the on-site IMPROVE monitoring data for the least-impaired days (i.e. the 20 percent best days or “best days”) and most impaired days (i.e. the 20 percent worst days or “worst days”) for the years 2000 through 2004, as specified in 40 CFR 51.308(d)(2)(i). Baseline visibility is equivalent to current visibility conditions for this initial review period and is the reference point against which visibility improvement is tracked.

Nevada has established baseline visibility conditions for the best and worst visibility days at the Jarbidge Wilderness Area using data from IMPROVE monitor JARB1. The average was calculated for the years 2000 through 2004 (the 2000 data is invalid for JARB1 as it fails to meet USEPA’s data completeness criteria) for the best and worst days. The baseline calculations were made in accordance with 40 CFR 51.308(d)(2) and USEPA’s *Guidance for Tracking Progress Under the Regional Haze Rule* (EPA-454/B-03-004, September 2003).

The baseline conditions are the average of the annual haze index calculated from the IMPROVE monitor data over the five-year baseline period 2000 through 2004 for both the 20 percent worst (12.07 dv) and 20 percent best (2.56 dv) days. Figures 2-1 and 2-2 are photographs of reference vistas representative of baseline extinction conditions for the best and worst days, respectively, at the Jarbidge Wilderness Area.

2.3 NATURAL CONDITIONS FOR THE JARBIDGE WILDERNESS AREA

Natural visibility represents the visibility condition that would be observed in the absence of human-caused impairment. The natural condition for each Class I area represents the visibility goal expressed in deciviews for the 20 percent worst and the 20 percent best days that would exist if there were only naturally occurring impairment. The 20 percent worst days natural conditions correspond to the long-term natural visibility goal to be reached by 2064. 40 CFR 51.308(d)(1) Each state must estimate natural visibility levels for Class I areas within its borders in consultation with federal land managers (FLMs) and other states. 40 CFR 51.308(d)(2)

Natural background visibility is based on annual average concentrations of fine particle components. The natural conditions estimates were calculated consistent with USEPA’s *Guidance for Estimating Natural Visibility Conditions Under the Regional Haze Rule* (EPA-454/B-03-005, September 2003). The natural background visibility for Jarbidge is 7.87 dv for the 20 percent worst days and 1.14 dv for the 20 percent best days.

Figures 2-3 and 2-4 are photographs of reference vistas representative of natural extinction conditions for the best and worst days at the Jarbidge Wilderness Area.

FIGURE 2-1

REFERENCE VISTA OF THE JARBIDGE WILDERNESS AREA
FOR BASELINE BEST DAYS

Reference Vista: Mary's River Peak

Photo taken at 3:00 pm

Haze Index (HI) = 3 deciview

B_{ext} = 13 Mm^{-1}

Visual Range = 300 km / 186 mi

FIGURE 2-2

REFERENCE VISTA OF THE JARBIDGE WILDERNESS AREA
FOR BASELINE WORST DAYS

Reference Vista: Mary's River Peak

Photo taken at 3:00 pm

Haze Index (HI) = 12 deciviews

B_{ext} = 33 Mm^{-1}

Visual Range = 120 km / 75 mi

FIGURE 2-3

REFERENCE VISTA OF THE JARBIDGE WILDERNESS AREA
FOR NATURAL CONDITIONS BEST DAYS

Reference Vista: Mary's River Peak

Photo taken at 9:00 am

Haze Index (HI) = 1 deciview

B_{ext} = 11 Mm^{-1}

Visual Range = 350 km / 218 mi

FIGURE 2-4

REFERENCE VISTA OF THE JARBIDGE WILDERNESS AREA
FOR NATURAL CONDITIONS WORST DAYS

Reference Vista: Mary's River Peak

Photo taken at 9:00 am

Haze Index (HI) = 8 deciviews

B_{ext} = 23 Mm^{-1}

Visual Range = 170 km / 106 mi

2.4 UNIFORM RATE OF PROGRESS GLIDEPATH TO NATURAL CONDITIONS IN 2064

Each state must set goals that provide for reasonable progress towards achieving natural visibility conditions by 2064. The reasonable progress goals must: 1) provide for improvement in visibility for the most impaired days over the period of the implementation plan; and 2) ensure no degradation in visibility for the least impaired days over the same period. States are directed to graphically show a uniform rate of progress (URP) toward natural visibility conditions for each Class I area within the State. The revised IMPROVE II algorithm was used for the calculation of the URP glidepath for the Jarbidge Wilderness Area.

A graph depicting the worst days glidepath for the Jarbidge Wilderness Area was developed in accordance with USEPA guidance for tracking progress (*Guidance for Setting Reasonable Progress Goals Under the Regional Haze Rule,* June 1, 2007), using data collected from the IMPROVE monitor JARB1. 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 URP is determined by the following equation, which calculates the slope of the glidepath in deciviews per year:

URP = (Baseline Condition – Natural Condition) / 60 years
URP = (12.07 dv – 7.87 dv) / 60 years
URP = 0.07 dv / year reduction

The uniform progress needed by 2018, the end of the first planning period, to achieve worst days natural visibility conditions by 2064 is calculated by multiplying the URP by the number of years in the first planning period (i.e. 2004 to 2018), as follows:

2018 URP = (URP) x (14 years)
2018 URP = 0.07 dv / year x 14 years
2018 URP = 0.98 dv reduction

Table 2-1 provides the URP data for the worst days and identifies the baseline for the best days. The baseline visibility for the 20 percent worst days at the Jarbidge Wilderness Area is calculated to be 12.07 dv. For the baseline 20 percent best days, visibility is calculated to be 2.56 dv. The URP glidepath is shown on Figure 2-5, which depicts the observed annual baseline visibility conditions by solid diamonds with the worst days baseline shown by the line through the solid diamonds. The glidepath for a URP toward reaching the goal of natural conditions is represented by the sloping line with the open triangles identifying the URP at five year intervals. Natural conditions for the worst days are shown by the horizontal line in the middle of the graph. The figure also shows the observed annual baseline conditions for the 20 percent best days by open diamonds with the baseline shown by the short line through the open diamonds. The reasonable progress goal must ensure no degradation in visibility for the best days over the planning period.

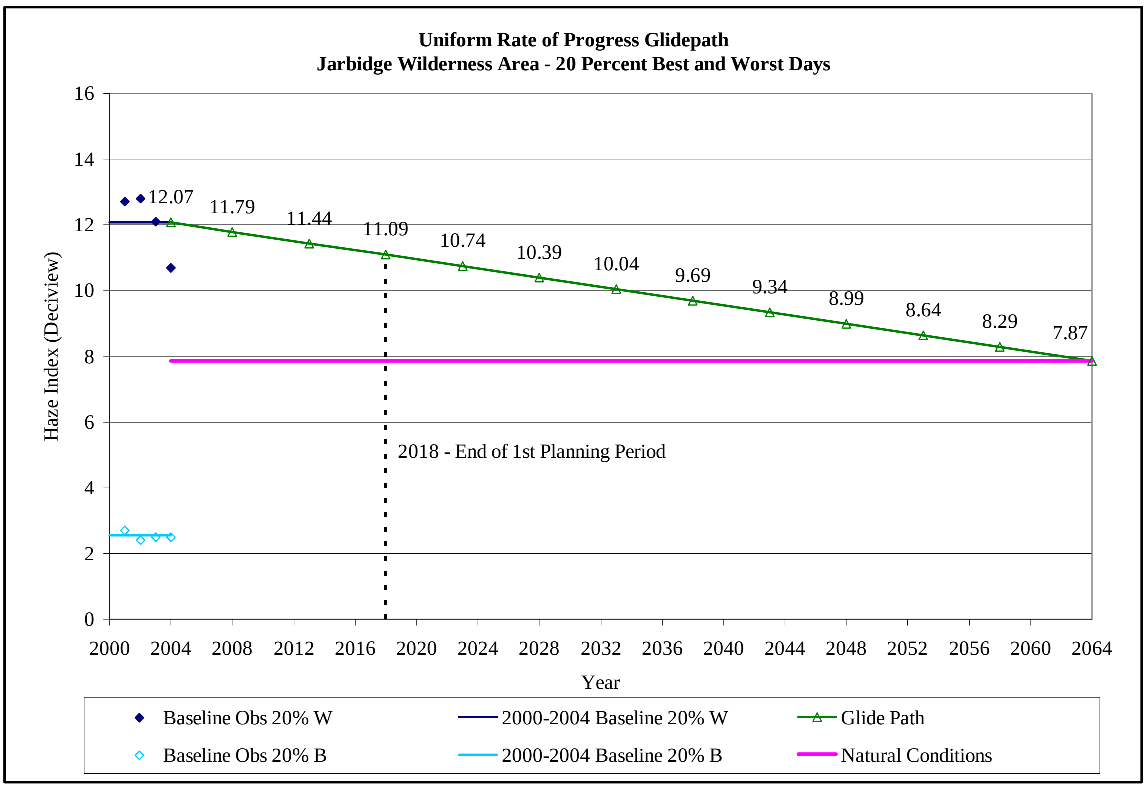
TABLE 2-1

UNIFORM RATE OF PROGRESS FOR THE
JARBIDGE WILDERNESS AREA

Class I Area	20% Worst Days Baseline Condition (dv)	20% Worst Days 2018 Uniform Progress Goal (dv)	2018 Reduction Needed for 20% Worst Days (dv)	20% Worst Days 2064 Natural Conditions (dv)	2064 Reduction Needed for 20% Worst Days (dv)	20% Best Days Baseline Condition (dv)
Jarbidge Wilderness Area	12.07	11.09	0.98	7.87	4.20	2.56

FIGURE 2-5

UNIFORM RATE OF PROGRESS GLIDEPATH FOR THE
JARBIDGE WILDERNESS AREA



2.5 HAZE IMPACTING PARTICLES – BASELINE PERIOD

Some of the fine particles that compose aerosols absorb light, while others reflect or scatter light, resulting in light extinction between the viewer and the light source. The IMPROVE monitor collects a 24-hour sample of these particles onto a filter, and they are analyzed at a laboratory to determine the standard components of the aerosol extinction.

Monitored Components

The monitored concentrations of PM_{10} are divided into six major components, the first five of which are assumed to be $PM_{2.5}$ and the sixth is $PM_{2.5-10}$. The monitored species are listed below by identifier with the common name in parenthesis.

- SO_4 (sulfate)
- NO_3 (particulate nitrate)
- OC (organic carbon)
- EC (elemental carbon)
- OF (other fine particulate or soil)
- CM (coarse matter)

The concentrations of these species are used in conjunction with the IMPROVE equation to calculate the light extinction.

Emission Species

The statewide emission inventory of pollutants that were used in the emission scenarios for this SIP include:

- SO_2 (Sulfur dioxide)
- SO_x (Sulfur oxides)
- NO_x (Nitrogen oxides)
- POA (Primary organic aerosol)
- EC (Elemental carbon)
- PMF (Particulate matter fine)
- PMC (Particulate matter coarse)
- NH_3 (Ammonia)

The baseline emissions and emission projections are discussed in detail in Chapter Three.

Extinction Species

Visibility conditions are then estimated by relating the IMPROVE 24-hour average PM mass measurements (i.e. concentration data for the species listed above) to the PM components of light extinction as identified in the IMPROVE equation. The extinction components are listed below. The bold text indicates how the monitored extinction components will be identified in the remainder of the SIP.

- Ammonium sulfate [$(NH_4)_2SO_4$] or **SO_4**
- Particulate ammonium nitrate [$(NH_4)NO_3$] or **NO_3**
- Organic matter carbon [**OMC**]
- Elemental carbon [**EC**]
- Fine soil [**SOIL**]
- Coarse matter [**CM**]
- **Sea Salt**

2.5.1 Aerosol Composition for the Jarbidge Wilderness Area

Analyses of the IMPROVE monitor data provides important insight to the relative importance of the components of measured visibility impairing pollutants. The monitoring data for the 20 percent worst, 20 percent best, and IMPROVE sample days were analyzed on an annual, monthly, and daily basis to evaluate the causes of visibility impairment during the baseline period.

2.5.1.1 Summary of Aerosol Composition

This section describes the aerosol composition observed at the JARB1 IMPROVE monitor during the baseline period. The following sections present the monitoring data for the 20 percent worst days, 20 percent best days, and all IMPROVE sample days.

Organic matter carbon (OMC) is the most important contributor to fine particulate mass and light extinction on the most impaired days and for all IMPROVE sample days. OMC is also a significant contributor on the least impaired days of the baseline period at JARB1. Elevated levels of OMC and EC and their seasonal signature suggest impact from fire and biogenic sources, which are significant natural sources of primary organic aerosol (POA) and volatile organic compounds (VOCs), components of OMC. Anthropogenic emissions contributing to OMC include carbon from combustion of fossil fuels and wood burning, but are not likely significant sources of OC emissions at this rural site. However significant visibility impacts due to OC emissions from natural fire events are common at the Jarbidge Wilderness Area and explain the large daily, seasonal, and annual variations of the reconstructed OMC extinction described in the next sections.

Coarse matter (CM) or particulate matter with particles having diameters between 2.5 and 10 microns is the second most important contributor to reconstructed extinction for the worst days of the baseline period. CM has a relatively small contribution to visibility impairment on the best days, but is a significant contributor to visibility impairment for IMPROVE sample days. The light extinction efficiency of CM is very low compared to the extinction efficiency for sulfate, nitrate, and carbon, as described in Chapter One. The significant CM contributions to reconstructed extinction suggest the seasonal importance of local and regional transport of particulate matter due to naturally occurring windblown dust events.

Ammonium sulfate (SO_4) or sulfate is an important contributor to visibility impairment at JARB1 for the worst days and IMPROVE sample days. SO_4 is the most significant contributor on the best days. Sulfate particles are formed in the atmosphere from SO_2 emissions. Sulfate particles occur as hydrogen sulfate, ammonium bisulfate and ammonium sulfate depending on the availability of ammonia in the atmosphere. Although SO_4 contributions show some seasonal increases during the summer months, the lack of daily variability suggests the sulfate contributions are influenced by regional transport rather than local sources.

Soil (SOIL) or particulate matter with particles having diameters less than 2.5 microns is a minor contributor to reconstructed extinction for the worst, best and IMPROVE sample days of the baseline period. Episodes of relatively high SOIL contribution coupled with relative high CM contributions may be indicative of local and regional seasonal transport of particulate matter due to windblown dust events. Occasionally, elevated SOIL can be attributed to long-range transport of international dust episodes originating outside the US.

Elemental carbon (EC) is a minor contributor to visibility impairment at JARB1 for the worst, best and IMPROVE sample days of the baseline period. The light extinction efficiency of EC is high compared to the extinction efficiency for sulfate, nitrate and carbon, as described in Chapter One. Common sources of EC emissions are fire, including agricultural burning, prescribed fire, and natural fire, as well as incomplete combustion of fossil fuels. The seasonality and common trend shared with OMC extinction suggest fire emissions may also be the dominant source of EC extinction at JARB1.

Ammonium nitrate (NO_3) or nitrate is a minor contributor to reconstructed extinction for the worst, best and IMPROVE sample days of the baseline period at JARB1. However, NO_3 is a significant contributor for some individual days. NO_3 is formed in the atmosphere by the reaction of ammonia (NH_3) and nitrogen oxides (NO_x). NO_3 formation is limited by the availability of ammonia and temperature. Ammonia preferentially reacts with SO_2 and sulfate before reacting with NO_x. Particle nitrate is formed at lower temperatures, so NO_3 levels are lower in the summer months and higher in the winter months. Therefore the relative NO_3 contribution to visibility impairment is seasonal as identified below. NO_x emissions are the result of fossil fuel combustion by point, area, on-road, and off-road mobile sources. The relatively minor contribution of NO_3 to reconstructed extinction at JARB1 suggests that formation is limited by both the availability of ammonia and the paucity of NO_x sources in this rural setting.

Sea Salt (SEA SALT) is a trace contributor to reconstructed extinction at JARB1. The new IMPROVE equation uses the chlorine ion from routine IMPROVE measurements to calculate sea salt levels, accounting for the occasional contribution of SEA SALT to extinction at JARB1.

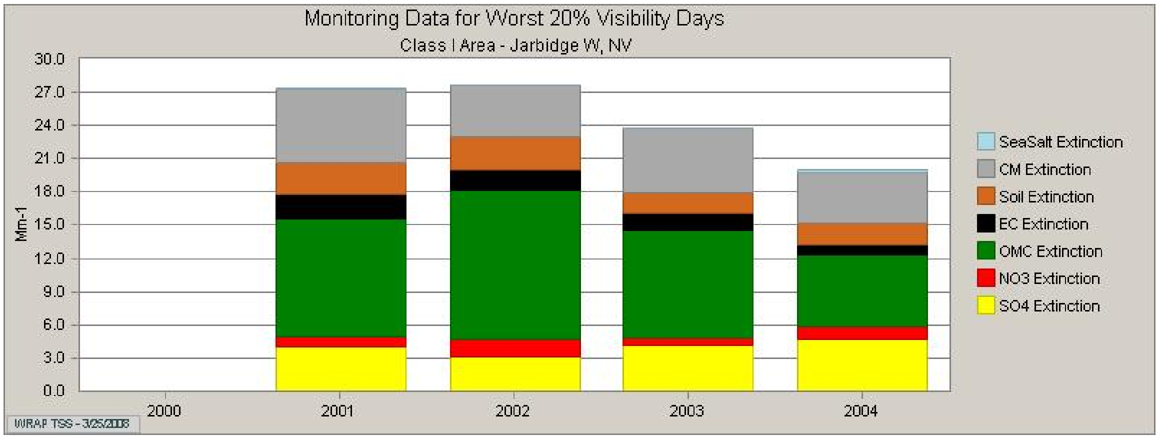
2.5.1.2 20 Percent Worst Days

Figure 2-6 shows the annual reconstructed light extinction over the baseline period based on monitor data from JARB1 site for the 20 percent worst days. The variability of annual worst days reconstructed light extinction is nearly 8 Mm^{-1}.

The line graph shown as Figure 2-7 shows the individual components of the reconstructed light extinction over the baseline period based on JARB1 IMPROVE data for the 20 percent worst days. OMC is the most significant contributor to visibility impairment at JARB1 for the baseline period, followed by CM and SO_4. SOIL, EC, and NO_3 are less significant but sub-equal contributors to visibility impairment for the baseline period.

FIGURE 2-6

ANNUAL RECONSTRUCTED EXTINCTION FOR WORST DAYS
OF THE BASELINE PERIOD



The baseline period annual variation for OMC is nearly 7 Mm^{-1}, indicating the large range of annual effects produced by fire emissions, one of the dominant sources of OMC. 2002 was a bad fire year in the western US, as reflected on Figure 2-7 by the OMC trend. The baseline period variation for CM is over 2 Mm^{-1}, suggesting the range of effects produced by emissions from localized wind events, especially during seasonal drought conditions. The remaining components show less variability during the baseline period.

FIGURE 2-7

ANNUAL RECONSTRUCTED EXTINCTION BY SPECIES FOR
WORST DAYS OF BASELINE PERIOD

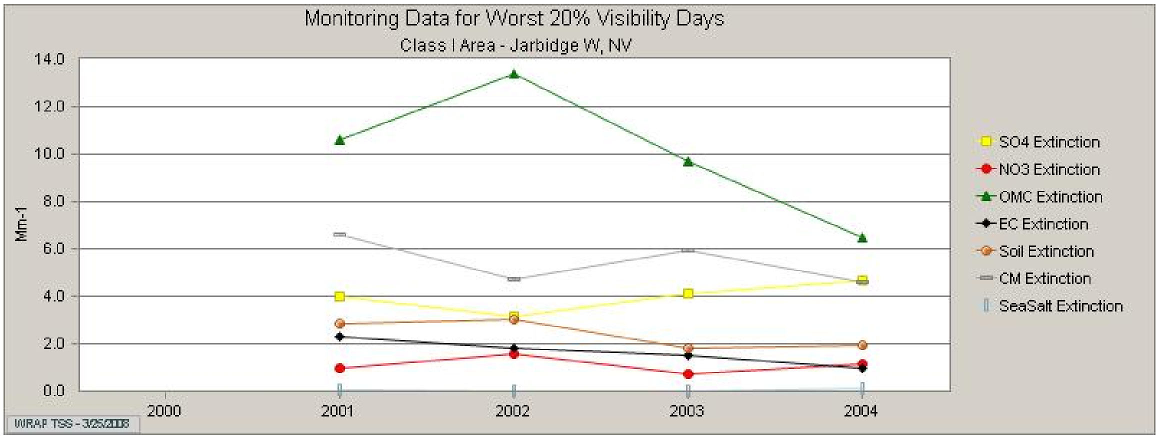
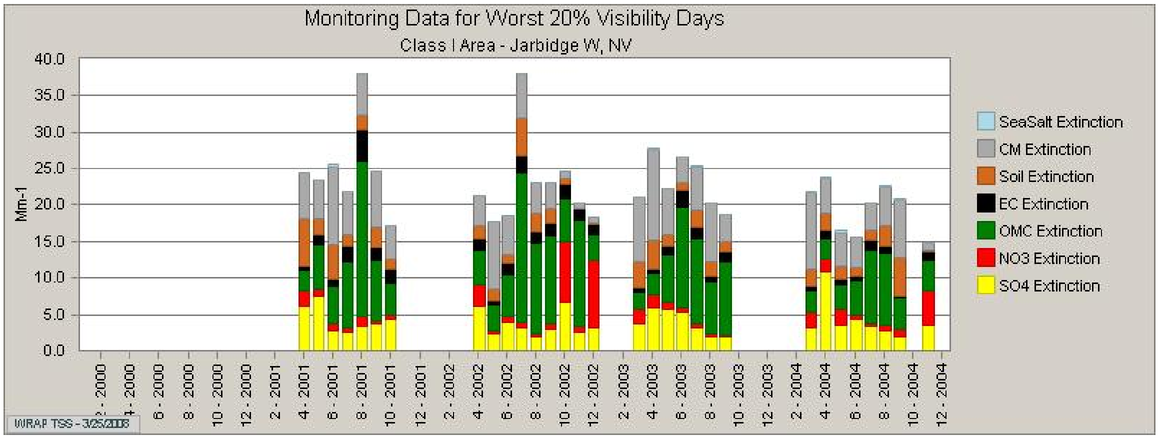


Figure 2-8 displays the monthly distribution of the reconstructed extinction for the 20 percent worst days of the baseline period for the Jarbidge Wilderness Area. The worst days are generally summer events, occurring during the period mid-March to the end of September of each year with a few exceptions. Fires, dust events, and photochemical processes are elevated during this time frame, which maximizes OMC and EC concentrations, CM and SOIL concentrations, and secondary particulate formation.

FIGURE 2-8

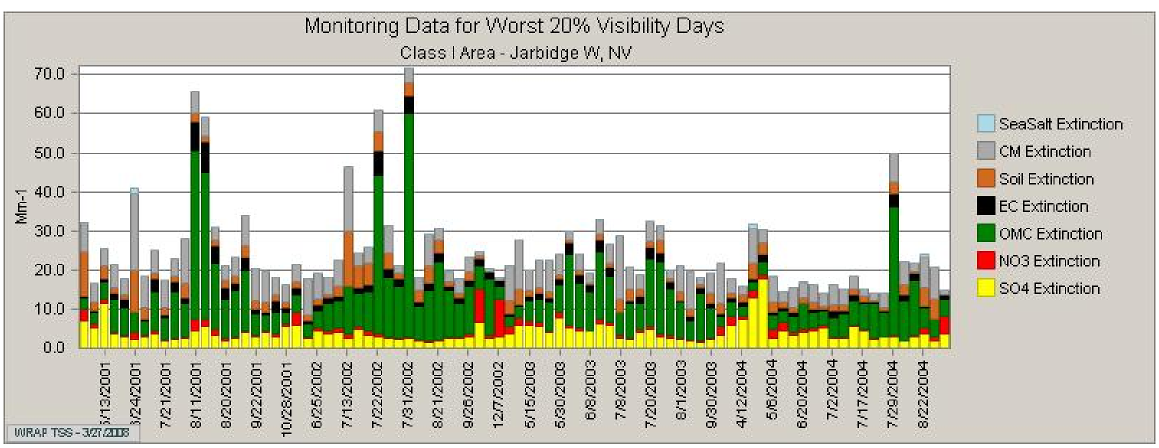
MONTHLY DISTRIBUTION OF WORST DAYS OF BASELINE PERIOD



Daily reconstructed light extinction for the 20 percent worst days of the baseline years at JARB1 is presented in Figure 2-9 and shows OMC, and/or CM are generally the largest components of visibility impairment on the worst days at the Jarbidge Wilderness Area. SOIL, NO_3, and SO_4 are significant components for a handful of days.

FIGURE 2-9

DAILY RECONSTRUCTED LIGHT EXTINCTION FOR
WORST DAYS OF BASELINE PERIOD

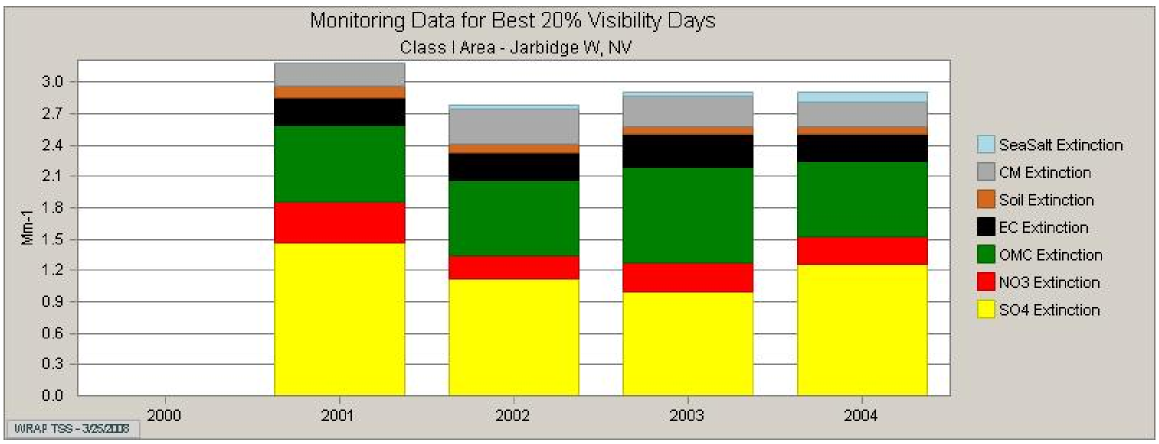


2.5.1.3 20 Percent Best Days

The bar graph shown in Figure 2-10 shows the reconstructed light extinction over the baseline period for the 20 percent best days based on data from JARB1. Note the baseline period annual variation is less than 0.5 Mm^{-1} for the best days, much less than the variability shown for the worst days.

FIGURE 2-10

ANNUAL RECONSTRUCTED EXTINCTION FOR
BEST DAYS OF BASELINE PERIOD



The line graph in Figure 2-11 shows the individual components of the reconstructed light extinction over the baseline period for the 20 percent best days at JARB1. SO_4 and OMC are the most significant contributors to visibility impairment for the best days of the baseline period, followed by sub-equal contributions from NO_3, EC, and CM. SOIL is a minor contributor to visibility impairment for the best days. SO_4 has approximately 0.5 Mm^{-1} variation, while OMC has approximately 0.2 Mm^{-1} variation for the best days of the baseline period.

FIGURE 2-11

ANNUAL RECONSTRUCTED EXTINCTION BY SPECIES FOR
<u>BEST DAYS OF BASELINE PERIOD</u>

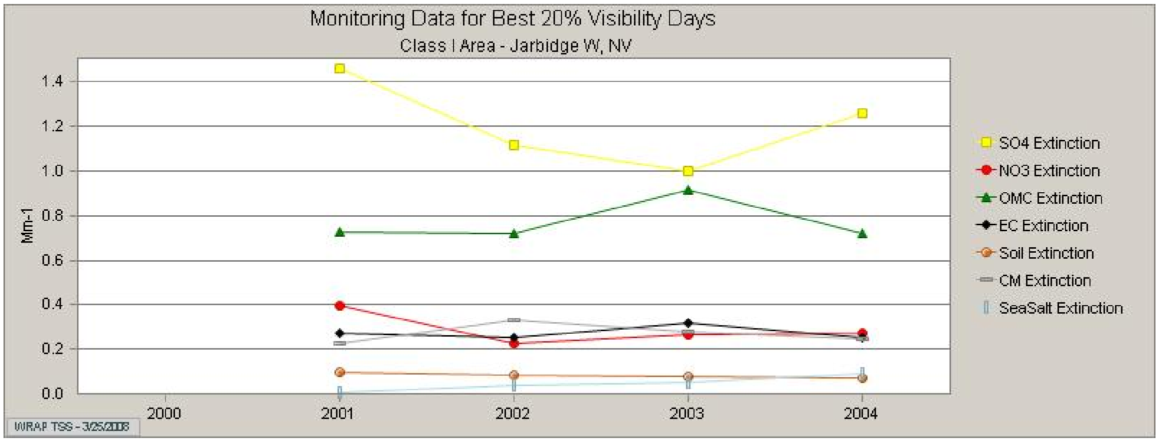
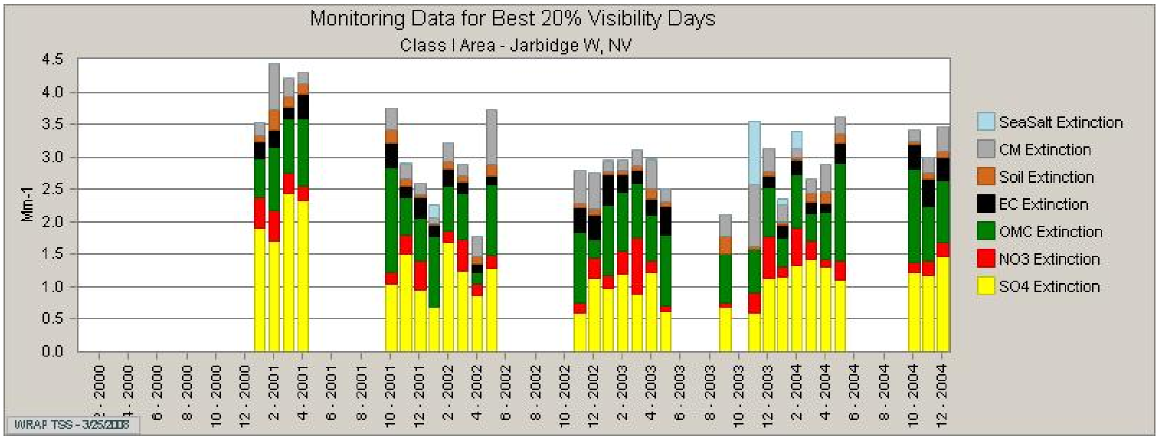


Figure 2-12 displays the monthly distribution of the reconstruction extinction for the 20 percent best days of the baseline period for JARB1. The best days are generally winter events occurring from October to May of each year, when fires, dust events, and photochemical processes are at a minimum.

FIGURE 2-12

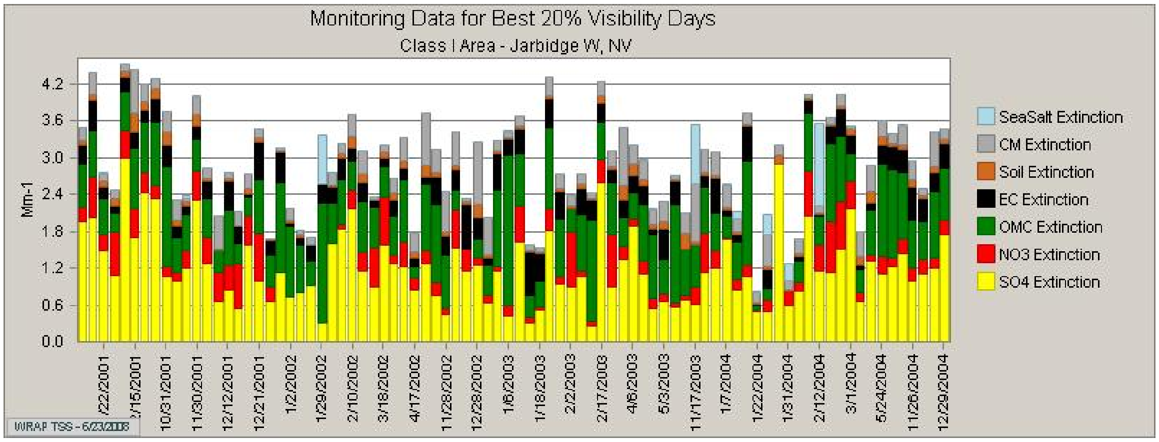
MONTHLY DISTRIBUTION OF BEST DAYS OF BASELINE PERIOD



Daily reconstructed light extinction for the 20 percent best days of the baseline period at JARB1 is presented in Figure 2-13 and shows OMC and/or SO_4 are generally the largest components of visibility impairment on the best days at the Jarbidge Wilderness Area. NO_3, CM, and Sea Salt are significant components for a handful of days.

FIGURE 2-13

DAILY RECONSTRUCTED LIGHT EXTINCTION FOR
BEST DAYS OF BASELINE PERIOD

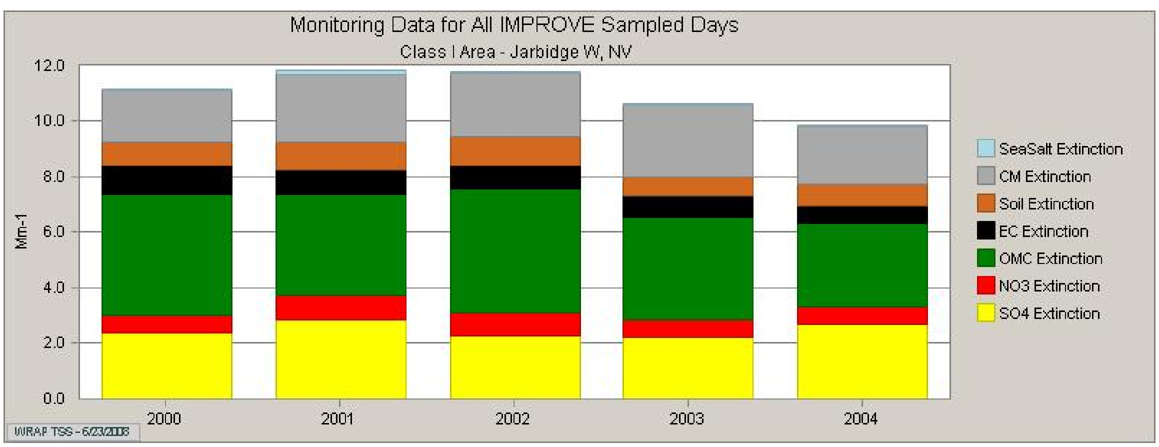


2.5.1.4 All IMPROVE Sample Days

Figure 2-14 shows the annual reconstructed light extinction over the baseline period based on monitor data from JARB1 site for all IMPROVE sample days. The variability of the IMPROVE sample days reconstructed light extinction is approximately 2 Mm^{-1}.

FIGURE 2-14

ANNUAL RECONSTRUCTED EXTINCTION FOR
IMPROVE SAMPLE DAYS OF BASELINE PERIOD

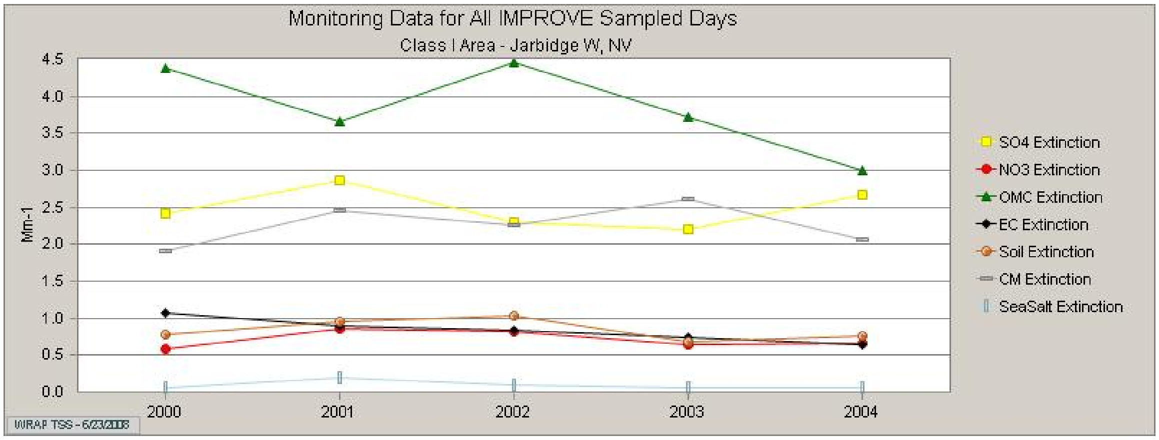


The line graph shown in Figure 2-15 shows the individual components of the annual reconstructed light extinction over the baseline period based on JARB1 IMPROVE data for the IMPROVE sample days. OMC is the most significant contributor to visibility impairment at JARB1 for the IMPROVE sample days of the baseline period, followed by sub-equal CM and

SO_4. SOIL, EC, and NO_3 are minor contributors to visibility impairment for the baseline period IMPROVE sample days.

FIGURE 2-15

ANNUAL RECONSTRUCTED EXTINCTION BY SPECIES FOR
IMPROVE SAMPLE DAYS OF BASELINE PERIOD



The baseline period annual variation for OMC is nearly 1.5 Mm^{-1}, indicating the range of annual effects produced by fire emissions. The baseline period variation for CM and SO_4 is less than 1 Mm^{-1}. The remaining components show less variability during the baseline period for the IMPROVE sample days.

Figure 2-16 displays the monthly reconstructed extinction for the IMPROVE sample days of the baseline period for the Jarbidge Wilderness Area, while Figure 2-17 presents the daily reconstructed light extinction for the IMPROVE sample days of the baseline period. These figures show pronounced seasonality of the reconstructed extinctions with the highest monthly extinctions occurring in the summer months and the lowest monthly extinctions occurring in the winter months. The visibility effects of CM, SOIL, EC, and OMC extinction overwhelm the contributions of SO_4 and NO_3 extinction, especially during the summer months. SO_4 contributes more to visibility impairment during the spring and early summer months, contributing less during the remaining months of the year. The contribution of NO_3 to visibility impairment is greatest during the winter months and is significant for some days. These effects are even more pronounced for the daily reconstructed extinctions presented in Figure 2-17.

FIGURE 2-16

MONTHLY RECONSTRUCTED EXTINCTION FOR
IMPROVE SAMPLE DAYS OF BASELINE PERIOD

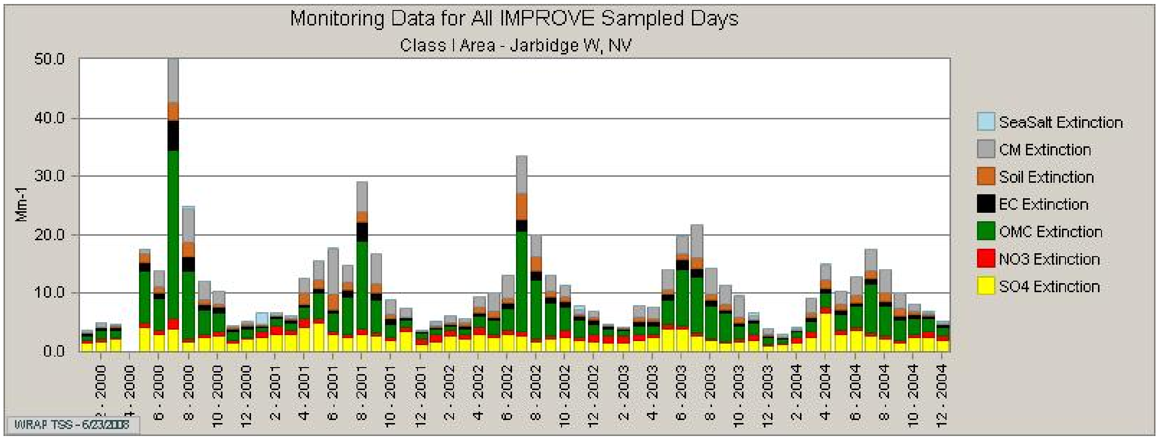
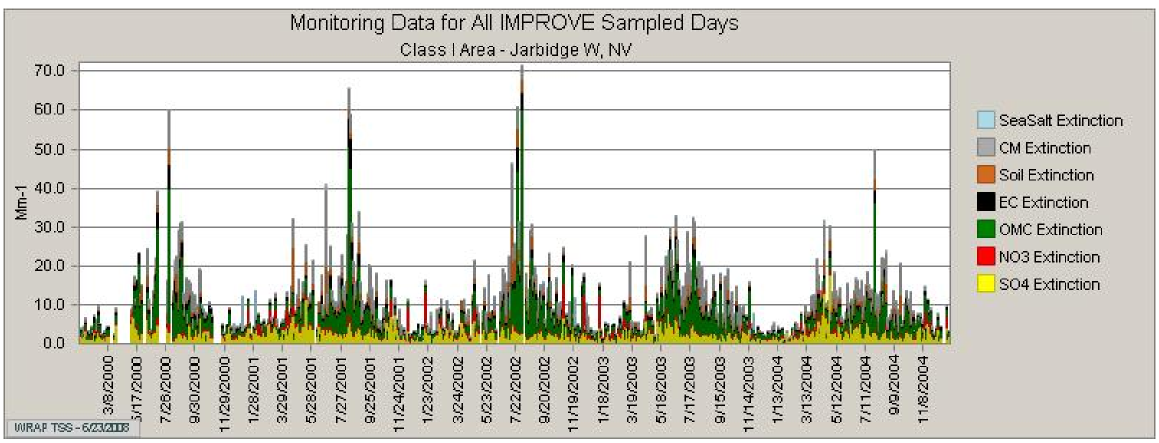


FIGURE 2-17

DAILY RECONSTRUCTED EXTINCTION FOR
IMPROVE SAMPLE DAYS OF BASELINE PERIOD



2.5.2 Comparison of Baseline Extinction for Best and Worst Days

Figure 2-18 compares the average baseline extinction for the 20 percent worst days with the 20 percent best days from the JARB1 monitor. All components of extinction are less on the best days, but significant reductions in CM and OMC extinction result in the majority of the visibility improvement on the best days, confirming the significant role of natural emissions in visibility impairment at the Jarbidge Wilderness Area.

Table 2-2 presents the monitored contributions to reconstructed light extinction by species for the most and least impaired days of the baseline period based on data from the WRAP's

Technical Support System. For the most impaired days, OMC and CM, on average, contribute nearly two thirds of the extinction. Sources of OMC and CM emissions are predominantly natural and uncontrollable, as are SOIL and EC emission sources. SO_4 and NO_3 contribute more than 15 percent and less than 5 percent, respectively to reconstructed extinction for the most impaired days. For the least impaired days, SO_4 and NO_3 contribute more than 40 percent and nearly 10 percent, respectively to the reconstructed extinction. Sources of SO_2 and NO_x emissions are largely anthropogenic and controllable.

FIGURE 2-18

COMPARISON OF BASELINE EXTINCTION FOR
<u>WORST AND BEST DAYS OF BASELINE PERIOD</u>

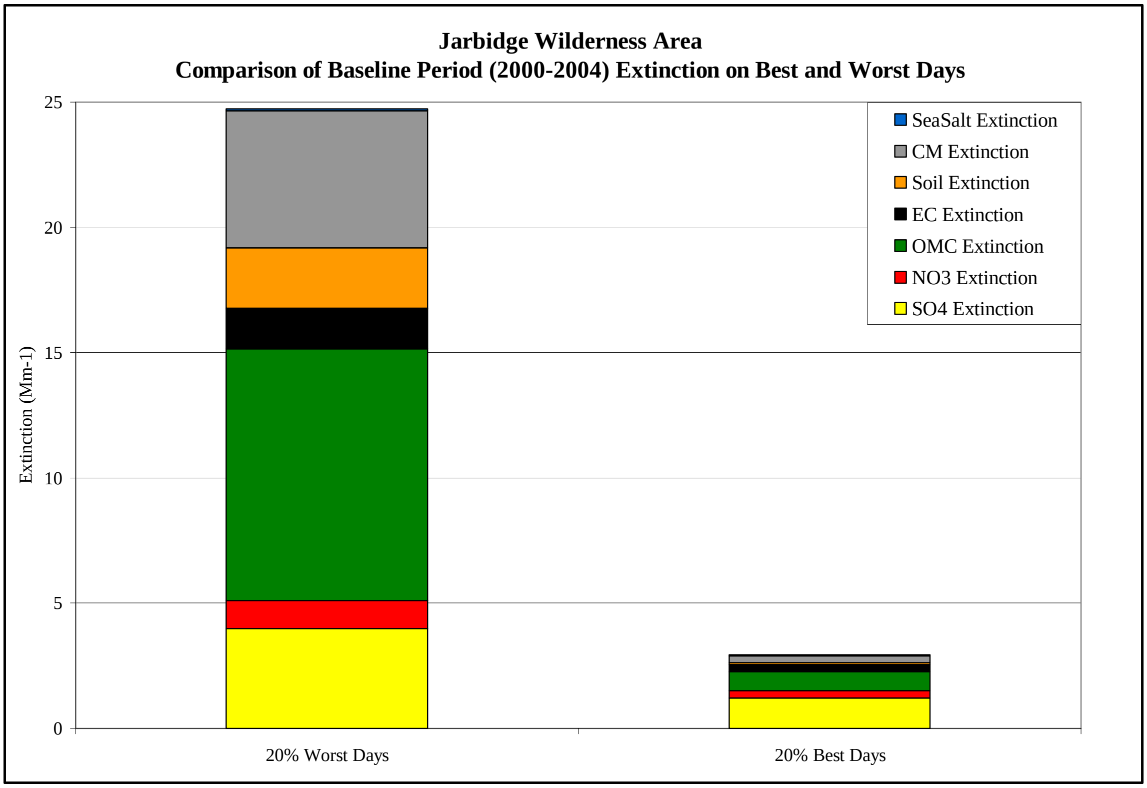


TABLE 2-2

MONITORED CONTRIBUTIONS TO ANNUAL RECONSTRUCTED
EXTINCTION BY SPECIES FOR BASELINE PERIOD

Year	SO_4 Extinction	NO_3 Extinction	OMC Extinction	EC Extinction	SOIL Extinction	CM Extinction	SeaSalt Extinction
20 Pecent Worst Days							
2001	14.6%	3.5%	38.6%	8.4%	10.4%	24.2%	0.3%
2002	11.5%	5.6%	48.4%	6.5%	10.9%	17.1%	0.0%
2003	17.3%	3.1%	40.8%	6.3%	7.7%	24.8%	0.0%
2004	23.6%	5.7%	32.4%	5.0%	9.7%	23.0%	0.7%
Average	**16.7%**	**4.5%**	**40.0%**	**6.5%**	**9.7%**	**22.3%**	**0.3%**
20 Percent Best Days							
2001	45.9%	12.3%	23.0%	8.5%	3.1%	7.2%	0.0%
2002	40.3%	8.3%	25.9%	9.4%	2.9%	11.9%	1.4%
2003	34.2%	9.2%	31.5%	11.0%	2.7%	9.6%	1.7%
2004	43.3%	9.3%	24.7%	8.9%	2.4%	8.2%	3.1%
Average	**40.9%**	**9.8%**	**26.3%**	**9.4%**	**2.8%**	**9.2%**	**1.6%**

2.5.3 Aerosol Pollutant Trends

Figure 2-19 presents the annual monitored light extinction in deciviews for the 20 percent worst and best days and a corresponding trend line. The long-term annual extinction trend for the 20 percent worst days, shown by the diamonds, is essentially flat, although there are large annual variations. The trend for the 20 percent best days, shown by the triangles, has a downward trend indicating improvement in the long-term visibility conditions at the Jarbidge Wilderness Area for the best days.

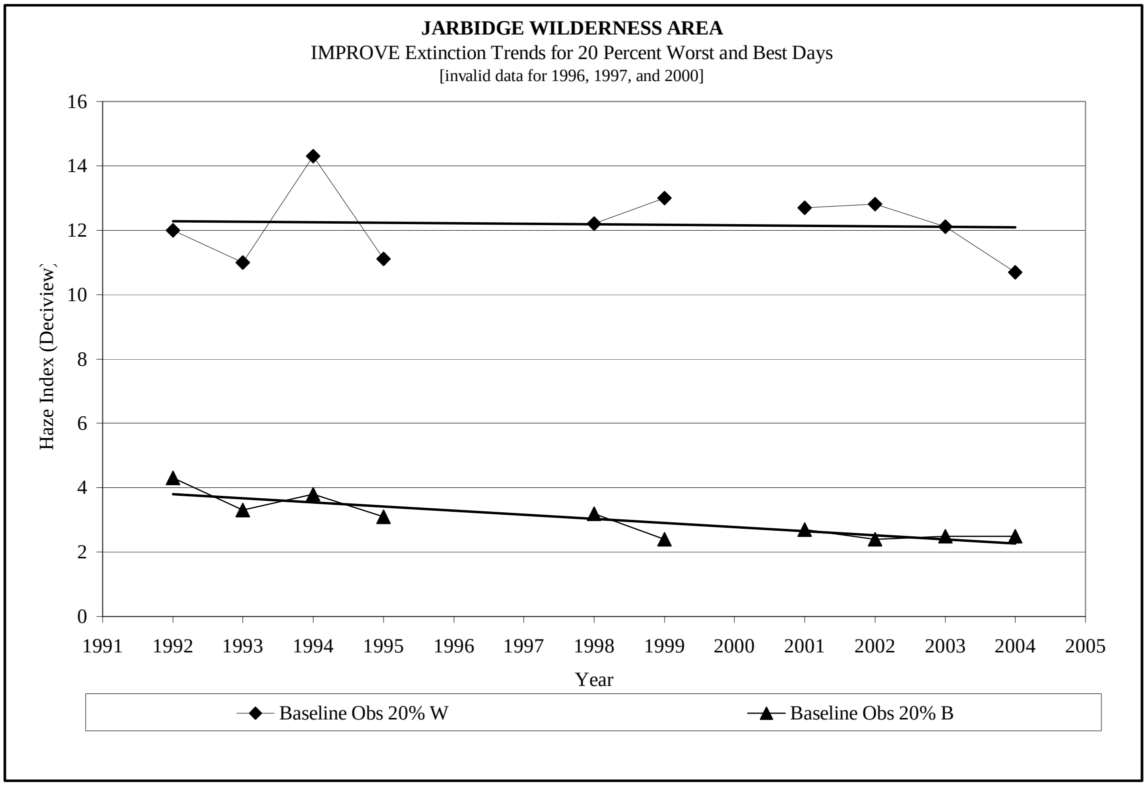
Figure 2-20 shows the annual extinction data on the 20 percent worst days for seven haze causing pollutants from JARB1 for the years 1992 through 2005 with a corresponding color-coded, long-term trend line. The graphs utilize valid data from years prior to and including the baseline period. Data from the years 1996, 1997, and 2000 did not meet the USEPA data completeness requirements (75 percent for the year and 50 percent for each quarter) and therefore don't have calculated annual concentrations.

Examination of the data provides insight into the long-term trends of haze causing pollutants at the JARB1 IMPROVE monitor. SO_4 and NO_3, considered to be emitted by mostly anthropogenic sources, have slight downward trends, although NO_3 is essentially flat. These data suggest slight improvement in the long-term control of SO_2 and NO_x emissions impairing visibility at the Jarbidge Wilderness Area for the worst days.

OMC extinction, despite its large annual variation, has a well-defined, upward long-term trend, suggesting a larger role of fire emissions in regional haze with time. EC, also thought to be largely due to fire emissions, has a flat trend.

FIGURE 2-19

ANNUAL IMPROVE RECONSTRUCTED EXTINCTION TRENDS
FOR WORST AND BEST DAYS



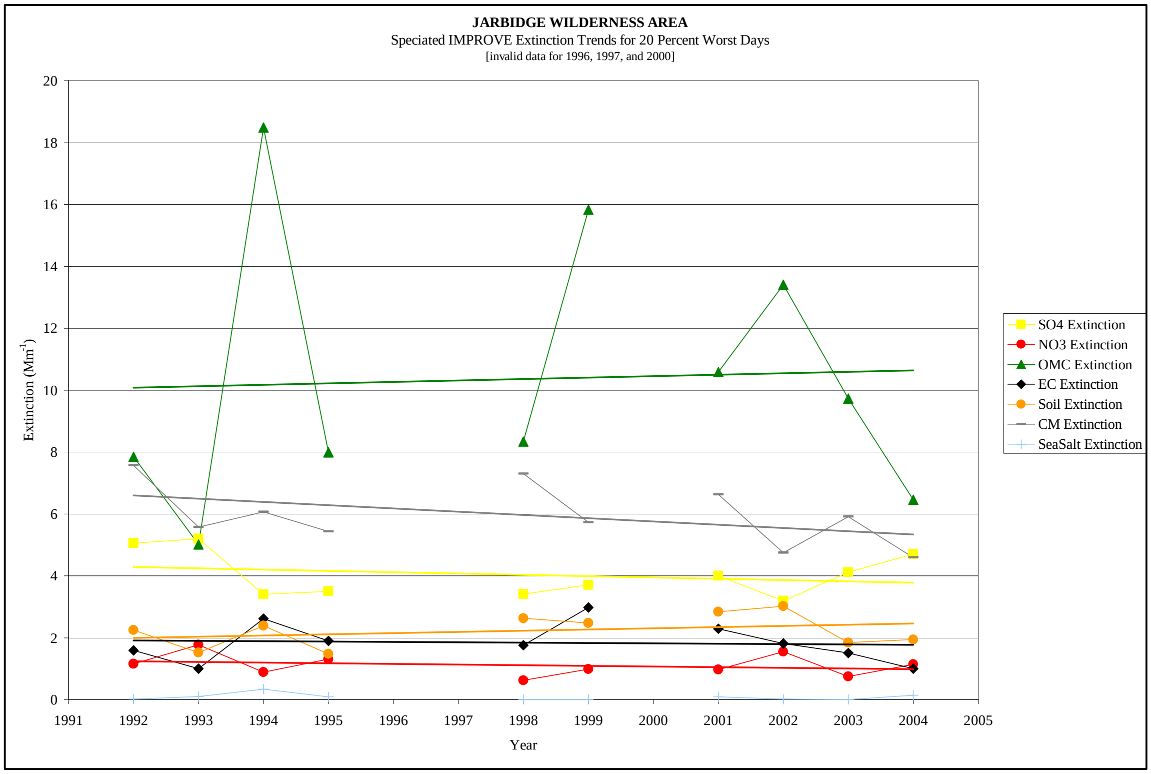
CM, also showing significant annual variations, has a long-term downward trend. SOIL shows an opposite, upward trend, although not as pronounced, perhaps due to increasing contributions to international transport resulting from climate change and increasing population pressure in the developing world.

Continued improvements in regional sulfate and, to a lesser degree, nitrate levels are expected in the western states as further controls are realized on major sources as the result of BART and the implementation of other regional haze programs, as well as compliance with ozone and $PM_{2.5}$ standards. We expect these regional downward trends in SO_2 and NO_x emissions will provide continued visibility improvement.

However, the trends in OMC and SOIL are not so encouraging. The wide variations in annual concentrations on the 20 percent worst days may be related to alternating drought and normal precipitation conditions with corresponding increases in carbon emissions due to wildfires and increases in dust (e.g., CM and SOIL) emissions resulting from increasingly prevalent dry and dusty conditions.

FIGURE 2-20

JARBIDGE WILDERNESS AREA
SPECIATED EXTINCTION TRENDS FOR WORST DAYS



NDEP has analyzed the JARB1 monitor data; identified the baseline and natural visibility conditions; identified a 2018 URP value of 11.09 dv for the worst days; and determined OMC and CM extinction contribute the majority of visibility impairment on the worst days. These data suggest that visibility improvement due to emissions reductions of SO_2 and NO_x from anthropogenic sources may be overwhelmed by seasonally variable OMC and CM, as well as EC and SOIL, extinction contributions due to emissions from natural sources.

These data suggest control of sources of OMC, CM, and SO_2 may be the most effective means of improving visibility impairment at the Jarbidge Wilderness Area. The following chapter discusses Nevada's sources of visibility impairing pollutants.

2.6 REFERENCES

U.S. EPA 2003. Guidance for Tracking Progress under the Regional Haze Rule. EPA-454/B-03-004. September 2003.

U.S. EPA 2003. Guidance for Estimating Natural Visibility Conditions under the Regional Haze Rule. EPA-454/B-03-005. September 2003.

U.S. EPA 2007. Guidance for Setting Reasonable Progress Goals under the Regional Haze Rule. U.S. Environmental Protection Agency, Office of Air Quality and Standards, Research Triangle Park, North Carolina. June 1, 2007 rev.

Chapter Three - Sources of Impairment in Nevada

3.1 BACKGROUND

3.2 SOURCES OF VISIBILITY IMPAIRMENT

3.2.1 Natural Sources of Visibility Impairment
3.2.2 Anthropogenic Sources of Visibility Impairment

3.3 DEVELOPMENT OF THE 2002 AND 2018 EMISSION INVENTORIES

3.4 POINT SOURCE EMISSION INVENTORY

3.4.1 2000-2004 Baseline Emissions
3.4.2 2018 Projected Emissions

3.5 FIRE EMISSION INVENTORY

3.6 AREA SOURCE EMISSION INVENTORY

3.7 OVERVIEW OF EMISSION INVENTORY SYSTEM – TSS

3.8 EMISSIONS IN NEVADA

3.8.1 Nevada SO_x Emission Inventory for 2002 and 2018
3.8.2 Nevada NO_x Emission Inventory for 2002 and 2018
3.8.3 Nevada VOC Emission Inventory for 2002 and 2018
3.8.4 Nevada POA Emission Inventory for 2002 and 2018
3.8.5 Nevada EC Emission Inventory for 2002 and 2018
3.8.6 Nevada PM Fine Emission Inventory for 2002 and 2018
3.8.7 Nevada PM Coarse Emission Inventory for 2002 and 2018
3.8.8 Nevada NH_3 Emission Inventory for 2002 and 2018

3.9 SUMMARY OF 2018 EMISSION PROJECTIONS

3.1 BACKGROUND

Federal visibility regulations at 40 CFR 51.308(d)(4)(v) require a statewide emission inventory of pollutants that are reasonably anticipated to cause or contribute to visibility impairment in any mandatory Class I area. The pollutants discussed in this chapter are sulfur oxides (SO_x), which include the particulate and gaseous phase, sulfur dioxide (SO_2), which includes the gas phase only, nitrogen oxides (NO_x), volatile organic compounds (VOC), primary organic aerosol (POA), elemental carbon (EC), PM fine (PMF), PM coarse (PMC), and ammonia (NH_3). Emission scenarios that were used for this analysis were the "Plan02d" and "PRP18a" inventories and were obtained from the Technical Support System (TSS) (http://vista.cira.colostate.edu/TSS/Results/Emissions.aspx). These inventories represent a series of refinements to previous inventories reflecting increasing levels of quality control and quality assurance by states and Western Regional Air Partnership's (WRAP) Regional Modeling Center (RMC) contractors.

This chapter presents the analysis of the sources of emissions of visibility impairing pollutants identified above. Emission inventories form one leg of the analysis stool to evaluate sources' impacts on visibility. Emission inventories were created for all critical chemicals or species known to directly or indirectly impact visual air quality. These inventories were input into air quality models to predict concentrations of pollutants over a given space and time. In support of the WRAP Regional Haze effort, RMC developed emissions inventories representing:

- 2002 Actual Baseline Emissions (Base02)
- 2000 Through 2004 Typical Baseline Emissions (Plan02)
- 2018 Base Case Emissions (Base18)
- 2018 Preliminary Reasonable Progress Emissions (PRP18)

The base and plan inventories represent a series of refinements to each inventory reflecting increasing levels of quality control and quality assurance by states and RMC contractors. The purpose of the Base02 inventory is to represent the actual conditions in calendar year 2002 with respect to ambient air quality and the associated sources of visibility impairing air pollutants. The purpose of the Plan02 inventory is to represent baseline emission patterns based on average, or "typical", conditions. It provides a basis for comparison with the 2018 projected emissions, as well as for gauging reasonable progress with respect to future year visibility.

Base18 represents conditions in future year 2018 with respect to sources of criteria and particulate matter air pollutants, taking into consideration growth and controls. The Base18 emissions scenario includes reductions due to "on-the-way" and "on-the-books" controls, consent decree reductions, SIP control measures, and other relevant regulations that have gone into effect since 2002, or will go into effect before the end of 2018. Modeling results based on the Base18 emission inventory are used to define the future year ambient air quality and visibility metrics. The PRP18 inventory was created to establish the most representative source-specific emissions projections data as the basis for preparing regional haze plans. The PRP18 inventory includes reductions to SO_x based on presumptive Best Available Retrofit Technology (BART) emission limits for large electric generating units (EGU)'s subject to BART.

Dispersion modeling predicts daily atmospheric concentrations of pollutants for the baseline year, and these modeled results are compared to monitored data taken from the Interagency Monitoring of Protected Visual Environments (IMPROVE) network. A second inventory is then created to predict emissions in 2018 based on expected controls, growth or other factors. Additional inventories are also created for future years to simulate the impact of different control strategies.

3.2 SOURCES OF VISIBILITY IMPAIRMENT

Emissions have been categorized by pollutant, source category and source area to provide for emissions analyses (Table 3-1).

TABLE 3-1

SUMMARY OF POLLUTANTS, SOURCE CATEGORIES, AND SOURCE AREAS

Pollutants	Source Categories	Source Areas
Sulfur dioxide (SO_2)	Point Sources	Pacific Offshore
Nitrogen oxides (NO_x)	Anthropogenic Fire Sources	Atlantic/Gulf Offshore
Volatile organic carbon (VOC)	Area Sources	WRAP States
Primary organic aerosol (POA)	WRAP Oil and Gas Sources	CENRAP States
Elemental carbon (EC)	On-Road Mobile Sources	Midwest RPO States
Particulate matter fine (PMF)	Off-Road Mobile Sources	MANE - VU States
Particulate matter coarse (PMC)	Road Dust	VISTAS States
Ammonia (NH_3)	Fugitive Dust	Canada
	Natural Fire Sources	Mexico
	Biogenic Sources	
	Wind Blown Dust	

Natural fire sources, biogenic sources and windblown dust are shown in *italics* to denote that they are natural sources; all other sources are anthropogenic.

3.2.1 Natural Sources of Visibility Impairment

Natural sources of visibility impairment include anything not directly attributed to human-caused emissions of visibility-impairing pollutants. Natural events (e.g. natural fire, biogenic emissions, and windblown dust) also introduce pollutants that contribute to haze in the atmosphere. Natural sources contribute to visibility impairment but natural emissions cannot be realistically controlled or prevented by Nevada or other regulatory agencies. In Nevada, natural sources are important contributors of EC, PM fine, PM coarse, POA, and VOC emissions.

3.2.2 Anthropogenic Sources of Visibility Impairment

Anthropogenic or human-caused sources of visibility impairment include anything directly attributable to human-caused activities that produce emissions of visibility-impairing pollutants. Some examples include point sources, area sources, mobile sources, oil and gas sources, road dust, fugitive dust and anthropogenic fires. Generally anthropogenic emissions include not only those that are generated or originated within the boundaries of the United States, but also international emissions that are generated outside of the United States but transported into the region. Some examples include emissions from Mexico, Canada and maritime shipping emissions in the Pacific Ocean. Note that Mexican and Canadian emission inventories include both anthropogenic and natural emissions.

Although international anthropogenic sources contribute to visibility impairment, they cannot be regulated, controlled or prevented by Nevada and, as with natural emissions, are beyond the scope of this planning document. Any reductions in international emissions would likely fall under the purview of the USEPA administrator. Table 3-2 shows that in Nevada, anthropogenic sources are important contributors of SO_x, NO_x, and NH_3. The source of data summarized in Table 3-2 is shown in more detail in section 3.8.

TABLE 3-2

SUMMARY OF ANTHROPOGENIC AND NATURAL EMISSION SOURCES IN NEVADA

Pollutant	2002		2018	
	Anthropogenic Sources	Natural Sources	Anthropogenic Sources	Natural Sources
SO_x	96%	4%	94%	6%
NO_x	86%	14%	83%	17%
EC	27%	73%	17%	83%
PMF	44%	56%	51%	49%
PMC	38%	62%	47%	53%
NH_3	86%	14%	88%	12%
POA	9%	91%	9%	91%
VOC	10%	90%	10%	90%
Total emissions:	28%	72%	27%	73%

3.3 DEVELOPMENT OF THE 2002 AND 2018 EMISSION INVENTORIES

In general, emission inputs were prepared by individual states and tribes for point, area and most dust emissions categories. With input and review by states, tribes and Federal Land Managers, WRAP forums and workgroups prepared consistent and comparable WRAP region emissions data for the mobile, fire, ammonia, area source oil and gas, eastern Pacific offshore shipping, some dust and biogenics emissions categories. The WRAP RMC gathered the latest, best and most representative emissions estimates at the time from the CENWRAP, Eastern U.S., Canada and Mexico regions in executing the sequence of modeling simulations discussed below. Boundary conditions reaching North America from the rest of the world were jointly prepared by all five Regional Planning Organizations (RPO)s from the GEOS-Chem global model.

The original 2002 and 2018 stationary point and area source emission inventories were developed by Eastern Research Group, Inc. (ERG) in 2005. At the request of the Western Governors' Association and the WRAP Stationary Sources Joint Forum, ERG calculated point and area sources emission projections for the Base18 inventory. A summary document was prepared by ERG January 25, 2006 (http://wrapair.org/forums/ssjf/documents/eictts/docs/WRAP_2018_EI-Version_1-Report_Jan2006.pdf). The original inventories evolved from states' actual emissions data submitted to USEPA for the 2002 National Emission Inventory (NEI). The 2002 NEI consisted of a complete set of point, non-point and mobile data that had been submitted to EPA. The 2002 emission inventory was chosen to provide a baseline against which reductions in visibility-impairing pollutants could be measured over time. The 2018 emission inventory was developed because 2018 is the year the first regional haze SIP planning period ends. Historical development of the different versions of the emission inventories that were developed for the Base02, the Plan02, the Base18 and the PRP18 inventories is described in detail in Chapter One.

3.4 POINT SOURCE EMISSION INVENTORY

Point sources are identified by point locations, typically because they are regulated and their locations are available in regulatory reports. Point sources can be further subdivided into EGU sources and non-EGU sources, particularly in criteria inventories in which EGUs are a primary source of NO_x and SO_x.

3.4.1 2000-2004 Baseline Emissions

A summary of NO_x and SO_2 emissions for the baseline period (Plan02d) in Nevada is noted in Table 3-3 by total tons and percent of total emissions by pollutant. The Plan02d inventory shows that nine facilities in Nevada contain 99 percent of the total SO_2 point emissions and that 19 facilities contribute to 97 percent of the total NO_x emissions in Nevada.

The data in Table 3-3 was compiled for the baseline period from the Plan02d inventory point source emissions-pivot table (01/14/08), located on the WRAP website (http://www.wrapair.org/forums/ssjf/pivot.html).

TABLE 3-3

SUMMARY OF SO_2 AND NO_X EMISSIONS
FROM NEVADA POINT SOURCES FOR THE BASELINE PERIOD

Annual Emissions (tpy)	SO_2		NO_x	
	Number of Facilities	Cumulative Percent of Total Point Source Emissions	Number of Facilities	Cumulative Percent of Total Point Source Emissions
> 10,000	1	79.5%	2	51.7%
2,000 to 10,000	1	93.1%	5	86.3%
500 to 2000	1	97.0%	4	94.4%
100 to 500	6	99.0%	8	97.0%

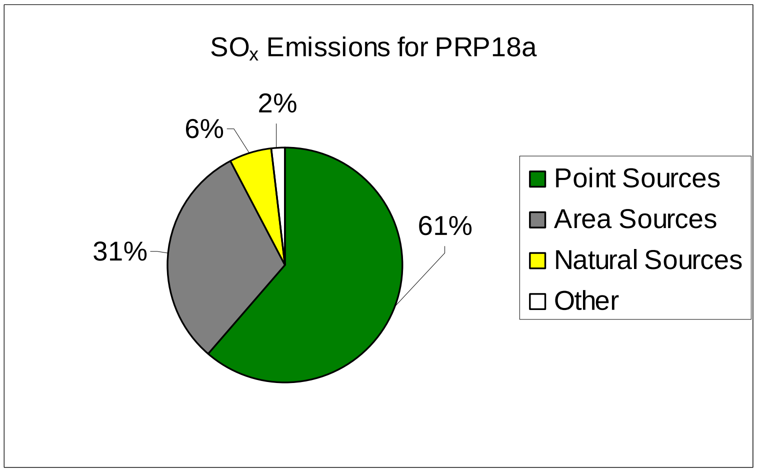
3.4.2 2018 Projected Emissions

SO_x includes emissions from both the particulate and gaseous phase. SO_2 refers only to emissions from the gaseous phase. The pivot tables only included emissions for SO_2. The TSS contained data for both SO_2 and SO_x. SO_2 emissions from point sources in Nevada are projected to total 27,526 tons from 13 facilities (three of which are proposed coal EGU facilities) by 2018. These 13 facilities represent 97.7 percent of the total SO_2 emissions from all point sources (28,167 tons) and 97.2 percent of the total SO_x emissions from all point sources (28,320 tons); see Table 3-4. The increase in point SO_2 vs. point SO_x emissions for the 2018 inventory is 153 tons; a 0.5 percent difference. The difference in total SO_2 emissions vs. total SO_x emissions for Nevada is an increase of 1.8 percent for the plan02d inventory and 2.5 percent for the PRP18a inventory. This equates to an increase in 1,236 tons for the plan02d inventory and 1,105 tons for the PRP18a inventory.

Figure 3-1 shows the percent contribution by source category for SO_x emissions projected for 2018, while Figure 3-2 shows the same for NO_x. Point sources represent 61 percent, area sources 31 percent, natural sources 6 percent and other source categories 2 percent of the total SO_x emissions. Natural sources include windblown dust, natural fire and biogenic source categories. Other includes on-road and off-road mobile sources, road dust, fugitive dust and anthropogenic fire source categories.

FIGURE 3-1

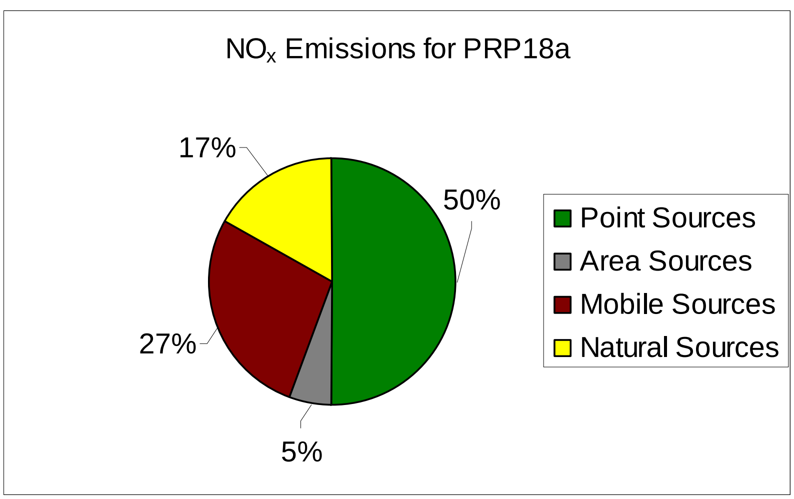
PERCENT CONTRIBUTION BY SOURCE CATEGORY FOR SO_x



NO_x emissions from point sources in Nevada are projected to total 65,581 tons from 15 facilities (three of which are proposed coal EGU facilities and two are natural gas EGU facilities) by 2018. These 15 facilities represent 97 percent of the total NO_x emissions from all point sources (67,632 tons) see Table 3-4. The pie chart shows the percent contribution by source category for NO_x emissions projected for 2018. Point sources represent 50 percent, mobile sources 27 percent, natural sources 17 percent, and area sources 5 percent of the total SO_2 emissions. The remaining one percent consists of emissions from oil and gas, fugitive dust and anthropogenic fire source categories.

FIGURE 3-2

PERCENT CONTRIBUTION BY SOURCE CATEGORY FOR NO_x



The data in Table 3-4 for SO_2 and NO_x was compiled from the 2018 inventory, PRP18a (11/14/07) point source emissions-pivot table, located on the WRAP website (http://www.wrapair.org/forums/ssjf/pivot.html). Nevada anticipates even further reductions in the future for both SO_x and NO_x from the projected controls to be installed at Nevada's four BART facilities. Chapter Five discusses those controls and proposed emission reductions in detail.

TABLE 3-4

SUMMARY OF SO_2 AND NO_X EMISSIONS FROM NEVADA POINT SOURCES FOR 2018

Annual Emissions (tpy)	SO_2		NO_x	
	Number of Facilities	Cumulative Percent of Total Point Source Emissions	Number of Facilities	Cumulative Percent of Total Point Source Emissions
> 10,000	0	0%	1	29.0%
2,000 to 10,000	3	78.7%	6	76.3%
500 to 2000	3	92.5%	8	90.8%
100 to 500	7	97.7%	15	97.0%

Table 3-5 shows emission projections for proposed EGU facilities as estimated for the 2018 emission inventory (PRP18a).

TABLE 3-5

PROPOSED 2018 EGUs AND CURRENT PERMIT ACTIVITY

Proposed EGUs in 2018 Emission Inventory	NO_x (tpy)	PM_{10} (tpy)	SO_2 (tpy)
Future Coal EGU (Newmont - Northern Nevada Energy)	499	89	670
Future Natural Gas EGU (Copper Mountain - Sempra Energy)	887	71	6
Future Natural Gas EGU (Chuck Lenzie - NV Energy)	739	59	5
Future Coal EGU (White Pine Energy Association/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

VOC, POA, EC, PMF and PMC emissions are dominated by natural sources. Figures 3-3 through 3-8 show a graphical representation for the projected PRP18a emissions. Figure 3-3 shows that natural sources, primarily from biogenic sources, represent 90 percent of the total projected VOC emissions.

FIGURE 3-3

PERCENT CONTRIBUTION BY SOURCE CATEGORY FOR VOC

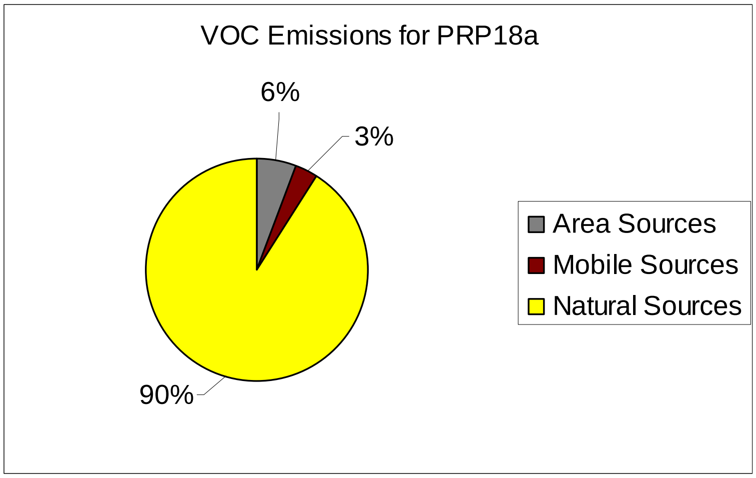


Figure 3-4 shows the percent contribution by source category for POA emissions projected for 2018. Natural fires comprise the majority of POA emissions at 91 percent.

FIGURE 3-4

PERCENT CONTRIBUTION BY SOURCE CATEGORY FOR POA

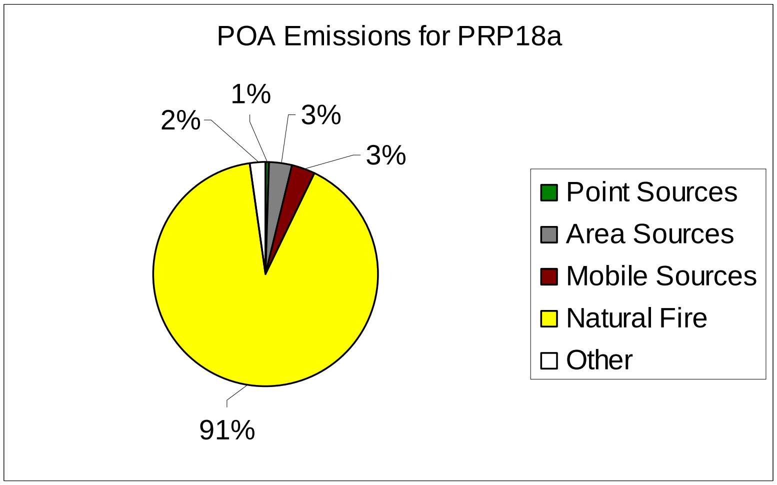


Figure 3-5 shows the percent contribution by source category for EC emissions projected for 2018. Natural fires comprise the majority of EC emissions at 83 percent.

FIGURE 3-5

PERCENT CONTRIBUTION BY SOURCE CATEGORY FOR EC

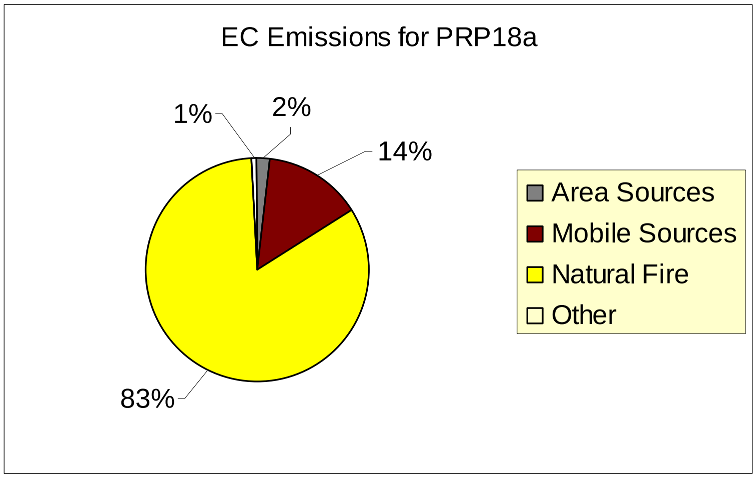


Figure 3-6 shows the percent contribution by source category for PM fine emissions projected for 2018. Natural sources, primarily from windblown dust, 43 percent, and natural fire, six percent, comprise the majority of PM fine emissions. Fugitive Dust is also a significant contributor of PM fine emissions at 30 percent.

FIGURE 3-6

PERCENT CONTRIBUTION BY SOURCE CATEGORY FOR PM FINE

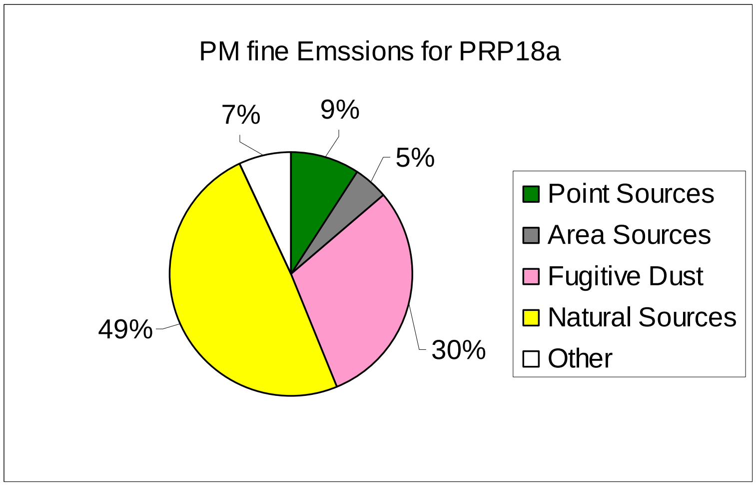


Figure 3-7 shows the percent contribution by source category for PM coarse emissions projected for 2018. Natural sources, primarily from windblown dust, 50 percent, and natural fire, three percent, comprise the majority of PM fine emissions. Fugitive Dust is also a significant contributor of PM coarse emissions at 36 percent.

FIGURE 3-7

PERCENT CONTRIBUTION BY SOURCE CATEGORY FOR PM COARSE

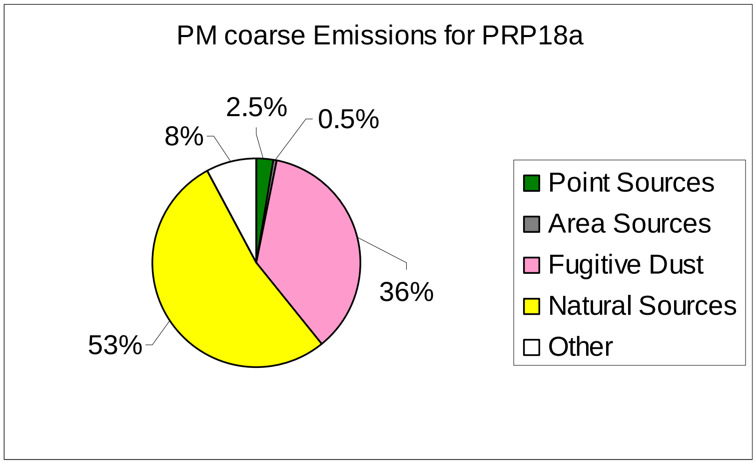
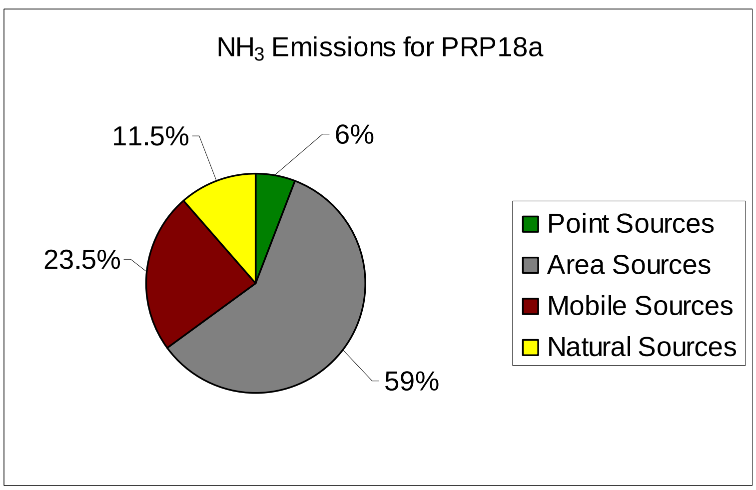


Figure 3-8 shows the percent contribution by source category for NH_3 emissions projected for 2018. Area sources, 59 percent, comprise the majority of NH_3 emissions. Mobile sources also a significant contributor of NH_3 emissions at 23.5 percent.

FIGURE 3-8

PERCENT CONTRIBUTION BY SOURCE CATEGORY FOR AMMONIA



3.5 FIRE EMISSION INVENTORY

The Fire Emissions Joint Forum of the WRAP, through a contract issued by the WGA to Air Sciences Inc. and E C/R incorporated, prepared Phase III baseline period (2000-2004) and Phase

IV projection year (PRP18a) fire emission inventories. A document was produced May 2007 describing these inventories. http://www.wrapair.org/forums/fejf/documents/task7/Phase3-4EI/WRAP_Fire_Ph3-4_EI_Report_20070515.pdf. Inventory years 2000 through 2004 were used to estimate the emissions for the 2000 through 2004 baseline period.

For the fire inventories in the Base02 inventory, actual 2002 data developed by the Regional Planning Organization' for the United States, version 2 of the year 2000 Canadian inventory and actual 2002 data for Ontario, Canada were used. There were no fire emissions in the 1999 Mexico inventories, so Mexican fires were not included in the Base02 inventories. The fire emission inventories developed for the WRAP modeling efforts were organized into seven source categories: wildfires, agricultural fires, wildland fire use, natural prescribed, anthropogenic prescribed, non-Federal rangeland fires and non-WRAP fires. The baseline period fire emission inventories were built based upon the Fire Emissions Joint Forum's Phase II (historical 2002) inventories for wildfire, wildland fire use, prescribed burning, agricultural burning and non-federal rangeland burning.

The difference between the Base02 and the Plan02 inventories was that actual fire data was used in Base02 and an average of fire data for years 2000 through 2004 was used to smooth out the high 2002 fire year to give a more typical fire inventory for Plan02. Thus, the Base02 was used for model performance evaluation and to represent actual emissions for comparison with actual data. Plan02 data was used for planning purposes as a typical dataset for the baseline period.

In the Base18b inventory for WRAP, CENRAP, and VISTAS, the baseline fire emission inventories were held constant at Plan02 typical emission levels. The Natural Fire source category emission inventory projection was held constant from 2002 to 2018 (PRP18a).

3.6 AREA SOURCE INVENTORY

The area source emission inventory was primarily driven by population and/or economic growth as expressed by growth factors from USEPA's EGAS growth factor model. EGAS Version 5.0 generates SCC-specific growth factors for a specified geographic area using various socio-economic data. For area sources, growth factors were obtained from one of three sources: the EGAS growth factor model, energy projections from Energy Information Administration or agricultural crop projections from the U.S. Department of Agriculture.

3.7 OVERVIEW OF EMISSION INVENTORY SYSTEM - TSS

The WRAP developed the Technical Support System (TSS) as an Internet access portal to all the data and analysis associated with the development of the technical foundations of regional haze plans across the Western US. The TSS provides state, county and grid cell level emissions information for typical criteria pollutants such as SO_2 and NO_x and other secondary particulate forming pollutants such as VOC and NH_3. Eleven different emission inventories were developed comprising the following source categories: point, area, on-road mobile, off-road mobile, oil and gas, anthropogenic fire, natural fire, biogenic, road dust, fugitive dust and windblown dust. More detailed information on the emission inventory information can be found on the WRAP TSS website at the following link: http://vista.cira.colostate.edu/TSS/Results/Emissions.aspx .

Additional emission information including regional emissions can be found on the WRAP RMC website at: http://pah.cert.ucr.edu/aqm/308/.

3.8 EMISSIONS IN NEVADA

The pollutants inventoried by the WRAP include SO_2, SO_x, NO_x, VOC, POA, EC, fine particulate (Soil-$PM_{2.5}$), coarse particulate ($PM_{2.5}$ to PM_{10}), and NH_3. An inventory was developed for the baseline year 2002, and projections of future emissions have been made for 2018. Nevada will provide updates to the WRAP on this inventory on a periodic basis. For purposes of the Regional Haze SIP, the WRAP developed emission inventories for each state with input from participating stakeholders.

The process for inventorying sources is similar for all species of interest. The number and types of sources is identified by various methods. For example, major stationary sources report actual annual emission rates to the USEPA national emissions database. Nevada collects annual emission data from both major and minor sources and this information is used as input into the emissions inventory. In other cases, such as mobile sources, a USEPA mobile source emissions model is used to develop emission projections. Nevada vehicle registration, vehicle mile traveled information and other vehicle data are used to tailor the mobile source data to best represent statewide and area specific emissions. Population, employment and household data are used in other parts of the emissions modeling to characterize emissions from area sources such as home heating. Thus, for each source type, emissions are calculated based on an emission rate and the amount of time the source is operating. Emission rates can be based on actual measurements from the source, or USEPA emission factors based on data from tests of similar types of emission sources. In essence, all sources go through a similar process. The number of sources is identified, emission rates are determined by measurements of those types of sources and the time of operation is determined. Annual emissions can be obtained by multiplying the emission rate times the number of hours of operation in a year.

Table 3-6 summarizes Nevada's statewide emissions for 2002 and 2018 projections in tons and are noted as either anthropogenic sources or natural sources. The percent change in tons from 2002 to 2018 is shown on a pollutant basis. Detailed discussions of each pollutant are described in the following sections. Based on the information presented in Table 3-6 the projected (PRP18a) sum of anthropogenic emissions for SO_x and NO_x for all source categories is 11.7 percent of the total 2018 projected sum of emissions statewide.

The figures and tables in this section and the remainder of this chapter are based on the Plan02d and PRP18a emission inventories. These inventories are described in detail in Chapter One, Section 1.3.2.

TABLE 3-6

EMISSIONS SUMMARY TABLE FOR NEVADA FOR 2002 AND 2018:
NATURAL VS. ANTHROPOGENIC SOURCES

Emissions Summary Table (tons per year)								
	2002				2018			
	Anthro-pogenic Source	Natural Source	Total Tons 2002		Anthro-pogenic Source	Natural Source	Total Tons 2018	Percent Change
SO_x	66,195	2,784	68,979		43,440	2,784	46,224	-33.0%
NO_x	139,372	23,102	162,475		112,394	23,102	135,496	-16.6%
EC	1,735	4,674	6,409		964	4,674	5,638	-12.0%
PMF	9,125	11,845	20,969		12,289	11,845	24,134	15.1%
PMC	62,020	99,122	161,142		89,165	99,122	188,287	16.8%
NH_3	10,408	1,684	12,092		12,819	1,684	14,503	19.9%
POA (OC)	2,233	22,501	24,734		2,321	22,501	24,822	0.4%
VOC	85,357	811,745	897,102		85,962	811,745	897,707	0.1%
Total emissions:	376,444	977,458	1,353,902		359,354	977,458	1,336,811	-1.3%

3.8.1 Nevada SO_x Emission Inventory for 2002 and 2018

Sulfur dioxide gases (SO_2) are formed when sulfur-containing fuels, such as diesel or coal, are burned, when gasoline is extracted from oil or when metals are extracted from ore. SO_2 dissolves in water vapor to form acid, and contributes to the formation of sulfate compounds [e.g. $(NH_4)_2SO_4$] when ammonia is available. These compounds can scatter the transmission of light, thus contributing to visibility reduction on a regional scale at our Class 1 Area.

Sulfur dioxide emissions produce sulfate particles in the atmosphere. Ammonium sulfate particles have a significantly greater impact on visibility than other pollutants like dust from unpaved roads due to the physical characteristics causing greater light scattering from the particles. Sulfur dioxide emissions come primarily from coal combustion at electrical generation facilities but smaller amounts come from natural gas combustion, mobile sources and even wood combustion.

A 33 percent statewide reduction in SO_x emissions is expected by 2018 due to planned controls on existing sources; even with the growth consideration in electric generating power for the state. Point sources account for 74 percent of SO_x emissions in the Plan02d inventory and decrease to 60 percent for 2018 projections as a result of stationary source controls. The PRP18 inventory included reductions to SO_x presumptive limits for subject to BART large EGU's. Power plants with a total generating capacity in excess of 750 MW must meet specific control levels for SO_2 of either 95 percent control or 0.15 lbs/MMBtu, for each EGU greater than 200 MW. Reductions seen in mobile source emissions are a result from the implementation of low-sulfur diesel fuel standards and other control programs discussed in Chapter Six. SO_x emissions from road dust and fugitive dust and to a lesser extent from area sources are anticipated to increase by 2018. Similar reductions in the west are expected from other states as BART and other planned controls take effect by 2018.

Figure 3-9 and Table 3-7 show the overall net decrease in emissions from 2002 to 2018 for Sulfur Oxides by source category. In all instances, ND means that you would never see these pollutants for these source categories (i.e. they do not exist from these emission sources).

FIGURE 3-9

NEVADA SO_x EMISSION INVENTORY – 2002 AND 2018

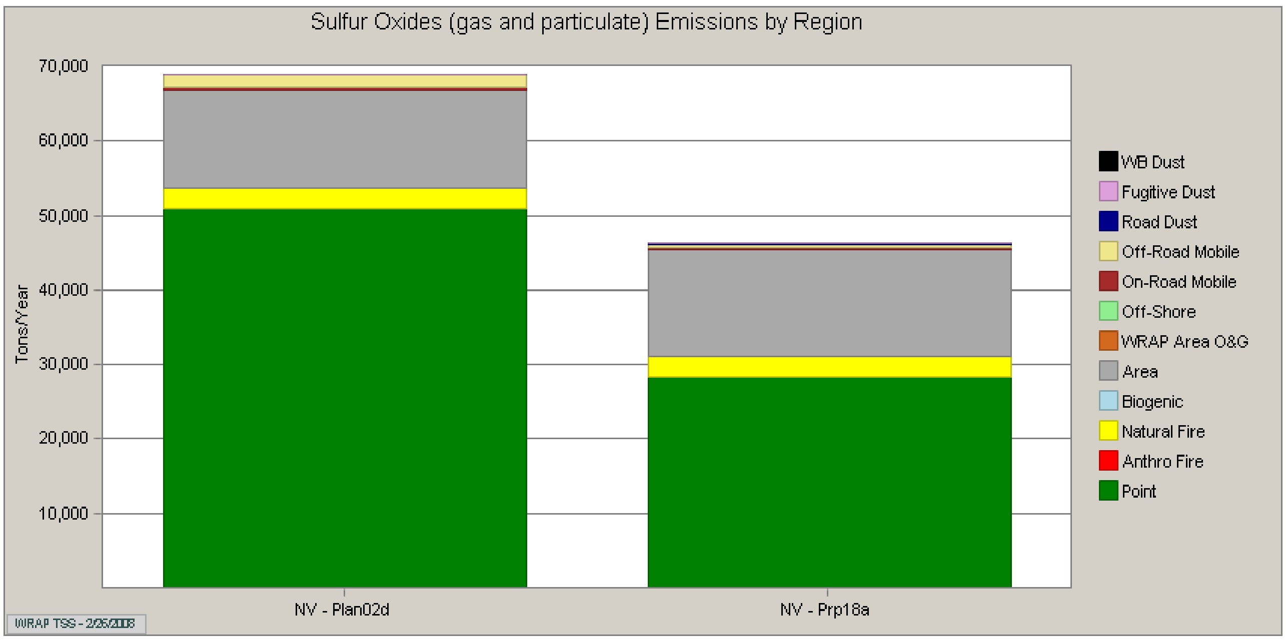


TABLE 3-7

NEVADA SO_x EMISSIONS BY SOURCE CATEGORY FOR 2002 AND 2018

Nevada Planning and Baseline Emission Inventories			
Source Category	Statewide SO_x		
	Plan 02d (tpy)	PRP 18a (tpy)	Net Change
Point	50,947	28,320	-44%
Area	13,037	14,280	10%
On-Road Mobile	510	336	-34%
Off-Road Mobile	1,672	473	-72%
Oil and Gas	1	0	-94%
Road Dust	3	5	53%
Fugitive Dust	10	13	35%
Windblown Dust	ND	ND	ND
Anthro Fire	14	12	-14%
Natural Fire	2,784	2,784	0%
Biogenic	ND	ND	ND
Total:	68,979	46,224	-33%

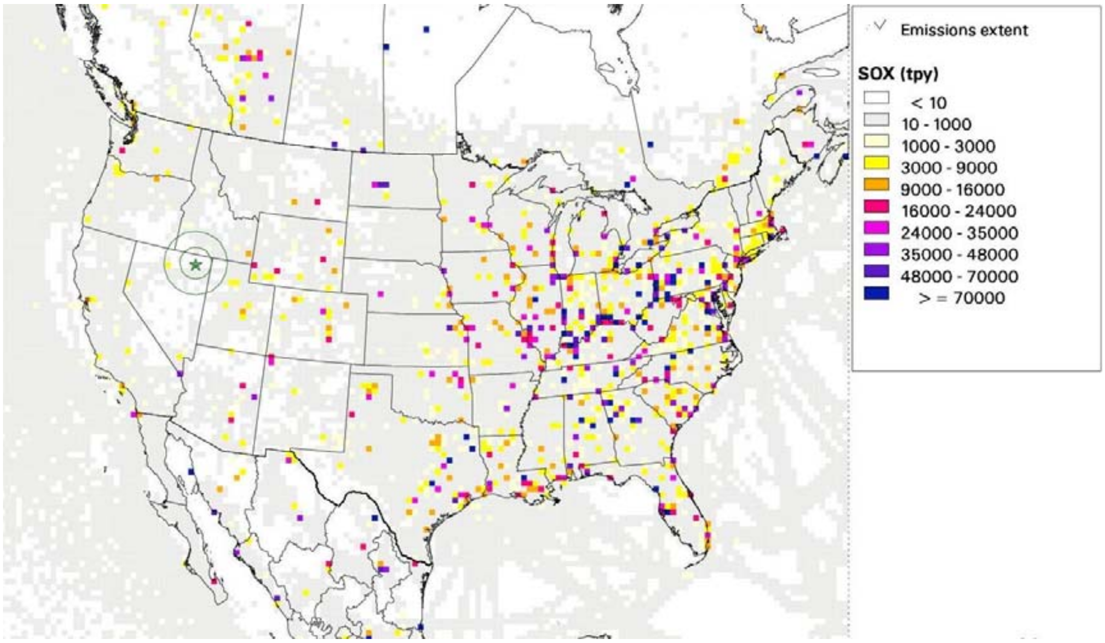
Figure 3-10, "Regional Maps of SO_x Emissions for 2002 and 2018," shows extensive areas within Nevada with less than 10 tons per year of SO_x emissions. Areas with more color are from urban/industrial areas of Reno and Las Vegas; a few larger areas of greater emissions are due to EGUs or other large point sources.

Figure 3-11, provides the Plan02d and PRP18a regional sulfur oxides ($SO_{x)}$ emission maps with the location of the JARB1 IMPROVE monitor identified with a green star surrounded by 100 km and 200 km radius concentric circles.

FIGURE 3-10

REGIONAL MAPS OF SO_x EMISSIONS FOR 2002 AND 2018

2002



2018

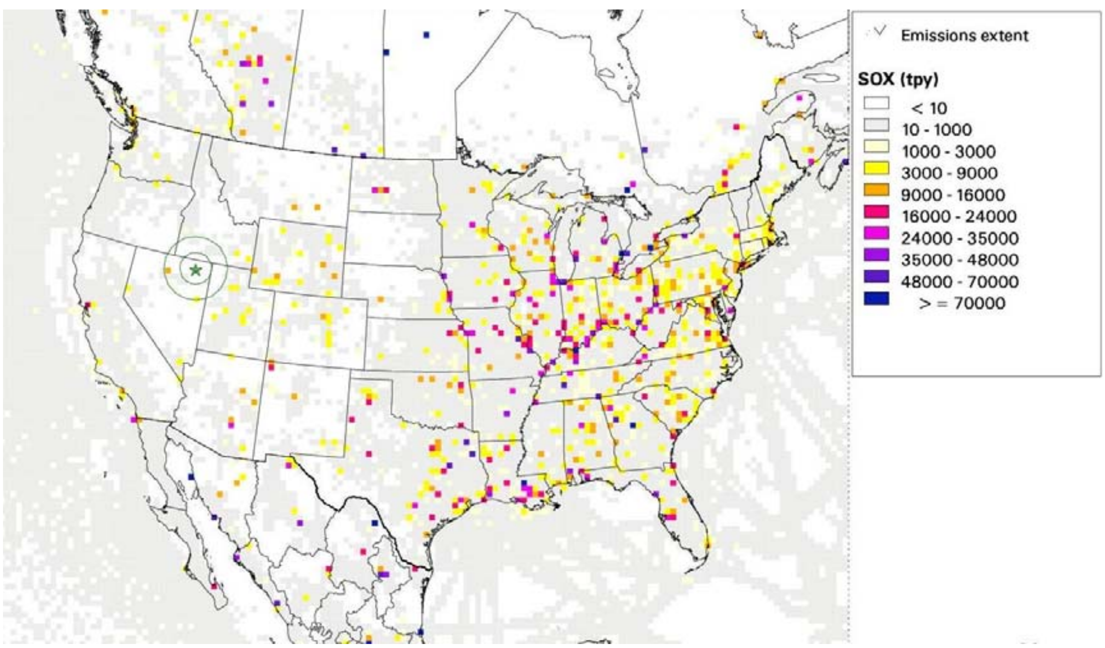
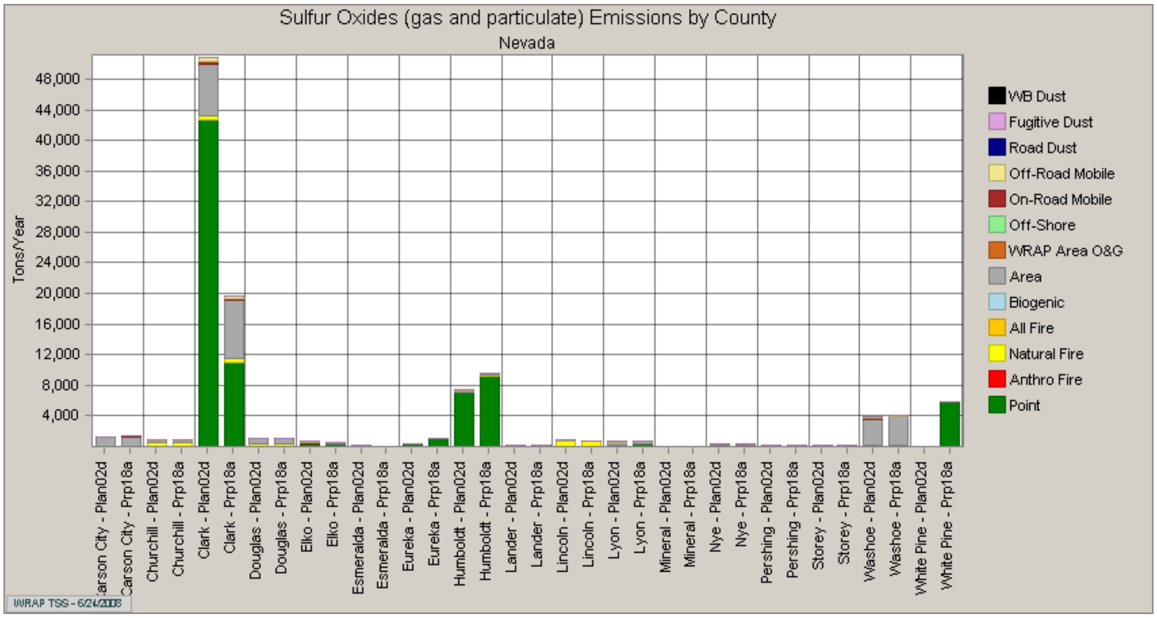


Figure 3-11 shows SO_x emissions by county and contribution by source category. Clark and Humboldt counties are dominated by point source emissions for 2002. Eureka, Humboldt and White Pine counties' projected emission increases for 2018 are primarily due to EGU sources. Area sources are the second most dominant contributor to SO_x emissions for Clark and Washoe counties.

FIGURE 3-11

SULFUR OXIDE EMISSIONS BY COUNTY (Plan02d) AND (PRP18a)



3.8.2 Nevada NO_X Emission Inventory for 2002 and 2018

NO_x is generated during any combustion process where nitrogen and oxygen from the atmosphere combine together under high temperature to form nitric oxide and to a lesser degree nitrogen dioxide and in much smaller amounts other odd oxides of nitrogen. These particles have a slightly greater impact on visibility than do sulfate particles and are four to eight times more effective at scattering light than mineral dust particles. These compounds can scatter the transmission of light, contributing to visibility reduction on a regional scale.

Point sources in Nevada contribute 37 percent of the total NO_x emissions from the Plan02d inventory and are projected to contribute 50 percent of the overall inventory for PRP18a. This net increase of 13 percent in point emissions does not incorporate any projected decrease in emissions due to installation of Nevada BART controls. Overall, NO_x emissions in Nevada are expected to decline by 17 percent, primarily due to significant reductions in emissions from mobile sources (from 45 percent in 2002 decreasing to 27 percent in 2018) primarily due to new federal vehicle emission standards. This equates to a 36,423 ton decrease in NO_x emissions from mobile sources. The 29 percent increase in area sources is largely due to forecasted increases in activity levels based on population growth. Figure 3-12 and Table 3-8 show the breakdown of NO_x emissions by source category for 2002 and 2018.

FIGURE 3-12

NEVADA NO_x EMISSION INVENTORY – 2002 AND 2018

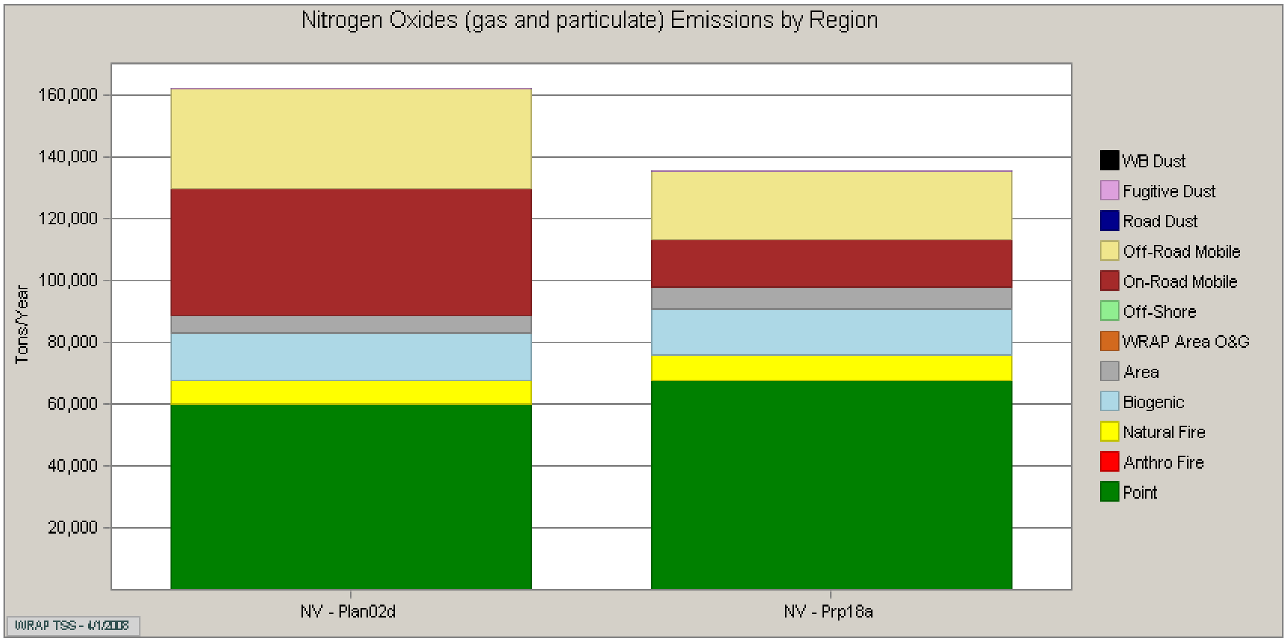


TABLE 3-8

NEVADA NO_x EMISSIONS BY SOURCE CATEGORY FOR 2002 AND 2018

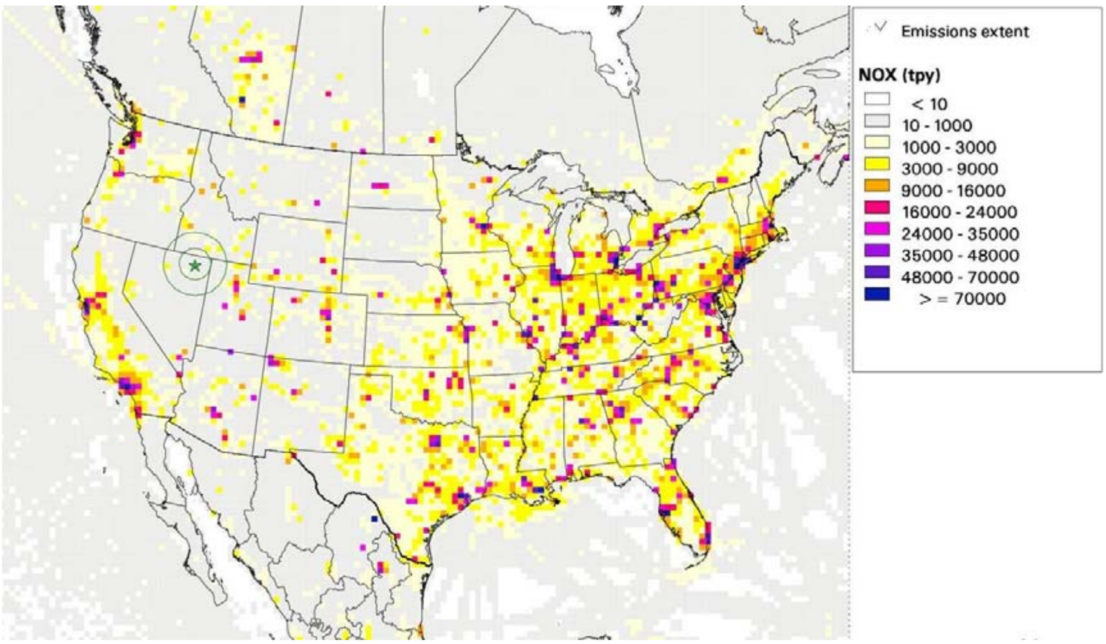
Nevada Planning and Baseline Emission Inventories			
Source Category	**Statewide NO_x**		
	Plan 02d (tpy)	PRP 18a (tpy)	Net Change
Point	59,873	67,632	13%
Area	5,728	7,418	29%
On-Road Mobile	41,089	15,049	-63%
Off-Road Mobile	32,565	22,182	-32%
Oil and Gas	63	63	1%
Road Dust	1	2	53%
Fugitive Dust	5	8	54%
Windblown Dust	ND	ND	ND
Anthro Fire	48	41	-16%
Natural Fire	8,085	8,085	0%
Biogenic	15,018	15,018	0%
Total:	162,475	135,496	-17%

Figure 3-13 provides the Plan02d and PRP18a regional NO_x emission maps with the location of the JARB1 IMPROVE monitor identified with a green star surrounded by 100 km and 200 km radius concentric circles.

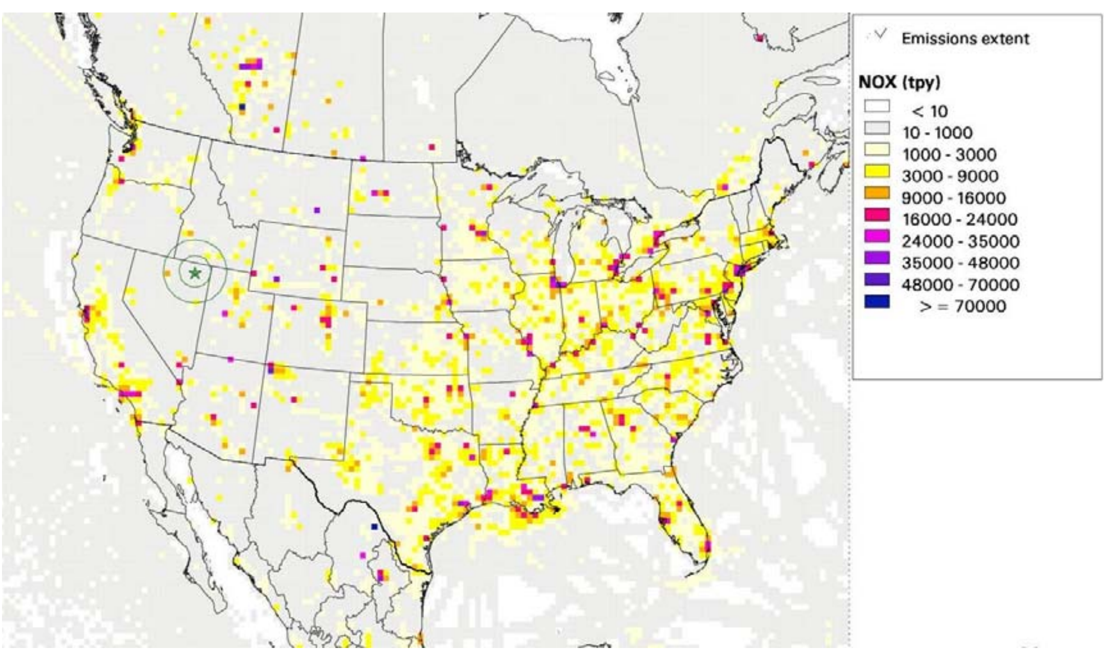
FIGURE 3-13

REGIONAL MAP OF NO_x EMISSIONS FOR 2002 AND 2018

2002



2018

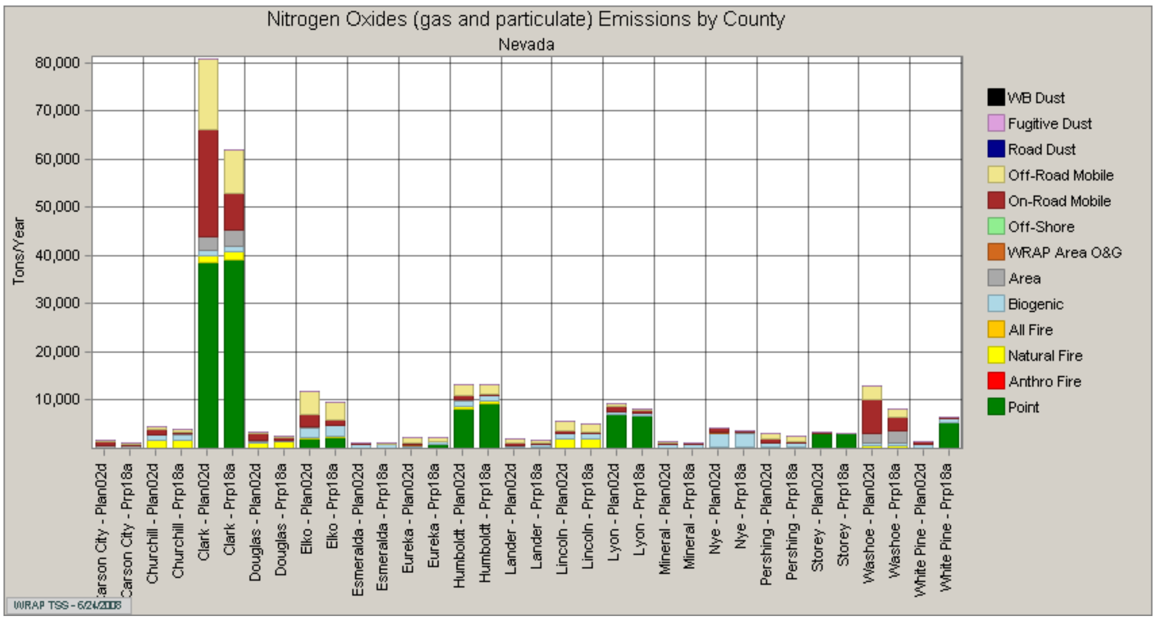


In Figure 3-14, note that for both 2002 and 2018, NO_x emissions in Nevada are primarily in the 10-1,000 tons per year range, except for the urban and industrial centers in Washoe and Clark counties.

Figure 3-14 shows NO_x emissions by county and contribution by source category. Clark, Humboldt, Lyon and Storey counties are dominated by point source emissions for 2002 as well as 2018 due to projected EGUs. Note the increase in point source emissions for White Pine County for 2018 due to proposed power plant(s). On-road mobile sources are the second most dominant contributor to NO_x emissions for Clark and Washoe counties for 2002, but with significant reductions by 2018, primarily due to the new federal vehicle emission standards.

FIGURE 3-14

<u>NITROGEN OXIDE EMISSIONS BY COUNTY (Plan02d) AND (PRP18a)</u>



3.8.3 Nevada VOC Emission Inventory for 2002 and 2018

VOCs are emitted as gases from certain solids or liquids. VOCs are emitted by a wide array of products numbering in the thousands. Examples include paints and lacquers, paint strippers, cleaning supplies, pesticides, building materials and furnishings, office equipment such as copiers and printers, correction fluids and carbonless copy paper, craft materials including glues and adhesives, permanent markers and photographic solutions (http://www.epa.gov/iedweb00/voc.html). Automobiles, industrial and commercial facilities, and refueling of automobiles all contribute to VOC loading in the atmosphere. Substantial natural emissions of VOCs come from vegetation; these emissions are categorized as biogenics. VOCs can directly impact visibility as emissions condense in the atmosphere to form an aerosol. Of more significance is the role VOCs play in the photochemical production of ozone in the troposphere. VOCs react with nitrogen oxides to produce nitrated organic particles that impact visibility in the same series of chemical events that lead to ozone. Thus, strategies to reduce ozone in the atmosphere often lead to visibility improvements. VOCs in Nevada are expected to increase slightly (0.07 percent) by 2018.

Figure 3-15 and Table 3-9 show the overall net zero percent change in emissions from 2002 to 2018 for VOCs. Biogenic sources, primarily from terpenes, dominate VOC emissions at approximately 90 percent for both 2002 and 2018. Area source emissions show a net increase in emissions, but area sources account for only 3.2 percent and 5.9 percent of the 2002 and 2018 VOC emission inventory respectively. Point VOC emissions show a net change of 75 percent, but point sources account for only 0.25 percent of the 2002 and 0.4 percent of the 2018 VOC emission inventory.

FIGURE 3-15

NEVADA VOC EMISSION INVENTORY – 2002 AND 2018

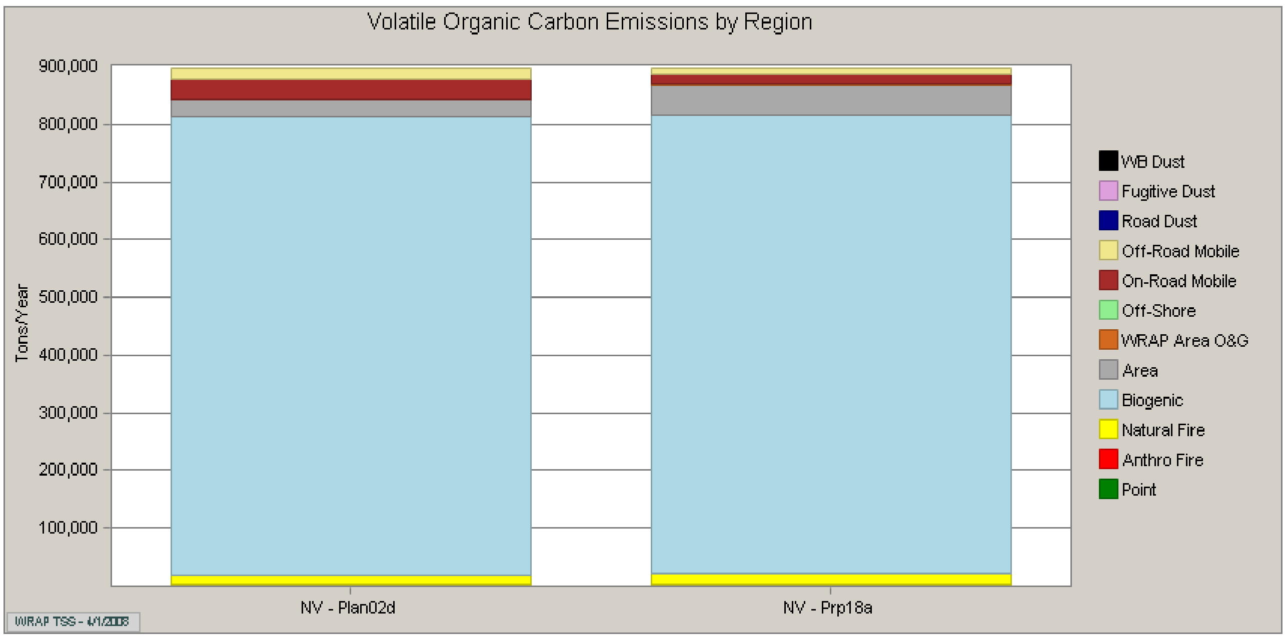


TABLE 3-9

NEVADA VOC EMISSIONS BY SOURCE CATEGORY FOR 2002 AND 2018

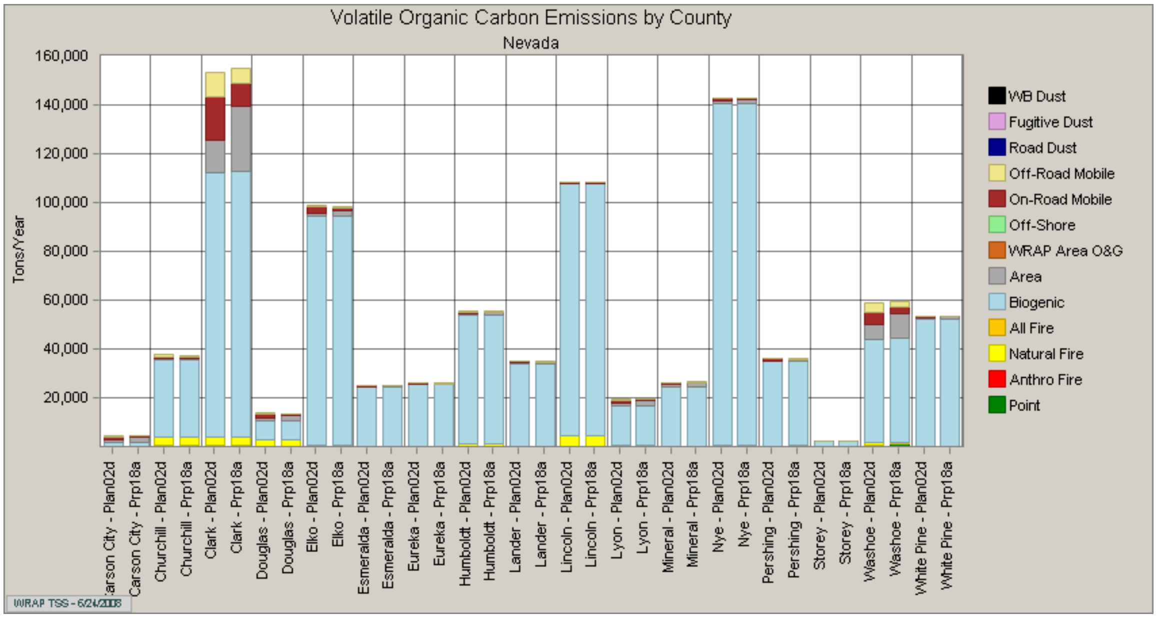
Nevada Planning and Baseline Emission Inventories			
Source Category	Statewide VOC		
	Plan 02d (tpy)	PRP 18a (tpy)	Net Change
Point	2,215	3,866	75%
Area	28,592	53,014	85%
On-Road Mobile	36,257	17,085	-53%
Off-Road Mobile	18,094	11,784	-35%
Oil and Gas	129	163	26%
Road Dust	ND	ND	ND
Fugitive Dust	ND	ND	ND
Windblown Dust	ND	ND	ND
Anthro Fire	70	50	-28%
Natural Fire	17,606	17,606	0%
Biogenic	794,139	794,139	0%
Total:	897,102	897,707	0%

There were no regional emission maps for VOCs created in the TSS.

Figure 3-16 shows VOC emissions by county. Biogenic sources dominate the VOC emissions for all counties in Nevada. Clark and Washoe counties show decreases to mobile source emissions and increases in area source emissions. Biogenic and natural fire emissions were held constant for the 2018 projections.

FIGURE 3-16

<u>VOLATILE ORGANIC CARBON EMISSIONS BY COUNTY (Plan02d) AND (PRP18a)</u>



3.8.4 Nevada POA Emission Inventory for 2002 and 2018

Primary organic aerosol (POA) includes organic molecules or compounds that are directly emitted from the combustion of organic material. These organic compounds include organic carbon (OC), hydrogen, oxygen as well as other organic atoms. Wide varieties of sources contribute to this classification, and include: combustion byproducts from wood and agricultural burning, diesel emissions, and the cooking of meat. Natural fire emissions however dominate this classification for Nevada, contributing to more than 90 percent of the total statewide emissions. Note that natural fire emissions were held constant for 2018 projections. Road dust and fugitive dust also show increases in POA emissions, but the projected emissions for these two source categories is only 2 percent of the total. Area sources, on-road mobile, road dust and fugitive dust increases are minimal and are likely due to growth projections. POAs are projected to have a small increase of 88 pounds of emissions by 2018.

Figure 3-17 and Table 3-10 show an overall negligible increase in total POA emissions from 2002 to 2018.

FIGURE 3-17

NEVADA POA EMISSION INVENTORY – 2002 AND 2018

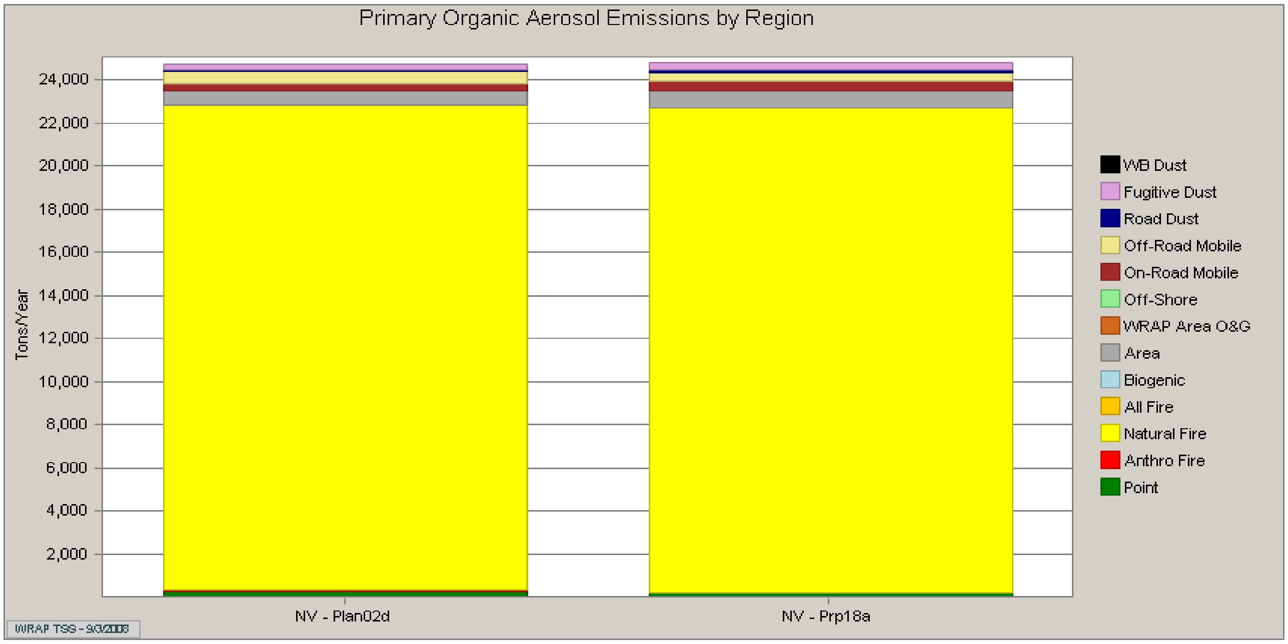


TABLE 3-10

NEVADA POA EMISSIONS BY SOURCE CATEGORY FOR 2002 AND 2018

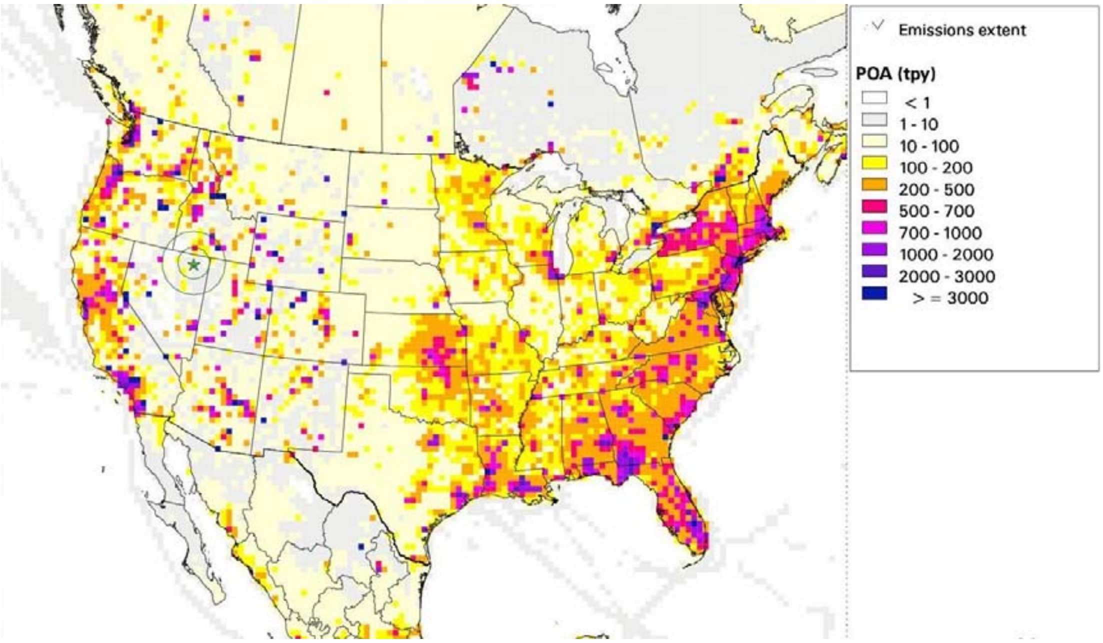
Nevada Planning and Baseline Emission Inventories			
Source Category	**Statewide POA**		
	Plan 02d (tpy)	PRP 18a (tpy)	Net Change
Point	256	168	-34.2%
Area	687	776	13.0%
On-Road Mobile	314	422	34.4%
Off-Road Mobile	572	393	-31.3%
Oil and Gas	0	0	0.0%
Road Dust	91	139	53.2%
Fugitive Dust	241	370	53.6%
Windblown Dust	ND	ND	ND
Anthro Fire	73	52	-28.2%
Natural Fire	22,501	22,501	0.0%
Biogenic	ND	ND	ND
Total:	24,734	24,822	0.4%

Figure 3-18, provides the Plan02d and PRP18a regional POA emission maps with the location of the JARB1 IMPROVE monitor identified with a green star surrounded by 100 km and 200 km radius concentric circles.

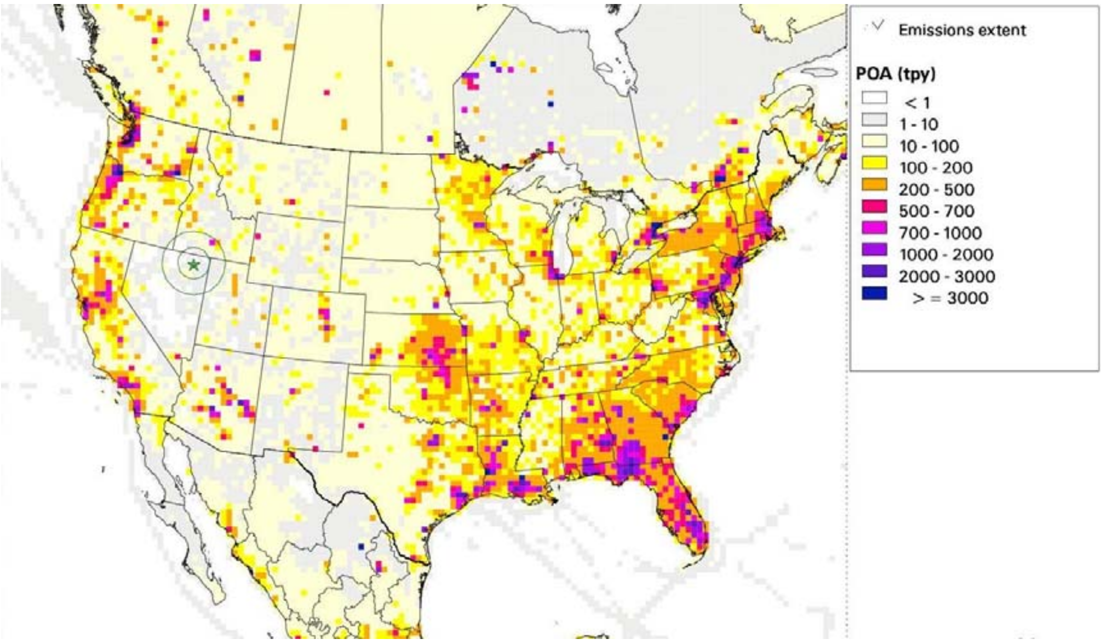
FIGURE 3-18

REGIONAL MAPS OF POA EMISSIONS FOR 2002 AND 2018

2002



2018

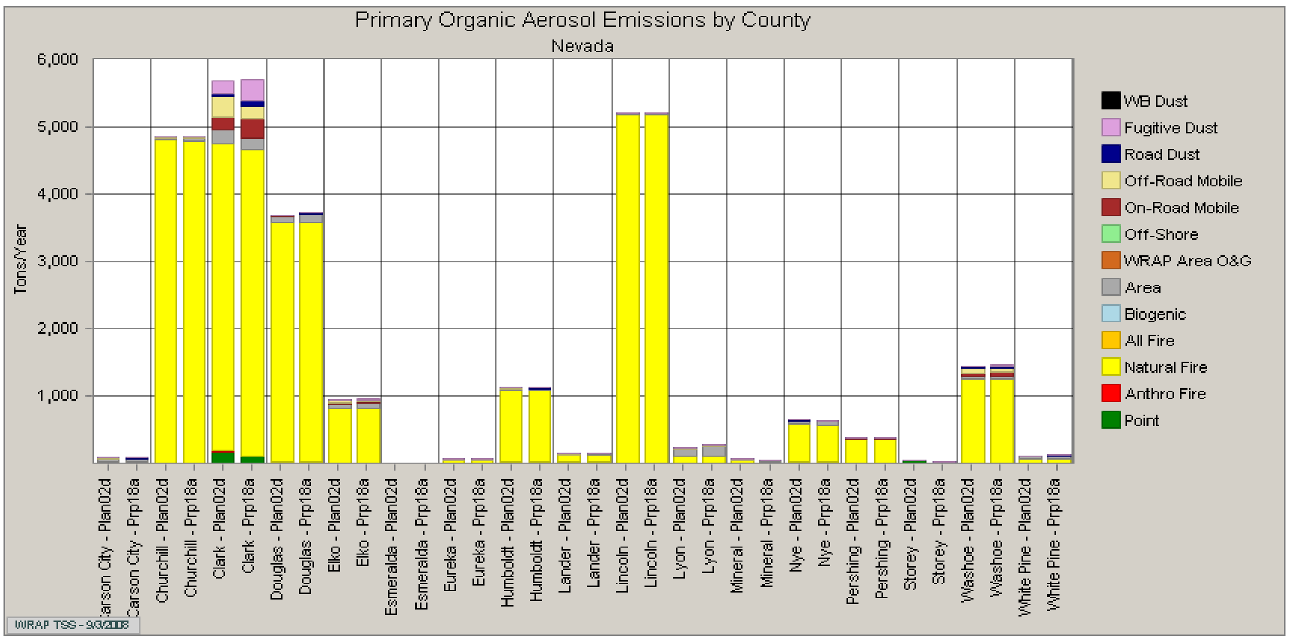


In Figure 3-18, note that there are significant decreases in POA emissions for Nevada. Large portions of Nevada show less than one ton per year of POA emissions for 2002, and even fewer cell with emissions less than 10 tons per year for 2018. Even though the POA net change is zero for Nevada, controls implemented in other states are reflected in Nevada's projections.

Figure 3-19 shows that Lincoln, Churchill, Clark, and Douglas counties were dominated by natural fire events in 2002, and since those projections were held constant, those same counties show identical emissions in 2018.

FIGURE 3-19

<u>PRIMARY ORGANIC AEROSOL EMISSIONS BY COUNTY (Plan02d) AND (PRP18a)</u>



3.8.5 Nevada EC Emission Inventory for 2002 and 2018

Elemental carbon (EC) particulates are directly emitted as a primary aerosol. For example, sources of elemental carbon include fossil fuel combustion (vehicles, boilers and other industrial processes), wildfires and all other types of burning. EC particulates absorb the transmission of light that contributes to visibility reduction on a regional scale at Class I areas. Elemental carbon is carbon black, or soot, a byproduct of incomplete combustion. It is the partner to primary organic aerosols and represents the more complete combustion of fuel, producing carbon particulate matter as the end product. By comparison, a carbon particle has a sixteen times greater impact on visibility than a coarse particle of granite has.

Figure 3-20 and Table 3-11 show statewide EC emission reductions of 12 percent. There are significant reductions in the mobile source categories resulting from new federal emission standards for mobile sources, especially for diesel engines. Natural fire emissions dominate this classification for Nevada, contributing to 83 percent of the total statewide emissions.

FIGURE 3-20

NEVADA EC EMISSION INVENTORY – 2002 AND 2018

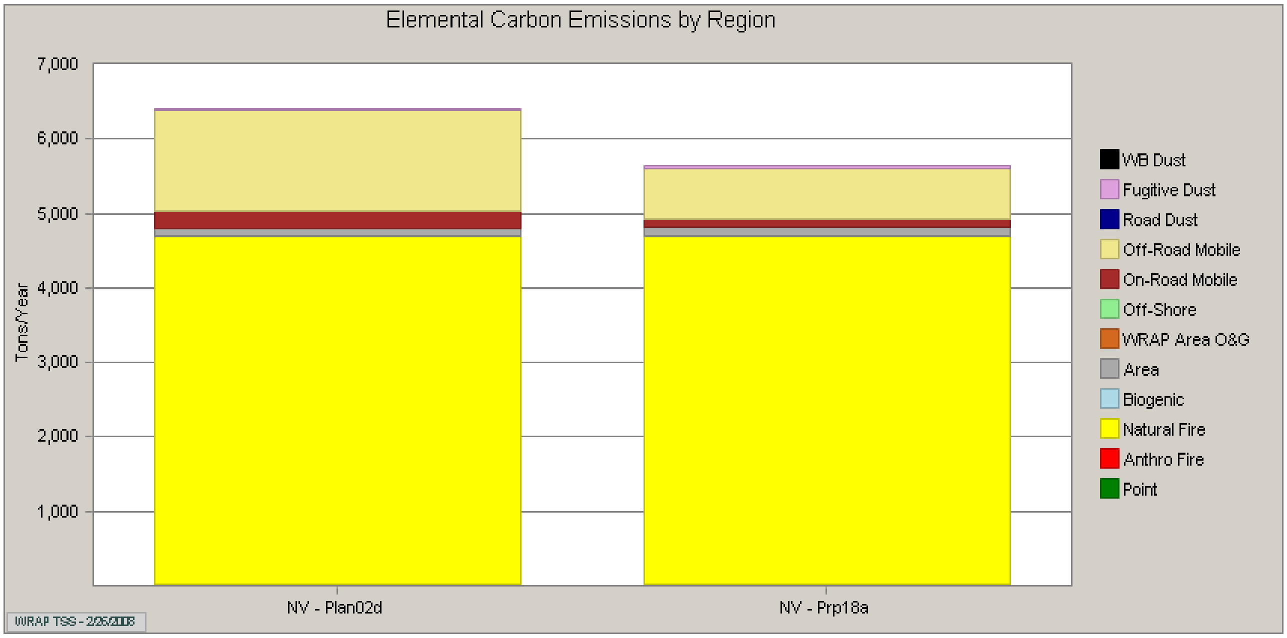


TABLE 3-11

NEVADA EC EMISSIONS BY SOURCE CATEGORY FOR 2002 AND 2018

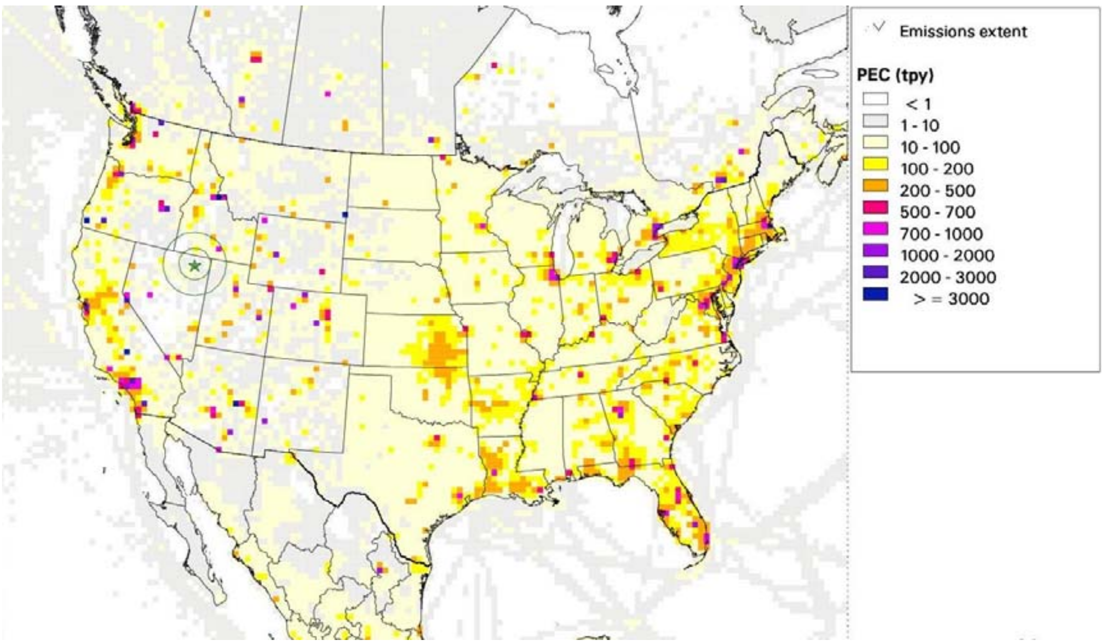
Nevada Planning and Baseline Emission Inventories			
Source Category	**Statewide EC**		
	Plan 02d (tpy)	PRP 18a (tpy)	Net Change
Point	13	13	-4%
Area	96	115	20%
On-Road Mobile	235	121	-48%
Off-Road Mobile	1,354	668	-51%
Oil and Gas	0	0	0%
Road Dust	7	11	53%
Fugitive Dust	17	26	54%
Windblown Dust	ND	ND	ND
Anthro Fire	13	10	-23%
Natural Fire	4,674	4,674	0%
Biogenic	ND	ND	ND
Total:	6,409	5,638	-12%

Figure 3-21 provides the Plan02d and PRP18a regional elemental carbon emission maps with the location of the JARB1 IMPROVE monitor identified with a green star surrounded by 100 km and 200 km radius concentric circles. Note that EC is the same as PEC (primary elemental carbon).

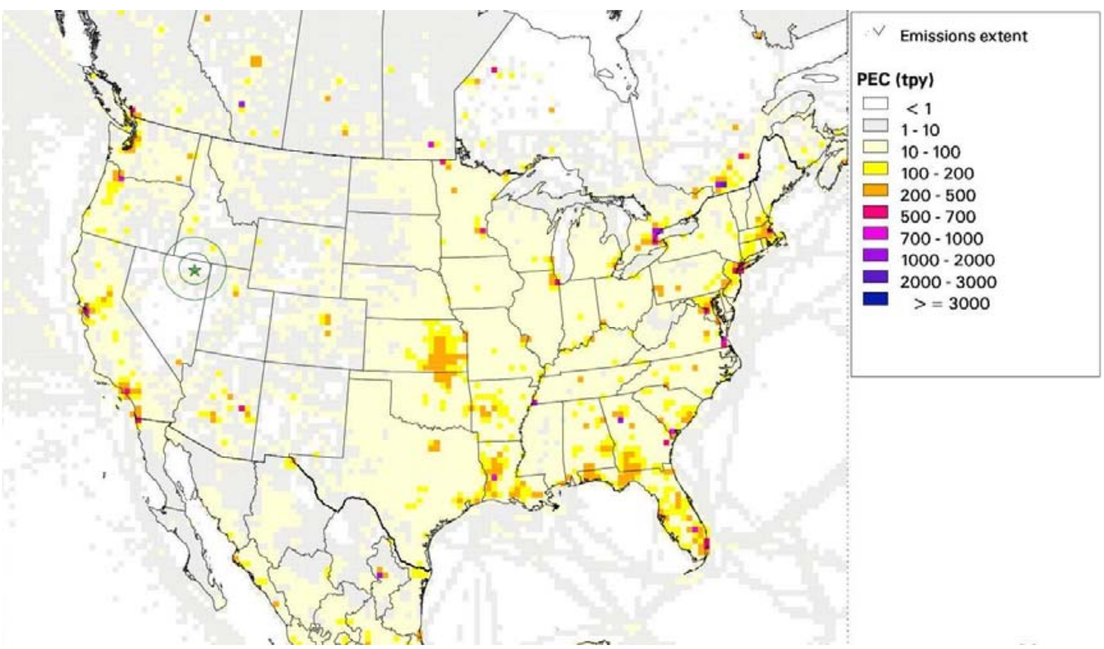
FIGURE 3-21

REGIONAL MAPS OF EC EMISSIONS FOR 2002 AND 2018

2002



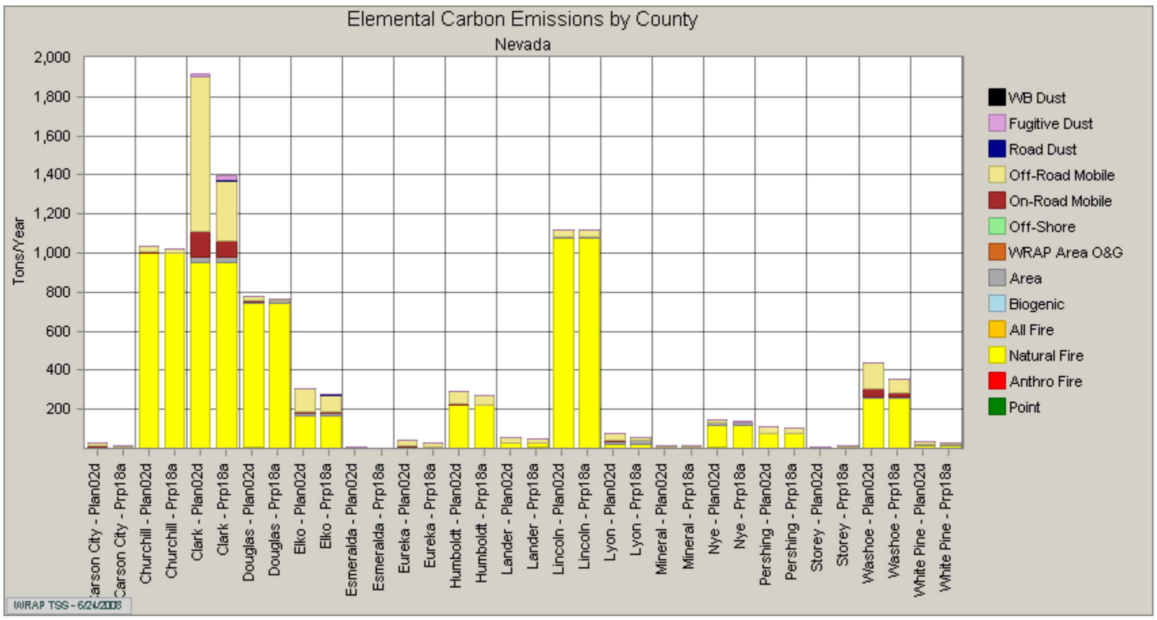
2018



In Figure 3-21, note the decrease in emissions for Nevada. Overall the EC emissions for Nevada are among the lowest in the U.S. 2018 projections show most of the state with EC emissions at less than 10 tons per year. Figure 3-22 shows that natural fire is the dominant source category for EC primarily for Lincoln, Churchill, Clark and Douglas counties. Significant off-road mobile source reductions for 2018 are seen for Clark and Washoe counties.

FIGURE 3-22

ELEMENTAL CARBON EMISSIONS BY COUNTY (Plan02d) AND (PRP18a)



3.8.6 Nevada PM Fine Emission Inventory for 2002 and 2018

PM fine emissions are comprised of fine particulates under 2.5 microns that are generated mostly from area sources, road dust and fugitive dust. PM fine emissions are largely related to agricultural and mining activities, windblown dust from construction areas, and emissions from unpaved and paved roads. A particle of fine dust has a relative impact on visibility one-tenth as great as a particle of elemental carbon. For any given visibility event where poor visual air quality is present in a scene, the impact of dust can vary widely. Overall, on the 20 percent worst days, PM fine has about the same impact as nitrate particles. Agricultural activities, dust from unpaved roads and construction are prevalent in this source category and changes in emissions are tied to population and vehicle miles traveled. Since PM fine emissions are not directly from the tailpipe of the vehicle, the mobile source categories do not show any fine particulates emissions; all vehicle-related emissions from paved and unpaved roads show up in the fugitive dust category. Fine particulate matter can remain suspended in the atmosphere for long periods of time and travel long distances. Fine particulates can efficiently scatter the transmission of light that contributes to visibility reduction on a regional scale at Class I areas. For 2018 projected emissions windblown dust was held constant.

In Figure 3-23 and Table 3-12, the projected statewide PM fine emission net increase is 15 percent. Most of the anticipated increase is associated with fugitive dust from 24 percent in the Plan02d inventory to 30 percent in the PRP18a inventory.

FIGURE 3-23

NEVADA SOIL (PM FINE) EMISSION INVENTORY – 2002 AND 2018

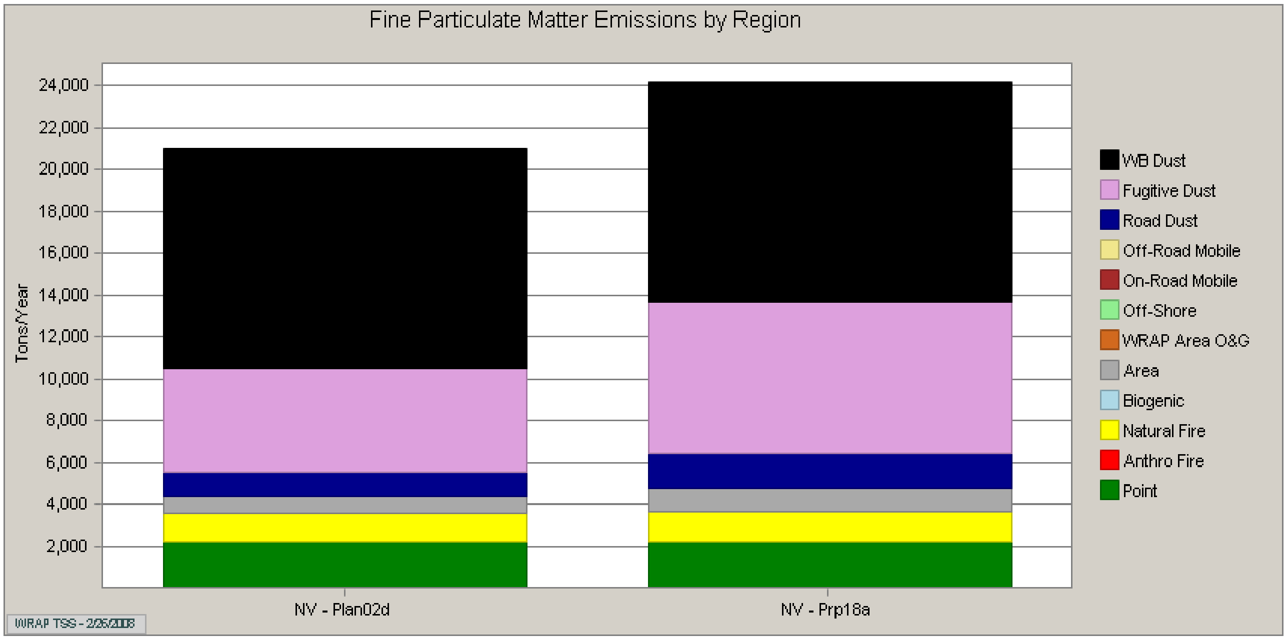


TABLE 3-12

NEVADA PM FINE EMISSIONS BY SOURCE CATEGORY FOR 2002 AND 2018

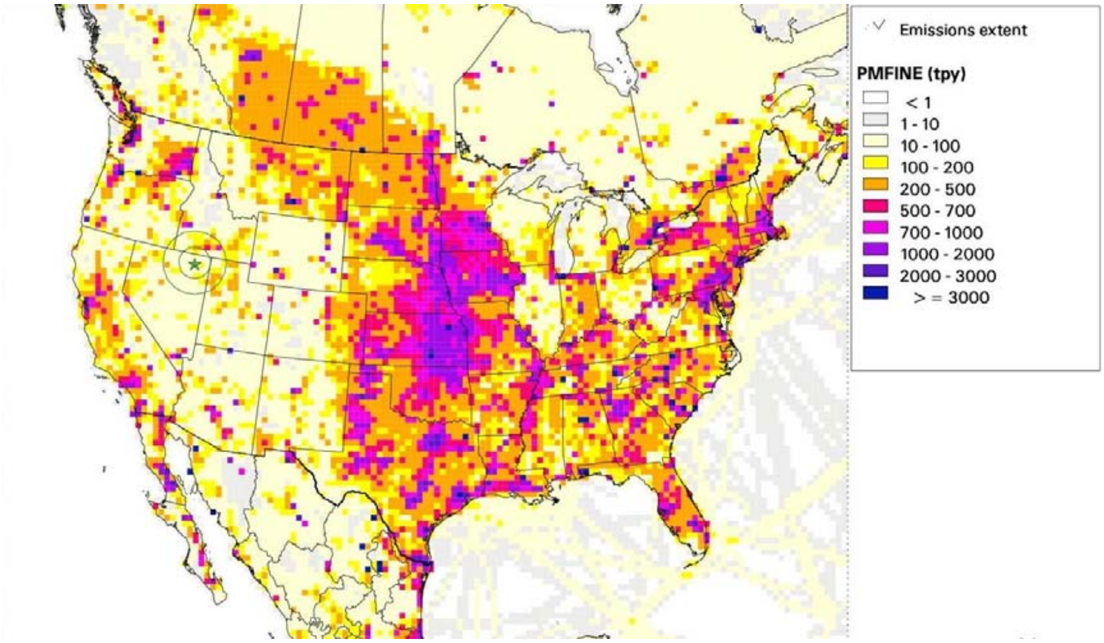
Nevada Planning and Baseline Emission Inventories			
Source Category	Statewide PM fine		
	Plan 02d (tpy)	PRP 18a (tpy)	Net Change
Point	2,158	2,211	2%
Area	830	1,150	39%
On-Road Mobile	0	0	0%
Off-Road Mobile	0	0	0%
Oil and Gas	0	0	0%
Road Dust	1,091	1,672	53%
Fugitive Dust	5,038	7,251	44%
Windblown Dust	10,438	10,438	0%
Anthro Fire	9	5	-48%
Natural Fire	1,406	1,406	0%
Biogenic	ND	ND	ND
Total:	20,969	24,134	15%

Figure 3-24, provides the Plan02d and PRP18a regional PM fine emission maps with the location of the JARB1 IMPROVE monitor identified with a green star surrounded by 100 km and 200 km radius concentric circles.

FIGURE 3-24

REGIONAL MAPS OF PM FINE EMISSIONS FOR 2002 AND 2018

2002



2018

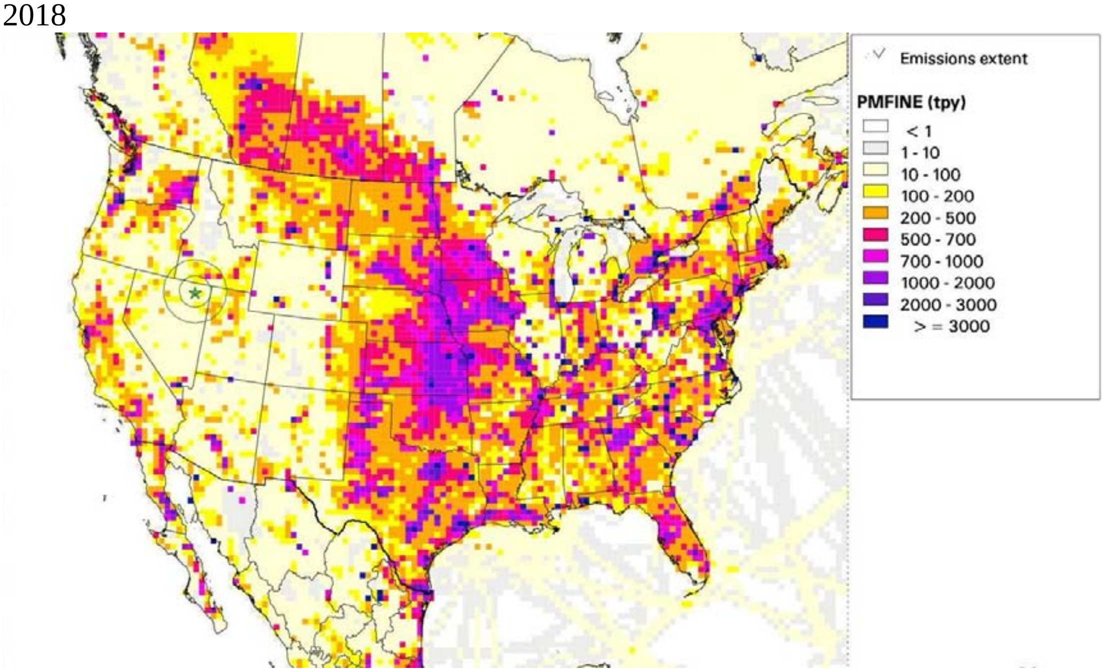
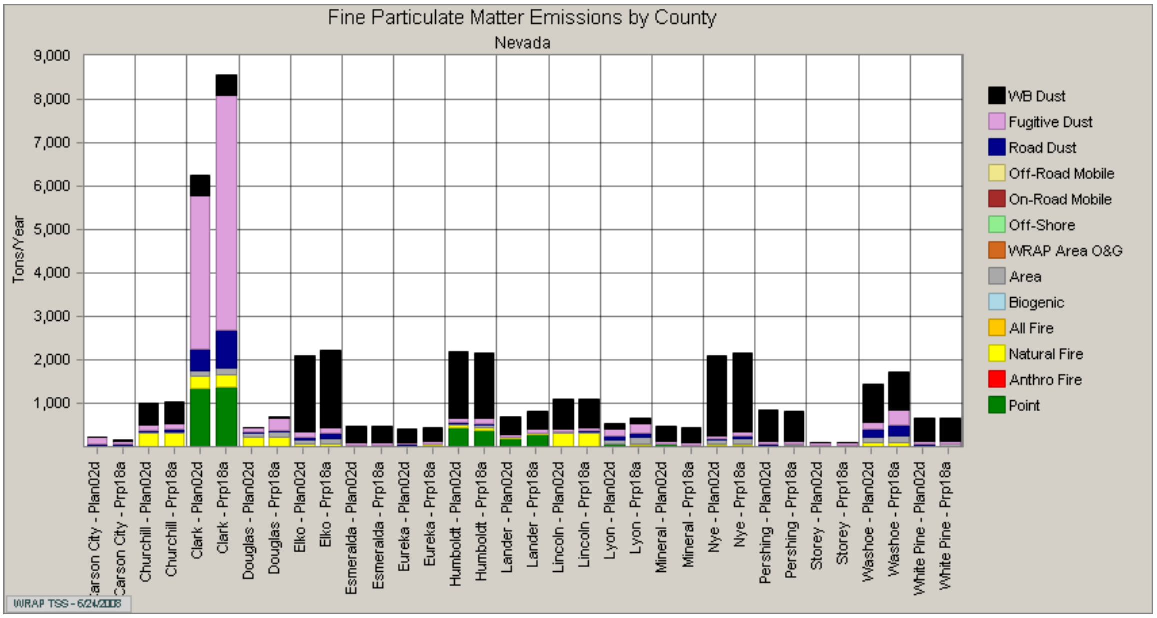


Figure 3-25 shows that Clark County has the greatest amount of PM fine emissions on a statewide basis, dominated by fugitive dust and point sources. Most of the counties in Nevada have significant windblown dust emissions.

FIGURE 3-25

PM FINE EMISSIONS BY COUNTY (Plan02d) AND (PRP18a)



3.8.7 Nevada PM Coarse Emission Inventory for 2002 and 2018

PM coarse emissions are closely related to the same sources as PM fine emissions but other activities like rock crushing and processing, material transfer, open pit mining and unpaved road emissions can be prominent sources. PM coarse emissions travel shorter distances in the atmosphere than other smaller particles but can remain in the atmosphere sufficiently long enough to play a role in regional haze. PM coarse emissions have the smallest direct impact on regional haze on a particle-by-particle basis where one particle of coarse mass has a relative visibility weight of 0.6 compared to a carbon particle having a weight of 10. Nevertheless, they are commonly present at all monitoring sites and are a greater contributor to regional haze than the PM fine component.

Figure 3-26 and Table 3-13 show the overall net increase in PM coarse emissions of 17 percent. A substantial increase in PM coarse emissions is seen in the road dust (53 percent) and fugitive dust (45 percent) categories. This is due to the fact that construction activities and emissions from paved and unpaved roads are linked to population, vehicle miles traveled and employment data. Growth in these factors results in projected emission increases from 2002 to 2018. Although PM coarse emissions from windblown dust decrease from 58 percent to 50 percent by 2018, windblown dust is still the primary source category for these emissions. Fugitive dust is also projected to be a major contributor to PM coarse emissions in 2018 at 36 percent.

FIGURE 3-26

NEVADA COARSE MASS (PM COARSE) EMISSION INVENTORY – 2002 AND 2018

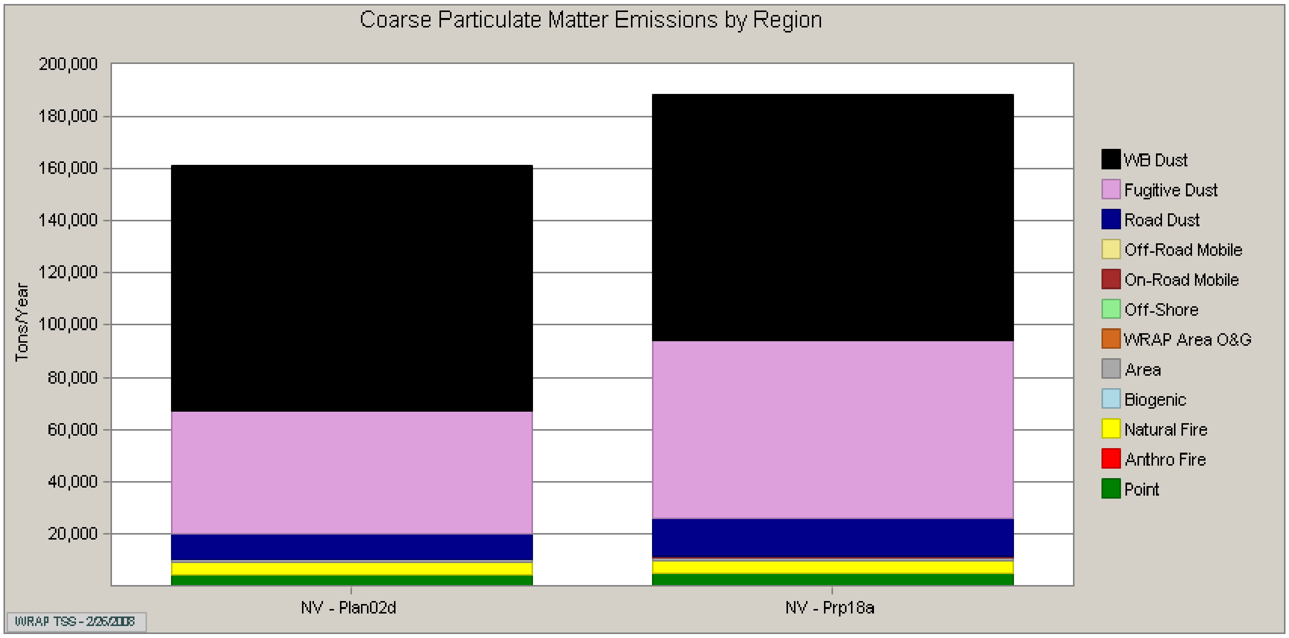


TABLE 3-13

NEVADA PM COARSE EMISSIONS BY SOURCE CATEGORY FOR 2002 AND 2018

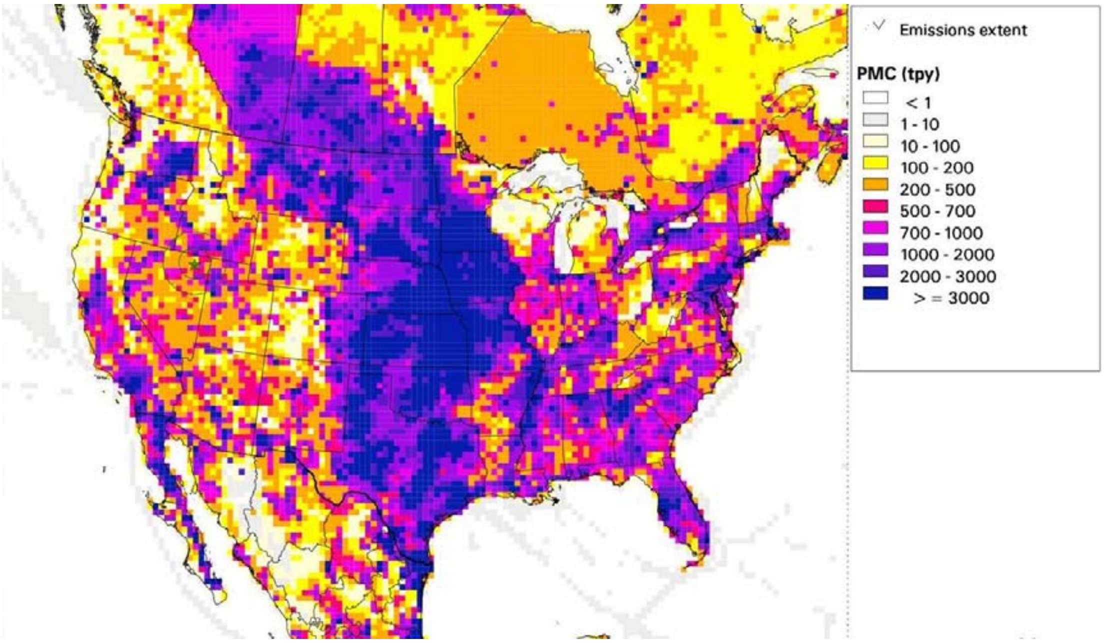
Nevada Planning and Baseline Emission Inventories			
Source Category	Statewide PM coarse		
	Plan 02d (tpy)	PRP 18a (tpy)	Net Change
Point	4,093	4,717	15%
Area	897	1,012	13%
On-Road Mobile	245	360	47%
Off-Road Mobile	0	0	0%
Oil and Gas	0	0	0%
Road Dust	9,413	14,439	53%
Fugitive Dust	47,366	68,634	45%
Windblown Dust	93,946	93,946	0%
Anthro Fire	7	3	-48%
Natural Fire	5,176	5,176	0%
Biogenic	ND	ND	ND
Total:	161,142	188,287	17%

Figure 3-27, provides the Plan02d and PRP18a regional PM coarse emission maps with the location of the JARB1 IMPROVE monitor identified with a green star surrounded by 100 km and 200 km radius concentric circles.

FIGURE 3-27

REGIONAL MAPS OF PM COARSE EMISSIONS FOR 2002 AND 2018

2002



2018

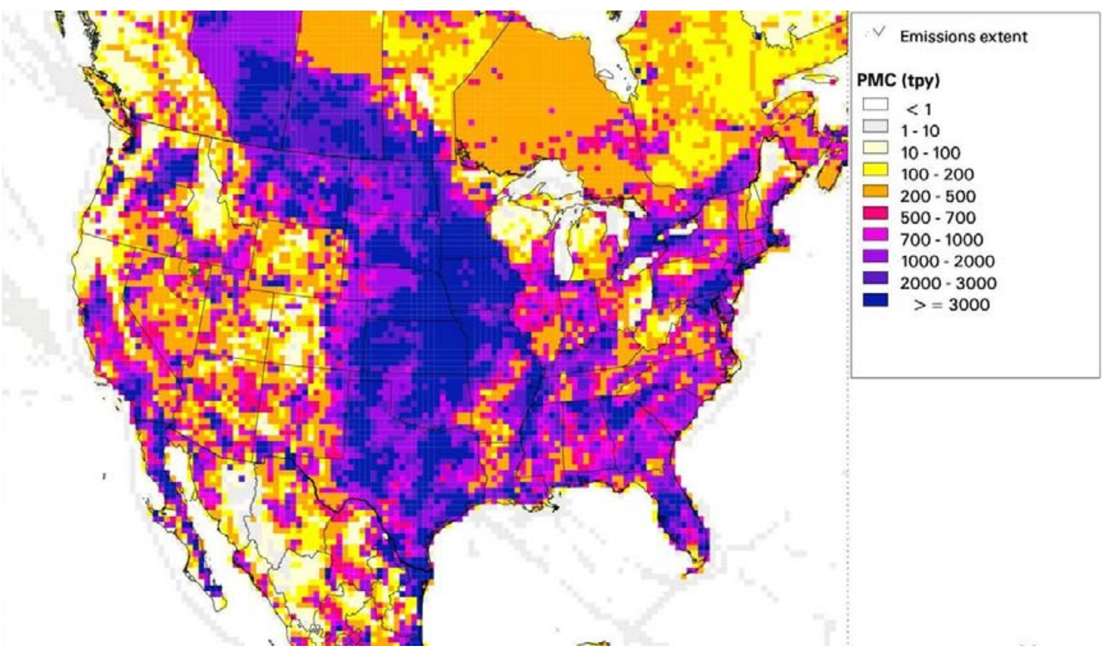
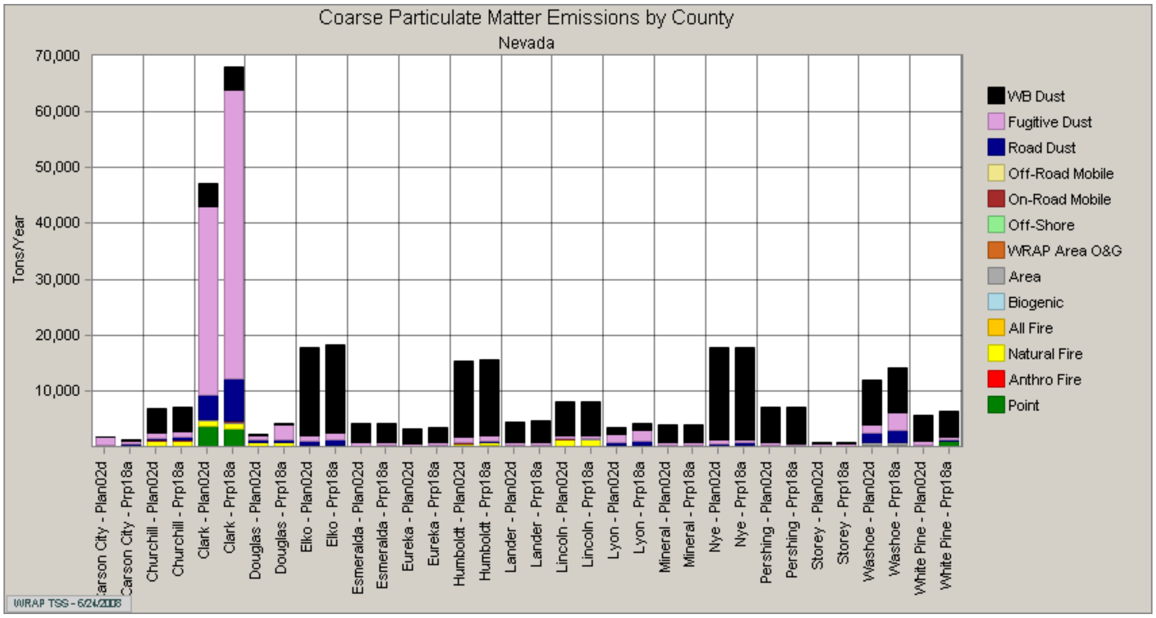


Figure 3-28 shows that Clark County has the highest PM coarse emissions in Nevada, due to fugitive dust sources. Windblown dust is a significant source of PM coarse emissions for most counties.

FIGURE 3-28

PM COARSE EMISSIONS BY COUNTY (Plan02d) AND (PRP18a)



3.8.8 Nevada NH_3 Emission Inventory for 2002 and 2018

NH_3 emissions come from a variety of sources including wastewater treatment facilities, livestock operations, fertilizer applications and mobile sources. NH_3 is directly linked to the production of ammonium nitrate and ammonium sulfate particles in the atmosphere when SO_2 and NO_x eventually convert over to these forms of particles. Increases in NH_3 emissions from the base case year to 2018 are linked to population statistics and increased vehicular traffic.

An EPA report "Estimating Ammonia Emissions from Anthropogenic Non-Agricultural Sources – Draft Final Report April 2004" (http://www.epa.gov/ttn/chief/eiip/techreport/volume03/eiip_areasourcesnh3.pdf) documents that NH_3 measurements vary substantially by vehicle class in on-road mobile sources. Fleet-average NH_3 emissions are thought to be increasing as advanced catalyst-equipped vehicles make up a larger fraction of the fleet. Advanced catalysts have higher NH_3 emission rates stemming from an over-reduction of NO_x to NH_3.

Non-road mobile sources include exhaust emissions from a wide range of non-road engines. These include construction equipment, agricultural equipment, lawn and garden equipment, commercial and recreational marine vessels and locomotives. Non-road gasoline engines typically are not equipped with catalysts.

Figure 3-29 and Table 3-14, show an overall net increase of NH_3 emissions of 20 percent. Point sources show a significant net increase of 155 percent, although the percent of the projected total point NH_3 emissions for PRP18a is not significant (six percent). On-road mobile NH_3 emissions are due to projected increases in vehicular traffic.

FIGURE 3-29

<u>NEVADA NH_3 EMISSION INVENTORY – 2002 AND 2018</u>

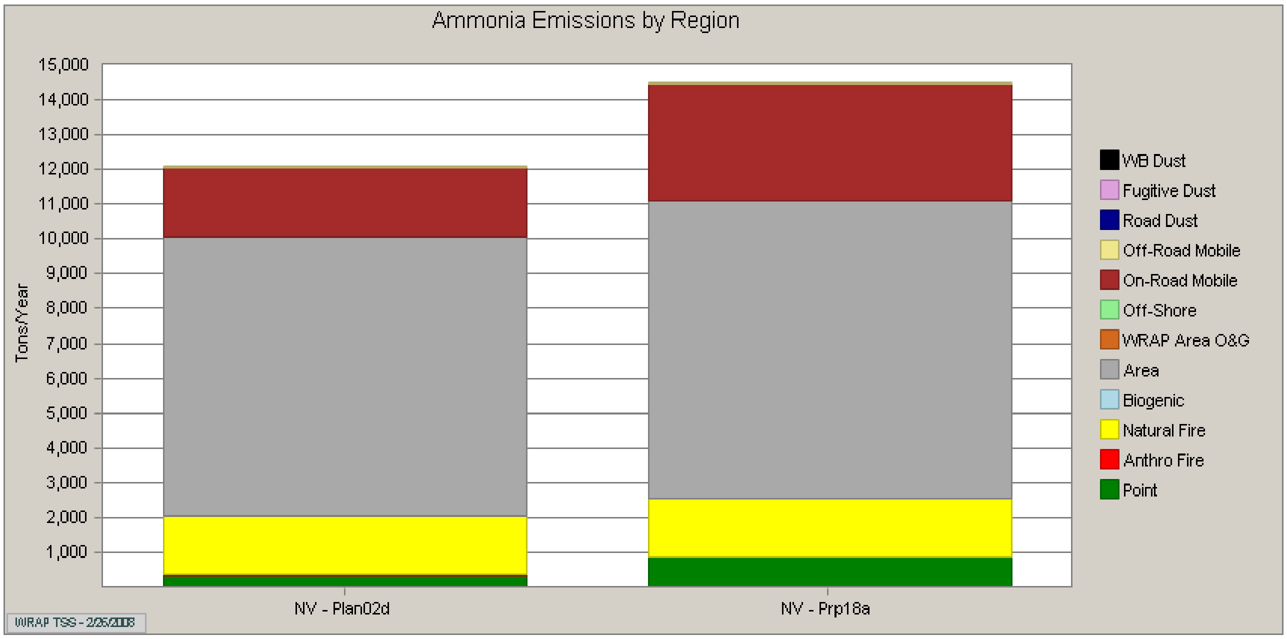


TABLE 3-14

NEVADA NH_3 EMISSIONS BY SOURCE CATEGORY FOR 2002 AND 2018

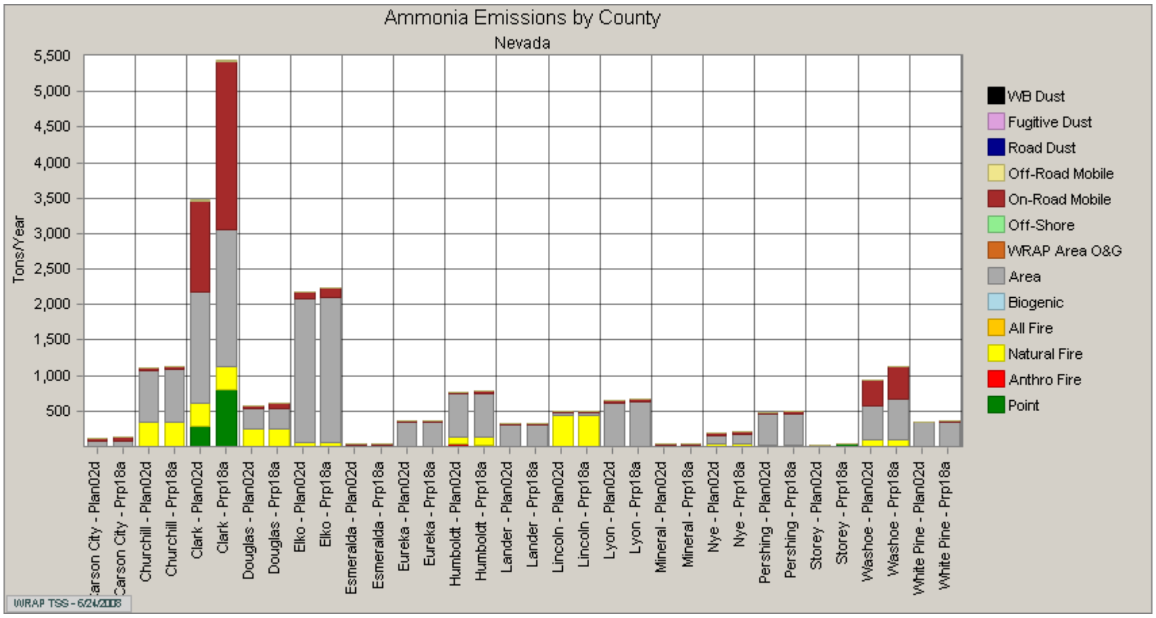
Nevada Planning and Baseline Emission Inventories			
Source Category	Statewide NH3		
	Plan 02d (tpy)	PRP 18a (tpy)	Net Change
Point	339	864	155%
Area	8,009	8,535	7%
On-Road Mobile	2,030	3,385	67%
Off-Road Mobile	22	30	37%
Oil and Gas	0	0	0%
Road Dust	ND	ND	0%
Fugitive Dust	ND	ND	0%
Windblown Dust	ND	ND	0%
Anthro Fire	8	5	-37%
Natural Fire	1,684	1,684	0%
Biogenic	ND	ND	ND
Total:	12,092	14,503	20%

There are no regional emission maps for ammonia.

Figure 3-30 shows consistently that Clark County has the greatest emissions on a county by county breakdown. Clark County's emissions are dominated by on-road and area sources. Most of the other Nevada counties are dominated by area sources.

FIGURE 3-30

AMMONIA EMISSIONS BY COUNTY (Plan02d) AND (PRP18a)



3.9 SUMMARY OF 2018 EMISSION PROJECTIONS

Analysis of the IMPROVE monitoring network data demonstrates the following pollutants, ranked according to percent contribution to annual extinction (see Table 2-2 in Chapter Two), contribute to reconstructed light extinction at JARB1 for the 20 percent worst days of the baseline period.

- OMC
- CM
- SO_4
- SOIL
- EC
- NO_3
- Sea Salt

The emissions analysis is part of the technical basis for identifying Nevada's reasonable progress goal. At the beginning of this section, Table 3-6 summarizes the contribution from natural vs. anthropogenic sources for each pollutant in 2002 and 2018. It shows that approximately three quarters (73 percent) of emissions in 2018 are expected to be from natural sources and, therefore, uncontrollable. Table 3-15 shows percent contribution from anthropogenic sources and dominant source categories for each pollutant in 2018. The "Total Emissions from All Source Categories" column includes natural emissions and puts the contribution from each pollutant into perspective with respect to other visibility impairing pollutants in Nevada.

TABLE 3-15

PREDOMINANT SOURCES OF POLLUTANTS: 2018

Pollutant	Total Emissions from All Source Categories in tpy *(percent of total)*	Percent from Anthropogenic Sources	Predominant Source and Percent from Predominant Source		Controllable
VOC	897,707 *(67)*	10	Biogenic	88	No
PM coarse	188,287 *(14)*	47	Windblown Dust	50	No
			Fugitive Dust	36	Yes
NO_x	135,496 *(10)*	83	Point	50	Yes
			Off-Road Mobile	16	Yes
			On-Road Mobile	11	Yes
			Biogenic	11	No
SO_x	46,224 *(3.5)*	94	Point	61	Yes
			Area	31	Yes
POA	24,822 *(2)*	9	Natural Fire	91	No
PM fine	24,134 *(2)*	51	Windblown Dust	43	No
			Fugitive Dust	30	Yes
NH_3	14,503 *(1)*	88	Area	59	Yes
			On-Road Mobile	23	Yes
EC	5,638 *(0.5)*	17	Natural Fire	83	No

In Nevada, anthropogenic sources are important contributors of SO_x, NO_x, and NH_3 in 2018. SO_x emissions are predominantly from point sources, 61 percent; area sources contribute 31 percent. NO_x emissions are also predominantly from point sources, approximately 50 percent, while mobile sources account for another 27 percent. VOC, POA, EC, PM fine and PM coarse emissions are dominated by natural source categories, and primarily are not controllable for those sources. NH_3 emissions are predominantly from area sources, 59 percent, with another 23 percent from on-road mobile. The total projected emissions for all pollutants in 2018 are 1,336,811 tons and of that total, only 27 percent are controllable.

Chapter Four – Visibility and Source Apportionment Modeling

4.1 INTRODUCTION

- 4.1.1 Air Quality Models
- 4.1.2 Model Performance Evaluation
  - 4.1.2.1 2002 Worst Days Performance
  - 4.1.2.2 2002 Best Days Performance
- 4.1.3 Weighted Emissions Potential Analysis

4.2 VISIBILITY MODELING RESULTS FOR 2018

- 4.2.1 2018 Visibility Projections for Jarbidge Wilderness Area

4.3 SOURCE APPORTIONMENT MODELING RESULTS

- 4.3.1 Sulfate Source Apportionment for Jarbidge Wilderness Area
- 4.3.2 Nitrate Source Apportionment for Jarbidge Wilderness Area
- 4.3.3 Source Apportionment for Other Class I Areas
- 4.3.4 Organic Aerosol Source Apportionment for Jarbidge Wilderness Area
  - 4.3.4.1 Organic Aerosol PSAT for Worst Days 2002 and 2018
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  - 4.3.4.3 Organic Aerosol PSAT for All Days 2002 and 2018

4.4 WEIGHTED EMISSIONS POTENTIAL ANALYSES RESULTS

- 4.4.1 Nitrogen Oxides – Regional WEP Analysis for 2018 Worst Days
- 4.4.2 Sulfur Oxides – Regional WEP Analysis for 2018 Worst Days
- 4.4.3 Organic Carbon – Regional WEP Analysis for 2018 Worst Days
- 4.4.4 Elemental Carbon – Regional WEP Analysis for 2018 Worst Days
- 4.4.5 Particulate Matter Fine – Regional WEP Analysis for 2018 Worst Days
- 4.4.6 Particulate Matter Coarse – Regional WEP Analysis for 2018 Worst Days

4.5 VISIBILITY AND SOURCE APPORTIONMENT MODELING SUMMARY

4.1 INTRODUCTION

The regional haze rule (RHR) requires states to "address regional haze in each mandatory Class I Federal area located within the State, and each mandatory Class I Federal area located outside the State which may be affected by emissions from within the State". The RHR also requires goals be established to "provide for reasonable progress toward achieving natural visibility conditions." CFR 40 Part 51.308(d) Air quality modeling analyses were performed to determine which Class I areas are affected by emissions from Nevada and to evaluate reasonable progress, as discussed in Chapter One. The Western Regional Air Partnership's (WRAP) Regional Modeling Center (RMC) performed these modeling analyses for the WRAP states, including Nevada.

Visibility modeling results indicate that the Jarbidge Wilderness Area (Jarbidge WA) will meet the Uniform Rate of Progress (URP) for 2018. The modeling results and technical analyses also indicate Nevada sources do contribute to visibility impairment at the Jarbidge WA, as well as Class I areas located in adjacent states. The modeling also indicates that out-of-state sources have the greatest impact on regional haze in Nevada. Regional weighted emissions potential (WEP) analyses indicate the significant role of emissions from wind blown and fugitive dust and natural fire in visibility impairment at the Jarbidge WA, thereby supporting the anecdotal observations of the Nevada Division of Environmental Protection (NDEP) staff discussed in Chapter One.

The visibility and source apportionment modeling described in this Chapter provides, in conjunction with the monitoring and emissions analyses, the technical basis used to identify and evaluate reasonable progress for the Jarbidge WA.

4.1.1 Air Quality Models

RMC utilized two grid-based models to analyze the effects of haze-causing particles within the WRAP area. The Community Multi-Scale Air Quality (CMAQ) model provided visibility modeling forecasts for 2018, the end of the first regional haze planning period. The results of CMAQ modeling are used in identifying the 2018 reasonable progress goals (RPG). The Particulate Matter Source Attribution Tracking (PSAT) algorithm in the Comprehensive Air Quality Model with Extensions (CAMx) model is used to assess source apportionment, particularly for sulfate and nitrate particle species, based on source area and source category, and to identify those Class I areas that are affected by Nevada emission sources.

The PSAT algorithm applies nitrate-sulfate-ammonia chemistry to a system of tracers, or "tags", to track chemical transformations, transport and removal of emissions. Each source area (state or region) is assigned a tag that is used to track the emissions from each 36-kilometer grid cell within the specified source area. Emissions from point, mobile, area and fire (natural and anthropogenic) source categories were tagged for each source area. The PSAT algorithm was also used, in a limited application (i.e., no source area attribution), to track natural and anthropogenic species of organic aerosols at each Class I area. The organic aerosol tracer tracked both primary and secondary organic aerosols (POA and SOA, respectively).

Meteorological inputs and emission inventories were prepared for 2002, chosen as representative of the baseline period 2000 through 2004. These inputs were used in the air quality model to predict fine particle mass and visibility. The model results for 2002 were compared with observed meteorological and air quality data to evaluate model performance. Several configurations of the meteorological and air quality model were evaluated to select the configuration that gave the best overall performance for the WRAP region. Once model performance was deemed adequate, the current and future year emissions were processed through the emissions model, as discussed in Chapter One. The modeled emissions scenarios are described in Chapters One and Three.

4.1.2 Model Performance Evaluation

The objective of the model performance evaluation was to compare model-simulated concentrations with observed data to determine whether the model's performance was sufficiently accurate to justify using the model for simulating future conditions, as discussed in Chapter One. The model was compared to ambient data for both particulate matter and gaseous species, for an annual time period and for a large number of sites. The model was evaluated for both the worst and best visibility conditions. The "Final Report for the WRAP 2002 Visibility Model Performance Evaluation" (Tonnesen, et al, 2006 can be found at http://pah.cert.ucr.edu/aqm/308/reports/final/2002_MPE_report_main_body_FINAL.pdf) discusses in detail how the model performance was evaluated.

The WRAP's RMC found the model over-predicted the observed data on the cleanest days (i.e., the 20 percent best days or best days) and under predicted the observed data on the most polluted days (i.e., the 20 percent worst days or worst days).

RMC has concluded that the CMAQ model cannot be used to forecast future coarse matter (CM) concentrations. Nevada has also deemed model performance was unacceptable for fine particulate matter (SOIL) on the worst days and nitrate on the best days. Model performance is discussed in greater detail below.

4.1.2.1 2002 Worst Days Performance

CMAQ model performance can be roughly judged by comparing the model predicted concentration (left side of Figure 4-1) against the monitored concentration from the Interagency Monitoring of Protected Visual Environments (IMPROVE) monitor JARB1 (right side of Figure 4-1) for the worst days of 2002. As shown, the model greatly under-predicts total mass and particularly CM (shown in gray on Figure 4-1). Similar model under-prediction is observed across the WRAP region, thus the RMC has concluded that the CMAQ model cannot be used to forecast future CM concentrations.

Figure 4-2 indicates the CMAQ model under predicts, as shown by negative percentages, all six components of extinction for the worst days at JARB1. Nevada deems model performance for the worst days is acceptable for sulfate (-32 percent), nitrate (-20 percent), organic matter (-40 percent), and elemental carbon (-33 percent), but is unacceptable for SOIL (-88 percent).

FIGURE 4-1

CMAQ MODEL PERFORMANCE FOR JARB1 2002 WORST DAYS

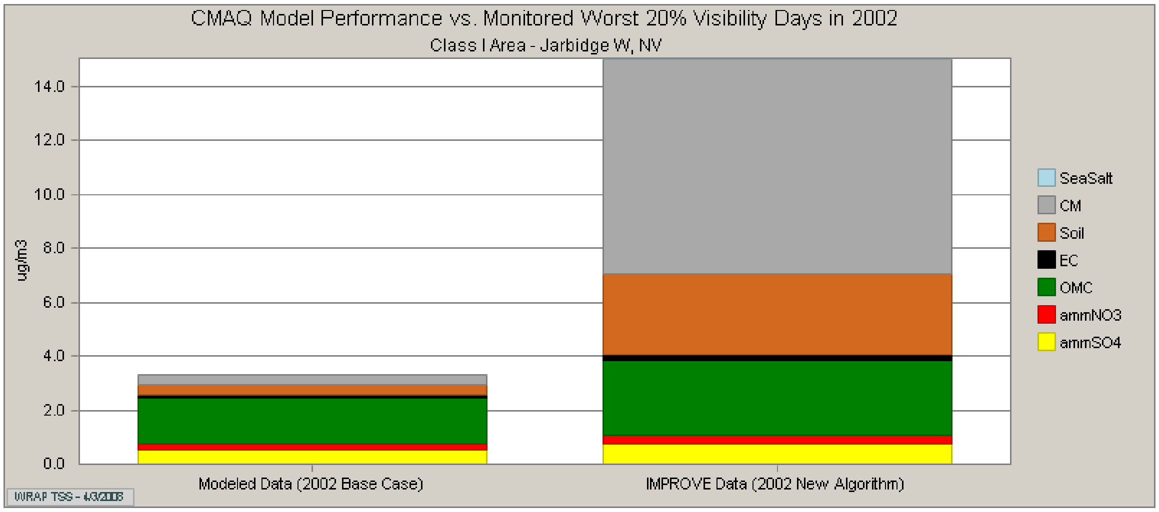
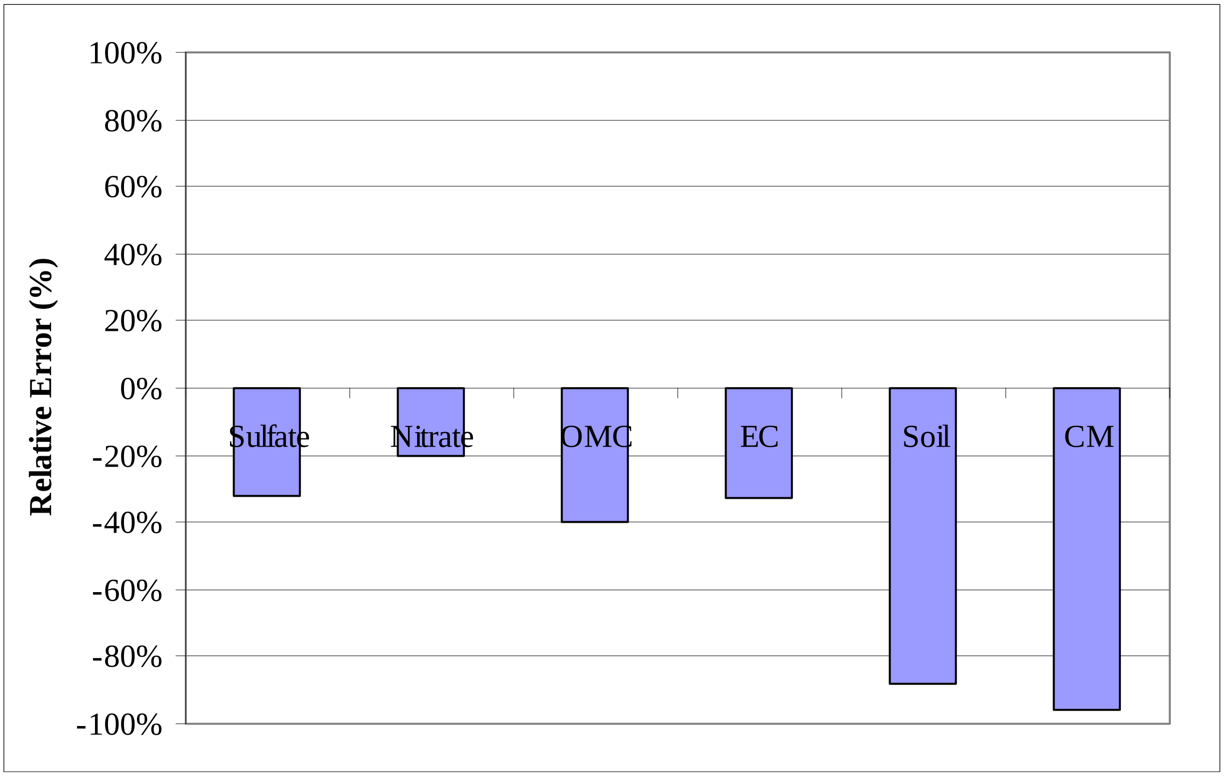


FIGURE 4-2

RELATIVE ERROR OF CMAQ MODEL PREDICTION VERSUS
IMPROVE DATA FOR JARB1 2002 WORST DAYS

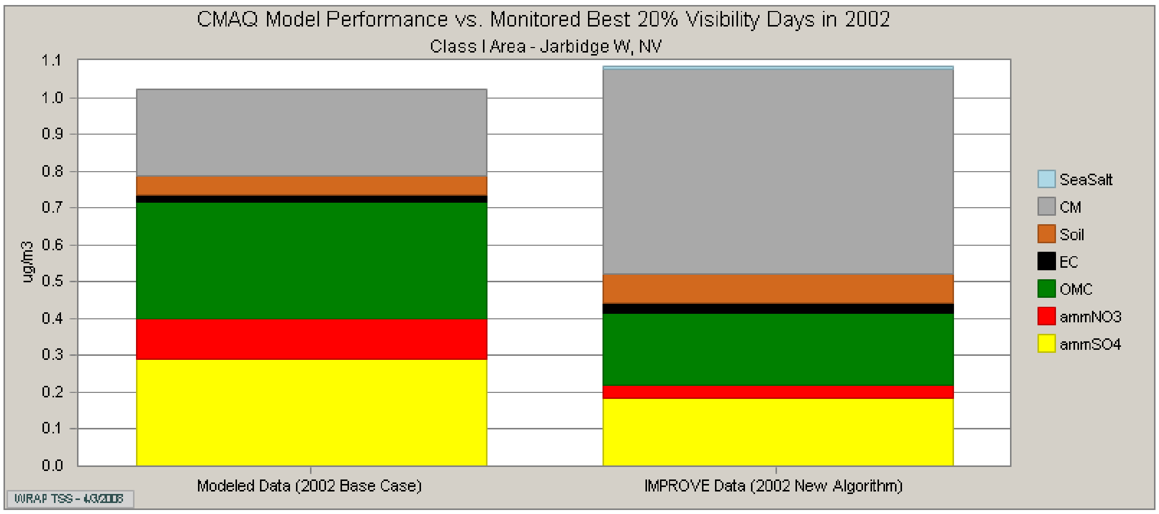


4.1.2.2 2002 Best Days Performance

Comparison of the model predicted concentration (left side of Figure 4-3) against the monitored concentration from the IMPROVE monitor JARB1 (right side of Figure 4-3) for the best days of 2002 shows much better agreement between total mass.

FIGURE 4-3

CMAQ MODEL PERFORMANCE FOR JARB1 2002 BEST DAYS



However, Figure 4-4 shows the model produces mixed predictions for the best days at JARB1. Nevada deems the model performance for the best days is acceptable for elemental carbon (-33 percent) and SOIL (-38 percent), but is marginally acceptable for sulfate (+61 percent) and organic matter (+60 percent). Model performance for nitrate (+175 percent) is unacceptable for the best days. As described above, RMC has concluded the CMAQ model cannot be used to predict future CM concentrations.

4.1.3 Weighted Emissions Potential Analysis

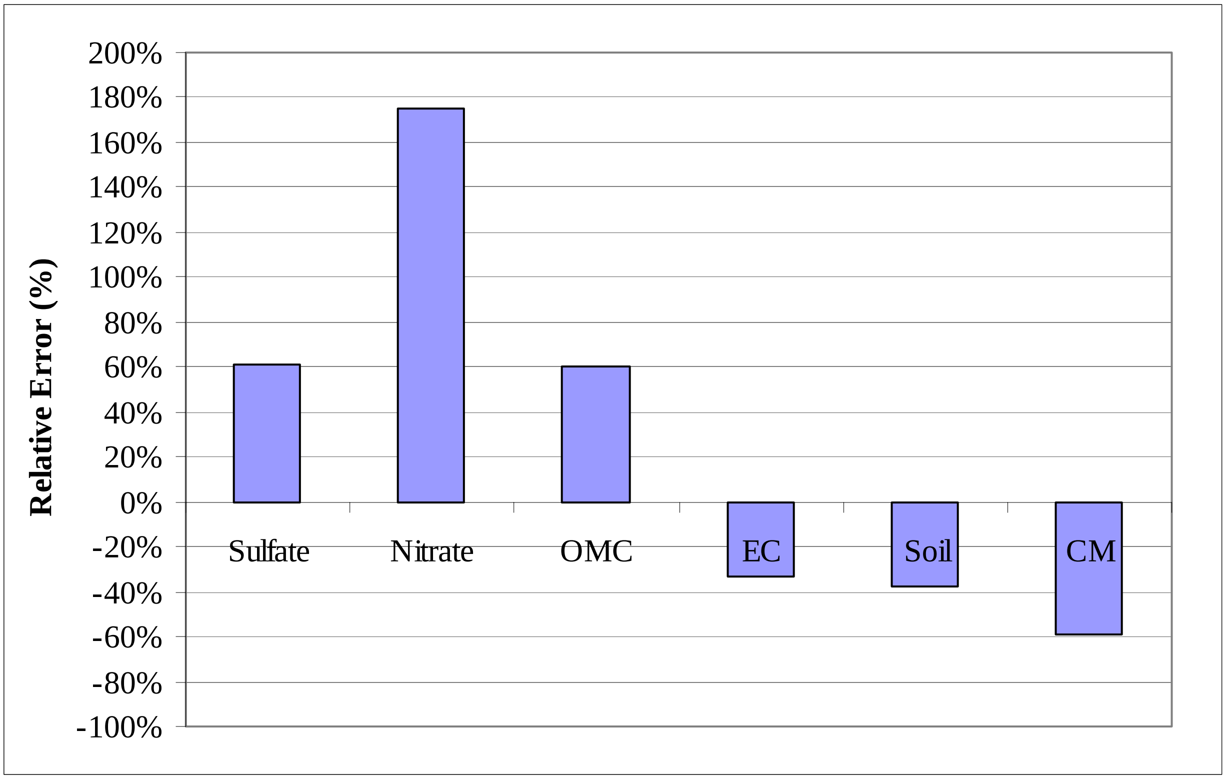
The WEP was developed as a screening tool for states to identify which source areas (e.g., states) have the potential to contribute to haze formation at specific Class I areas, based on both the 2002 and 2018 emissions inventories, as discussed in Chapter One. WEP was used to investigate the attribution of sources of nitrogen oxides (NO_x), sulfur dioxide (SO_2), organic carbon (OC), elemental carbon (EC), fine particulate matter (PMF) and coarse particulate matter (PMC). The results of the WEP analyses are discussed below in section 4.4.

4.2 VISIBILITY MODELING RESULTS FOR 2018

Visibility modeling results indicate projected visibility conditions for the Jarbidge WA, based on the PRP18a emission inventory, will meet the URP for 2018 (i.e., 2018 projected visibility conditions show better progress than the glidepath).

FIGURE 4-4

RELATIVE ERROR OF CMAQ MODEL PREDICTION VERSUS
IMPROVE DATA FOR JARB1 2002 BEST DAYS



4.2.1 2018 Visibility Projections for Jarbidge Wilderness Area

Table 4-1 lists the 2018 URP for the Jarbidge WA and the CMAQ visibility modeling forecasts for 2018. The results of this modeling will be used in establishing RPGs for the Jarbidge WA. The 2018 model forecasts indicate Jarbidge WA will meet the 2018 URP for the 20 percent worst days and will maintain visibility for the best days in 2018.

The 2018 modeling results of 11.05 deciviews (dv) presented in Table 4-1 and Figure 4-5 show an improvement of 1.02 dv from the worst days baseline value of 12.07 dv for the Jarbidge WA using the USEPA specific days method. This results in an improvement of 4.1 percent over the 2018 URP value of 11.09 dv, or 104.1 percent toward the 2018 URP. This indicates that Nevada's projected reasonable progress is better than the URP. The visibility model projections are based on the 2018 preliminary reasonable progress (PRP18a) emission inventory identified in Chapter Three. The 2018 PRP does not include all of Nevada's Best Available Retrofit Technology (BART) emission controls, or all of adjacent states' BART controls. Additional emission reductions due to the installation of BART and other controls under the RHR are anticipated to improve modeled visibility forecasts.

TABLE 4-1

SUMMARY OF MODEL-PREDICTED PROGRESS
TOWARD 2018 UNIFORM RATE OF PROGRESS AT JARB1

Mandatory Class I Federal Area	20 Percent Worst Days				20 Percent Best Days		
	Worst Days Baseline (dv)	2018 URP (dv)	2018 Modeling Results (dv)	CMAQ Modeling Percent Toward 2018 URP	Best Days Baseline (dv)	Average 2018 Modeling Results (dv)	CMAQ 2018 Modeling Result Less Than Baseline?
Jarbidge Wilderness Area	12.07	11.09	11.05	104.1%	2.56	2.50	Yes

FIGURE 4-5

CMAQ MODEL PROJECTIONS IN HAZE INDEX
FOR JARB1 2018 WORST DAYS

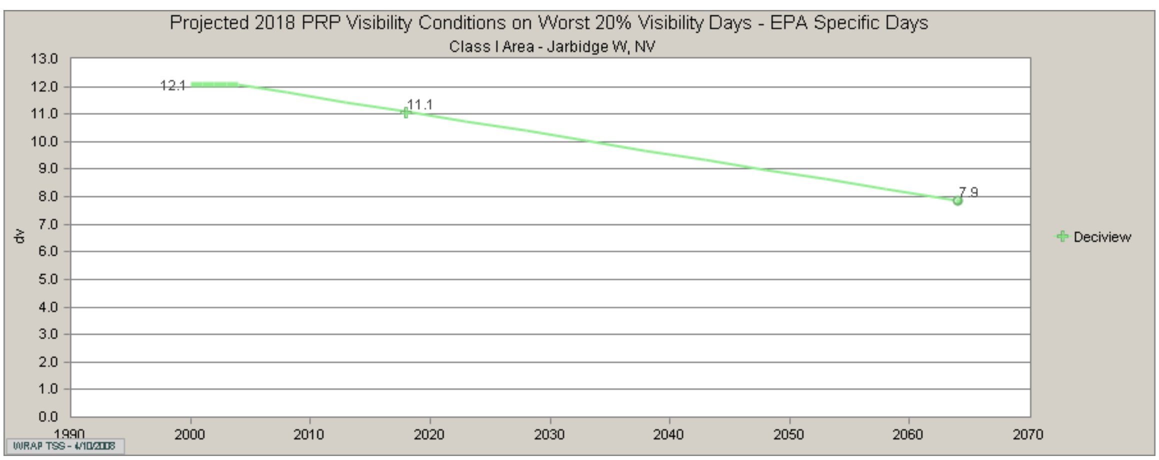


Figure 4-6 provides the species-specific extinction glide slopes in inverse megameters and corresponding 2018 model projections for the worst days at JARB1 using the USEPA specific days method. Table 4-2 presents these data graphically and identifies the 2018 URP, the model-projected 2018 extinction and the percentage of modeled progress from the baseline toward the 2018 URP. The values presented in Figures 4-5 and 4-6 are rounded to one decimal place, while those in Table 4-2 are presented to two decimal places.

All components show extinction reductions from baseline conditions, except CM and Sea Salt extinctions. These two remain constant from the baseline period to 2018 because the emission inventories for these components were held constant for the baseline period and the 2018 projection for the purposes of modeling.

Projected 2018 extinction meets the URP for all components except SO_4 and Soil, as shown in Figure 4-6 and indicated by modeled extinction changes of greater than 100 percent in Table 4-2. The projected SO_4 extinction of 3.34 Mm^{-1} achieves 80 percent of the 2018 URP value (3.17 Mm^{-1}). The projected NO_3 extinction of 0.7 Mm^{-1} shows an improvement of 1000 percent toward the 2018 URP of 1.06 Mm^{-1}.

Recall that the RMC has indicated the CMAQ model cannot be used to forecast future CM concentrations, and NDEP has deemed the model performance for Soil on the worst days as unacceptable. The results for these species are presented for informational purposes.

FIGURE 4-6

CMAQ MODEL PROJECTIONS IN EXTINCTION
BY SPECIES FOR JARB1 2018 WORST DAYS

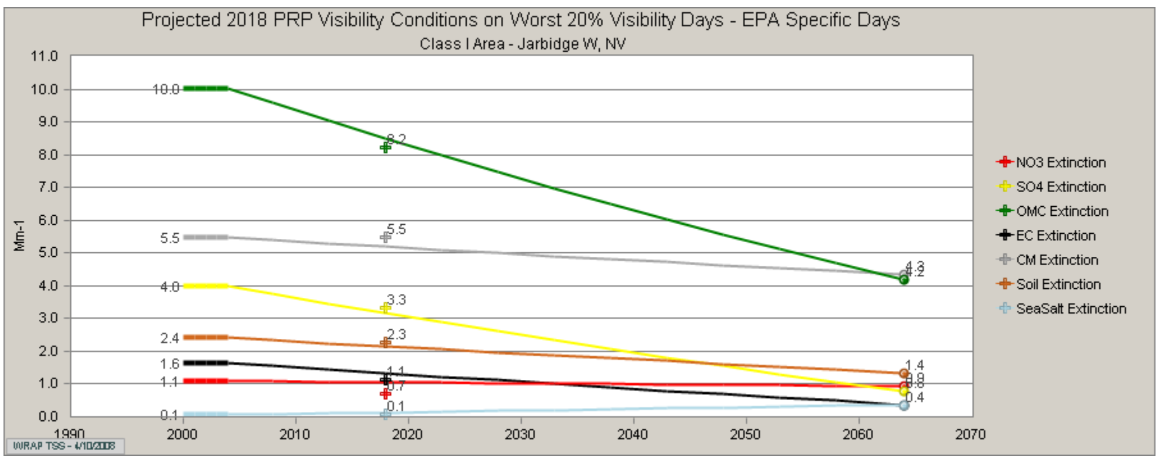


TABLE 4-2

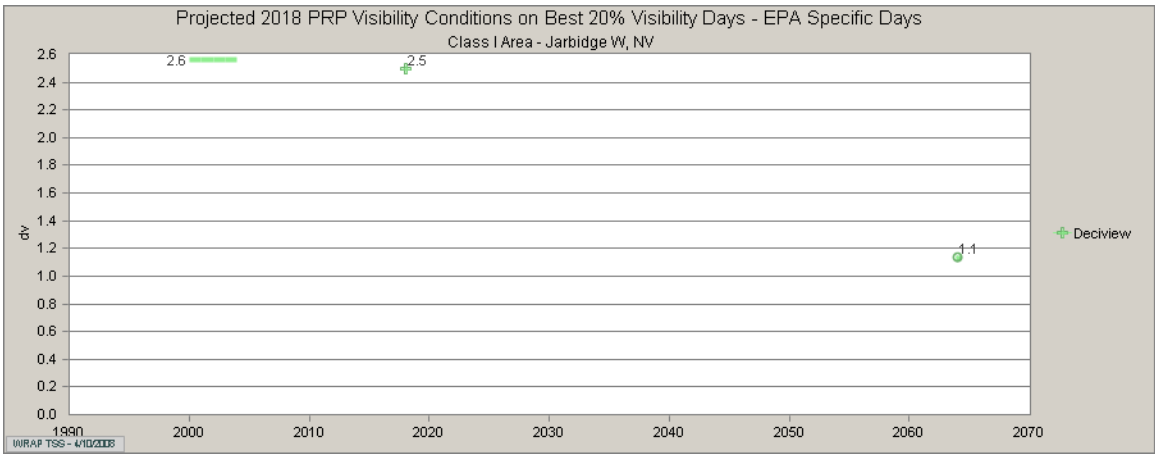
SUMMARY OF MODEL PREDICTED PROGRESS TOWARD
SPECIES-SPECIFIC 2018 WORST DAYS URP AT JARB1

Extinction (Mm^{-1})	Sulfate	Nitrate	Organic Carbon	Elemental Carbon	Fine Soil	Coarse Mass	Sea Salt
Baseline	4	1.1	10.04	1.65	2.41	5.47	0.06
2018 URP	3.17	1.06	8.49	1.34	2.15	5.2	0.13
Projected 2018 RP	3.34	0.7	8.24	1.12	2.29	5.47	0.06
Modeled Change from Baseline to 2018 URP (% of Goal)	80%	1000%	116%	171%	46%	0%	0%

Figure 4-7 indicates the 2018 model-projected extinction for the best days at JARB1, using the USEPA specific days method, is 2.50 dv, which is below the best days baseline average of 2.56 dv. These data indicate Nevada is forecast to maintain visibility for the best days of 2018 at the Jarbidge WA.

FIGURE 4-7

CMAQ MODEL PROJECTIONS IN HAZE INDEX FOR JARB1 2018 BEST DAYS



4.3 SOURCE APPORTIONMENT MODELING RESULTS

The PSAT algorithm in the CAMx model was developed to assess source apportionment. The PSAT analysis was used to attribute particle species, particularly sulfate and nitrate, from specific source areas and source categories, as discussed earlier. Emissions from each state or region for point, mobile, area and fire sources were tagged and tracked. The PSAT modeling utilized the Plan02c and Base18b emission inventories.

4.3.1 Sulfate Source Apportionment for Jarbidge Wilderness Area

Figure 4-8 displays the 2002 and 2018 worst days particulate sulfate concentrations impacting the JARB1 monitor due to emissions from WRAP states. The chart provides details on the relative source contribution for each WRAP state during 2002 and 2018. The data indicate the overall SO_2 emission sources for the worst days are from the states of Idaho, Oregon and Washington. Idaho's contributions to sulfate are primarily from natural fire emissions which were held constant from 2002 to 2018. Point sources also contribute significantly to sulfate from Idaho. Washington, Oregon, Nevada and California show contributions to sulfate primarily from point sources and natural fires.

Figure 4-9 shows the contributions to sulfate concentration from all modeled source areas for the worst days of 2002 and 2018 at the JARB1 monitor. These charts show that source areas outside the domain and within the WRAP region have sub-equal contributions of approximately 40 percent to year 2002 sulfate concentration at the JARB1 monitor for the worst days. Adding other source area contributions outside of the United States (i.e., Canada, Mexico and Pacific

Offshore) to the Outside Domain source area contributions suggests over 55 percent of the sulfate contributions to visibility impairment at the Jarbidge WA are outside the jurisdiction of state or federal regulation.

FIGURE 4-8

SULFATE PSAT SOURCE REGION BAR
CHART FOR WORST DAYS 2002 AND 2018

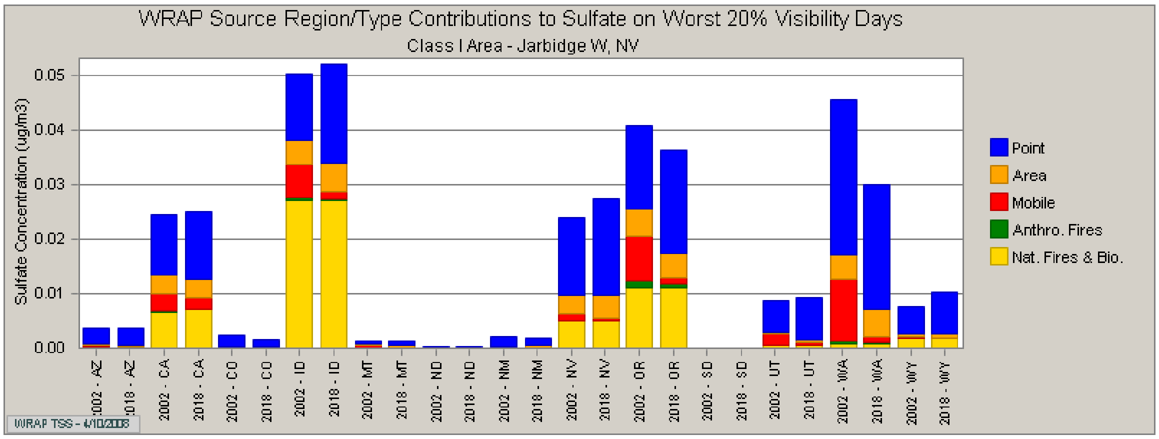


FIGURE 4-9

SULFATE PSAT REGIONAL PIE CHART FOR WORST DAYS 2002 AND 2018

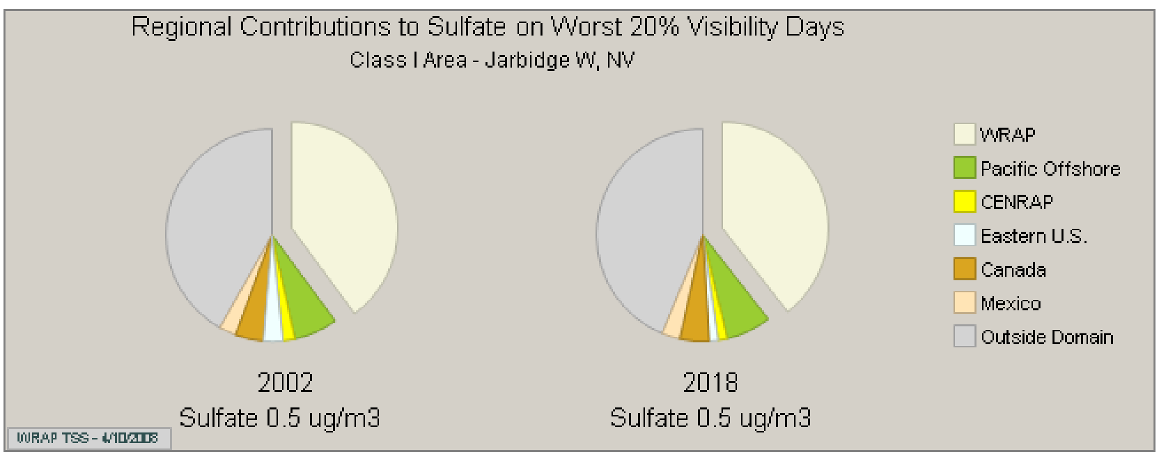


Figure 4-10 displays the 2002 and 2018 best days' particulate sulfate concentrations impacting the JARB1 monitor due to emissions from WRAP states. The chart provides details on the relative source contribution for each WRAP state during 2002 and 2018. The data indicate the dominant WRAP source area contribution for the best days is Nevada. Lesser contributions are due to emissions from Idaho, Oregon and California. Point sources are the dominant source category.

Figure 4-11 show the contributions to sulfate concentration from all modeled source areas for the best days of 2002 and 2018 at the JARB1 monitor. These charts show that WRAP source areas contribute less than a third to the sulfate concentration at the JARB1 monitor for the best days. Source areas outside the jurisdiction of state or federal regulation and/or control (i.e., Outside Domain, Canada, Mexico and Pacific Offshore) contribute more that two thirds to the sulfate concentration at the JARB1 monitor.

FIGURE 4-10

SULFATE PSAT SOURCE REGION BAR CHART FOR BEST DAYS 2002 AND 2018

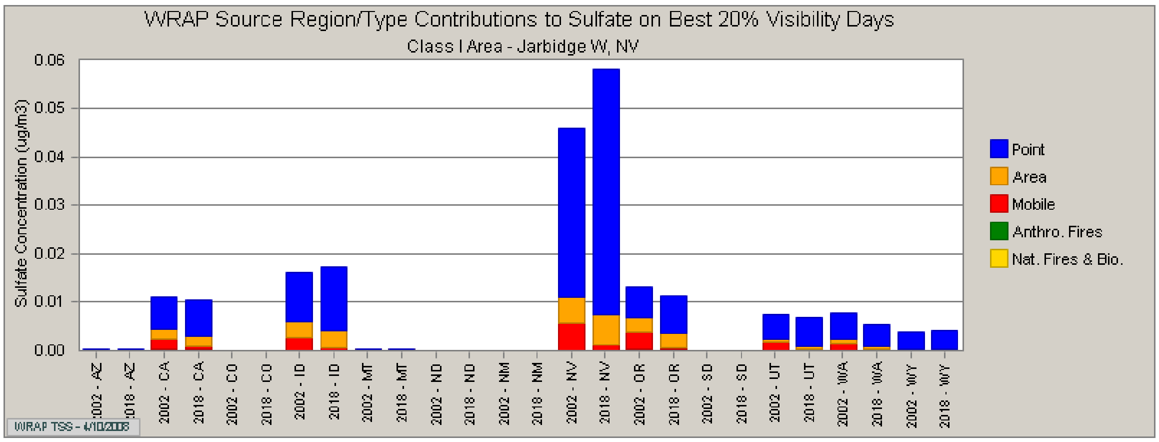
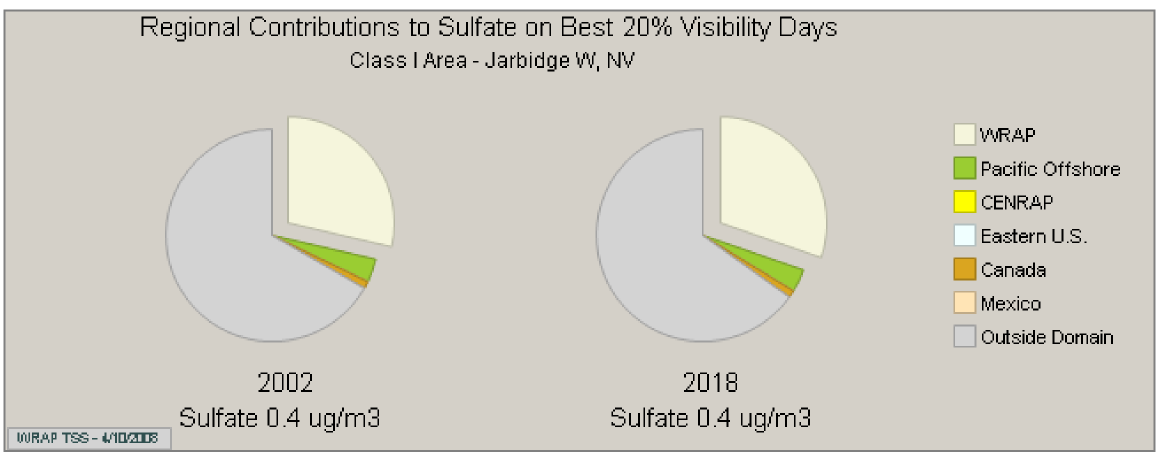


FIGURE 4-11

SULFATE PSAT REGIONAL PIE CHART FOR BEST DAYS 2002 AND 2018



4.3.2 Nitrate Source Apportionment for Jarbidge Wilderness Area

Figure 4-12 displays the particulate nitrate concentrations for 2002 and 2018 worst days for WRAP source areas at the JARB1 monitor. The chart provides details on the relative source contribution of each WRAP state during 2002 and 2018. The data indicate the dominant WRAP source area contributions for the worst days are from Idaho, Utah and Nevada. California, Oregon and Washington had lesser contributions to nitrate concentrations at the JARB1 monitor. Mobile source emissions are the dominant source category for NO_x emissions, although area source emissions are significant for Idaho. Point source emissions from Idaho, Nevada and Utah are also important contributors to the modeled nitrate concentration for the worst days of 2002 and 2018.

FIGURE 4-12

NITRATE PSAT SOURCE REGION BAR CHART FOR WORST DAYS 2002 AND 2018

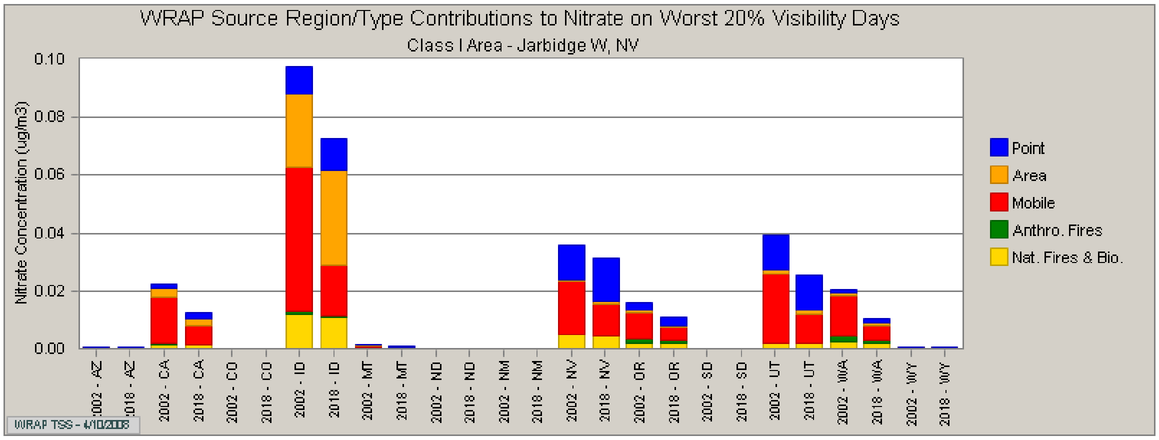


Figure 4-13 shows the contributions to nitrate concentration from all modeled source areas for the worst days of 2002 and 2018 at the JARB1 monitor. The pie charts show the WRAP region contributes more than three quarters to 2002 nitrate concentration at the JARB1 monitor for the worst days of 2002. The WRAP contribution drops to more than two thirds for 2018. Outside Domain sources combined with contributions from Mexico, Canada and Pacific Offshore areas contribute nearly a quarter to sulfate concentrations at the JARB1 monitor in 2002. Contributions from these sources increase to nearly a third for 2018.

FIGURE 4-13

NITRATE PSAT REGIONAL PIE CHART FOR WORST DAYS 2002 AND 2018

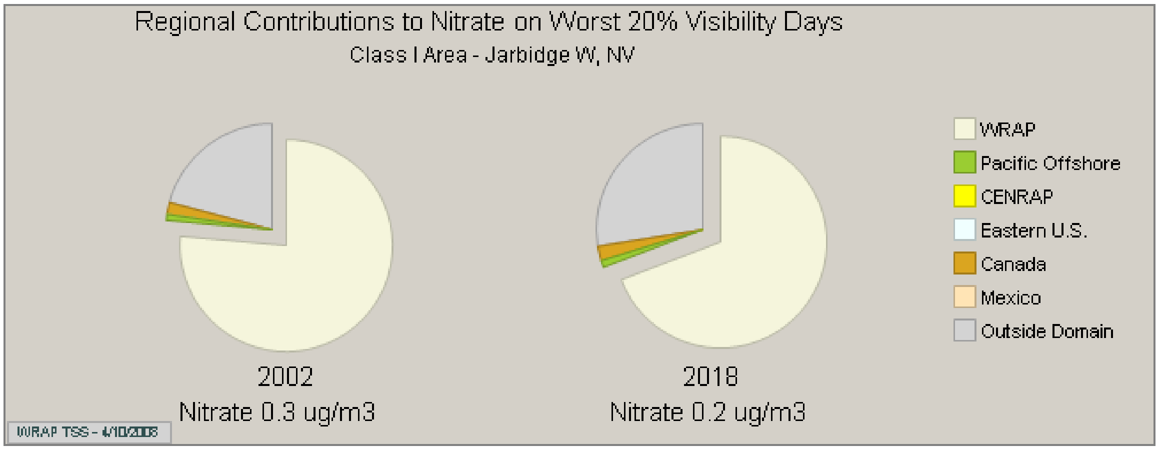


Figure 4-14 displays the 2002 and 2018 best days' particulate nitrate concentrations impacting the JARB1 monitor due to emissions from WRAP states. The chart provides details on the relative source contribution for each WRAP state during 2002 and 2018. The data indicate the dominant WRAP source area contribution for the best days is the State of Nevada with significant contributions from California and Idaho. Oregon, Utah and Washington show lesser contributions. Mobile sources are the dominant source category, except in Nevada, where point and mobile sources have sub-equal contribution to nitrate concentration at the JARB1 monitor. Area sources in Idaho also contribute significantly.

FIGURE 4-14

NITRATE PSAT SOURCE REGION BAR CHART FOR BEST DAYS 2002 AND 2018

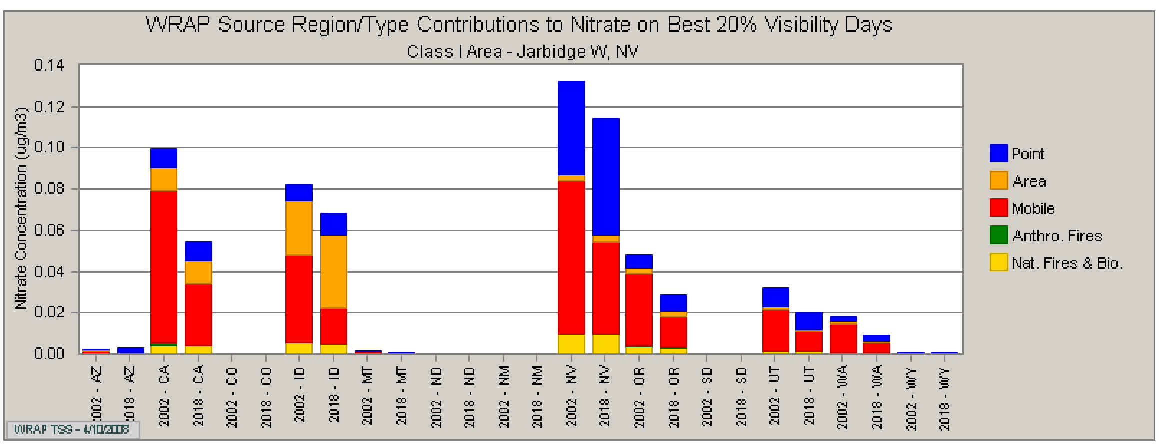
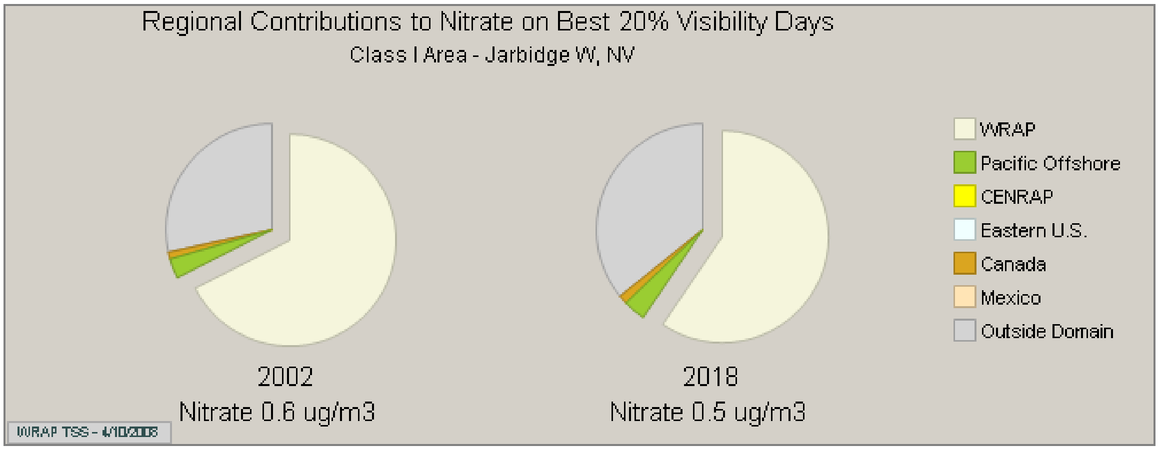


Figure 4-15 displays the contributions to nitrate concentration from all modeled source areas for 2002 and 2018 best days at JARB1. The pie charts indicate WRAP states contribute approximately two thirds to the nitrate concentration at the JARB1 monitor with the remaining nitrate impact due to Outside Domain, Canada and Pacific Offshore sources.

FIGURE 4-15

NITRATE PSAT REGIONAL PIE CHART FOR BEST DAYS 2002 AND 2018



4.3.3 Source Apportionment for Other Class I Areas

The PSAT source apportionment modeling results were evaluated to determine which Class I areas in adjacent states might be affected by emissions from Nevada sources. Table 4-3 presents the results of this evaluation for sulfate extinction. The table identifies the rank and percentage of the total modeled concentration due to SO_2 emissions from sources within Nevada to the IMPROVE monitors representing all Class I areas in the five adjacent states. The rank and percentage contribution is based on contributions from all modeled source areas. The bolded values are the highest percentage contribution to visibility impairment at Class I areas in each of the five adjacent states due to emissions from Nevada sources for the worst days projected for 2018.

Examination of the best days 2018 rank and contribution identifies the maximum contribution to sulfate extinction due to emissions from Nevada sources occurs at SAWT1 located in the Sawtooth Wilderness Area, with a rank of 4 and a contribution of 7.2 percent. For the worst days, Nevada's maximum contribution occurs at ZION1 located in Zion National Park with a rank of 6 and a contribution of 5.6 percent. Figure 4-16 shows SO_2 emissions from sources outside the modeling domain, which are beyond the jurisdiction of United States regulatory agencies and uncontrollable, contribute nearly eight times as much as Nevada sources to sulfate extinction on the 2018 best days at the Sawtooth Wilderness Area. Figure 4-17 shows the two source areas with the greatest contributions to sulfate extinction on the 2018 worst days to Zion National Park are Outside Domain and Pacific Offshore. Sources in Mexico are the fourth largest contributor while the majority of emissions from the third largest source area contributor are natural.

Table 4-4 presents the results of the source apportionment modeling for nitrate extinction at the Class I areas in adjacent states. Examination of the best days 2018 rank and contribution identifies the maximum contribution to nitrate extinction due to emissions from Nevada sources occurs at JOSH1 located in Joshua Tree National Park, with a rank of 4 and a contribution of 12.4 percent. For the worst days, Nevada's maximum contribution occurs at BLIS1 located in Bliss State Park (monitor location for Desolation Wilderness Area and Mokelumne Wilderness Area) with a rank of 3 and a contribution of 20.0 percent. The bolded values in this table represent the maximum visibility impacts at the Class I areas in adjacent states due to Nevada's emissions for the worst days projected for 2018.

TABLE 4-3

NEVADA'S SULFATE EXTINCTION CONTRIBUTION TO
CLASS I AREAS OUTSIDE OF NEVADA

IMPROVE Site Code	IMPROVE Site Name	Sulfate Extinction Contribution due to Nevada Emissions							
		Best Days				Worst Days			
		2002		2018		2002		2018	
		Impact	Rank	Impact	Rank	Impact	Rank	Impact	Rank
Arizona									
GRCA2	Hance Camp	3.1%	4	2.8%	5	6.0%	6	**2.8%**	6
IKBA1	Ike's Backbone	4.2%	6	2.6%	8	3.3%	8	1.5%	10
SIAN1	Sierra Ancha	2.6%	9	1.6%	9	3.1%	8	1.5%	9
SYCA1	Sycamore Canyon	6.3%	3	3.1%	6	5.6%	6	2.5%	8
TONT1	Tonto	2.2%	7	1.3%	9	2.7%	8	1.3%	9
California									
BLIS1	Bliss State Park	3.0%	4	3.1%	4	4.8%	5	**4.4%**	5
DOME1	Dome Lands	6.3%	3	5.3%	3	2.0%	7	1.6%	8
HOOV1	Hoover	2.3%	4	2.2%	4	3.0%	6	2.6%	6
JOSH1	Joshua Tree	6.6%	4	4.0%	4	1.7%	6	1.2%	6
KAIS1	Kaiser	1.6%	4	1.5%	4	2.9%	6	2.4%	6
LAVO1	Lassen Volcanic	2.7%	4	3.0%	4	2.1%	7	2.3%	7
LABE1	Lava Beds	3.5%	4	3.8%	4	3.1%	7	3.2%	7
SAGA1	San Gabriel	2.4%	4	2.0%	4	1.0%	7	0.7%	8
SAGO1	San Gorgonio	6.9%	4	4.1%	5	1.5%	6	0.9%	6
SEQU1	Sequoia	3.1%	4	2.2%	5	2.8%	5	2.0%	5
YOSE1	Yosemite	2.9%	6	2.4%	7	1.9%	4	1.6%	4
Idaho									
CRMO1	Craters of the Moon	3.5%	7	4.1%	6	1.6%	9	1.9%	9
SAWT1	Sawtooth	5.9%	5	7.2%	4	2.2%	8	**2.5%**	8
Oregon									
CRLA1	Crater Lake	0.8%	7	0.8%	7	1.2%	7	1.4%	7
HECA1	Hells Canyon	1.2%	8	1.6%	5	3.2%	7	**4.0%**	6
STAR1	Starkey	1.6%	7	1.9%	7	1.7%	7	2.0%	7
Utah									
BRCA1	Bryce Canyon	3.8%	3	4.1%	4	8.1%	5	4.8%	6
CAPI1	Capitol Reef	2.4%	8	2.5%	8	6.0%	6	3.9%	6
ZION1	Zion	5.4%	3	4.9%	3	9.0%	4	**5.6%**	6

FIGURE 4-16

SULFATE PSAT SOURCE REGION BAR CHART FOR BEST DAYS
2002 AND 2018 AT SAWTOOTH WILDERNESS AREA

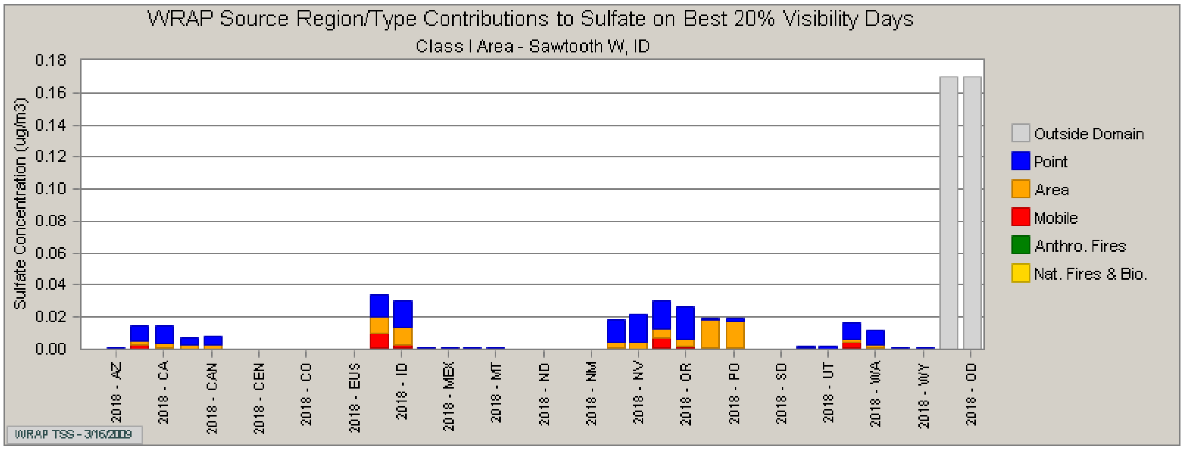


FIGURE 4-17

SULFATE PSAT SOURCE REGION BAR CHART FOR WORST DAYS
2002 AND 2018 AT ZION NATIONAL PARK

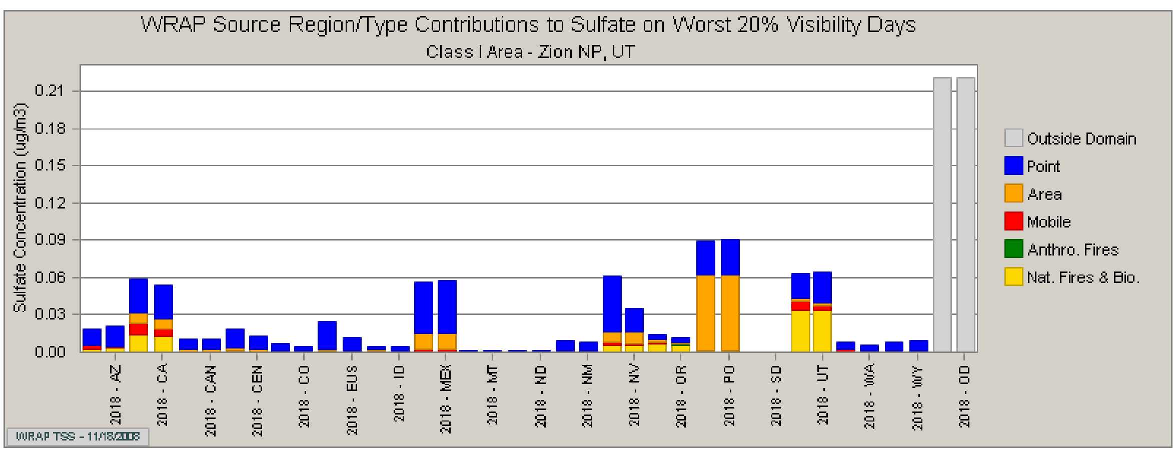


Figure 4-18 shows NO_x emissions from California sources are the dominant contributor to nitrate extinction on the 2018 best days at Joshua Tree National Park, followed by sources outside the modeling domain and Pacific offshore sources. Figure 4-19 shows NO_x emissions from California sources are the dominant contributor for the 2018 worst days, followed by emissions from sources outside the modeling domain to nitrate extinction at the Desolation Wilderness Area.

TABLE 4-4

NEVADA'S NITRATE EXTINCTION CONTRIBUTION TO
CLASS I AREAS OUTSIDE OF NEVADA

IMPROVE Site Code	IMPROVE Site Name	Nitrate Extinction Contribution due to Nevada Emissions							
		Best Days				Worst Days			
		2002		2018		2002		2018	
		Impact	Rank	Impact	Rank	Impact	Rank	Impact	Rank
Arizona									
GRCA2	Hance Camp	5.8%	5	5.8%	5	2.2%	6	2.8%	6
IKBA1	Ike's Backbone	2.8%	6	3.2%	6	1.6%	8	2.4%	8
SIAN1	Sierra Ancha	2.3%	7	2.7%	7	2.6%	5	3.9%	5
SYCA1	Sycamore Canyon	3.4%	6	4.3%	6	3.4%	6	**4.3%**	6
TONT1	Tonto	2.4%	6	2.7%	6	1.5%	7	2.1%	7
California									
BLIS1	Bliss State Park	4.2%	4	4.9%	4	16.3%	3	**20.0%**	3
DOME1	Dome Lands	8.6%	3	9.6%	3	1.8%	4	2.3%	4
HOOV1	Hoover	4.3%	3	4.8%	3	7.7%	3	8.3%	3
JOSH1	Joshua Tree	11.0%	4	12.4%	4	0.6%	4	0.6%	4
KAIS1	Kaiser	2.3%	4	2.7%	4	2.9%	6	4.0%	4
LAVO1	Lassen Volcanic	3.6%	4	4.8%	4	2.4%	6	3.0%	5
LABE1	Lava Beds	3.7%	5	4.4%	5	6.6%	4	8.0%	4
SAGA1	San Gabriel	2.0%	4	2.4%	4	0.3%	6	0.4%	5
SAGO1	San Gorgonio	5.4%	4	6.4%	4	0.3%	5	0.5%	5
SEQU1	Sequoia	2.7%	4	3.6%	4	1.6%	4	2.0%	4
YOSE1	Yosemite	1.8%	4	2.2%	4	3.8%	4	5.1%	4
Idaho									
CRMO1	Craters of the Moon	5.8%	8	6.6%	5	2.3%	9	2.7%	8
SAWT1	Sawtooth	6.5%	5	7.5%	5	3.1%	7	**3.2%**	6
Oregon									
CRLA1	Crater Lake	1.2%	6	1.5%	7	1.6%	7	2.0%	7
HECA1	Hells Canyon	2.0%	8	2.4%	8	4.8%	6	**5.5%**	5
STAR1	Starkey	3.2%	6	3.7%	6	3.7%	7	4.5%	6
Utah									
BRCA1	Bryce Canyon	4.0%	4	4.0%	5	8.8%	4	**8.8%**	4
CAPI1	Capitol Reef	2.9%	5	2.9%	6	5.2%	4	5.4%	5
ZION1	Zion	6.2%	4	6.2%	5	8.1%	4	7.9%	4

FIGURE 4-18

NITRATE PSAT SOURCE REGION BAR CHART FOR BEST DAYS
<u>2002 AND 2018 AT JOSHUA TREE NATIONAL PARK</u>

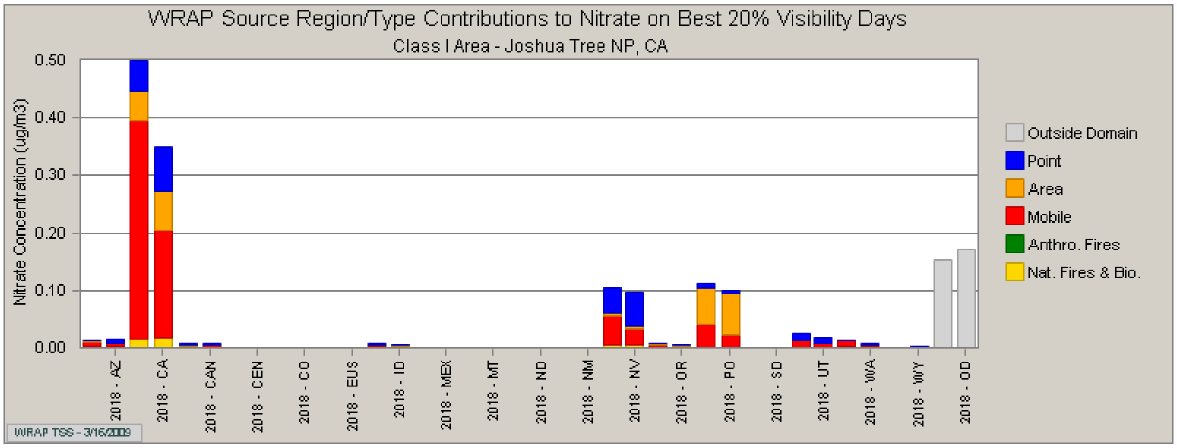
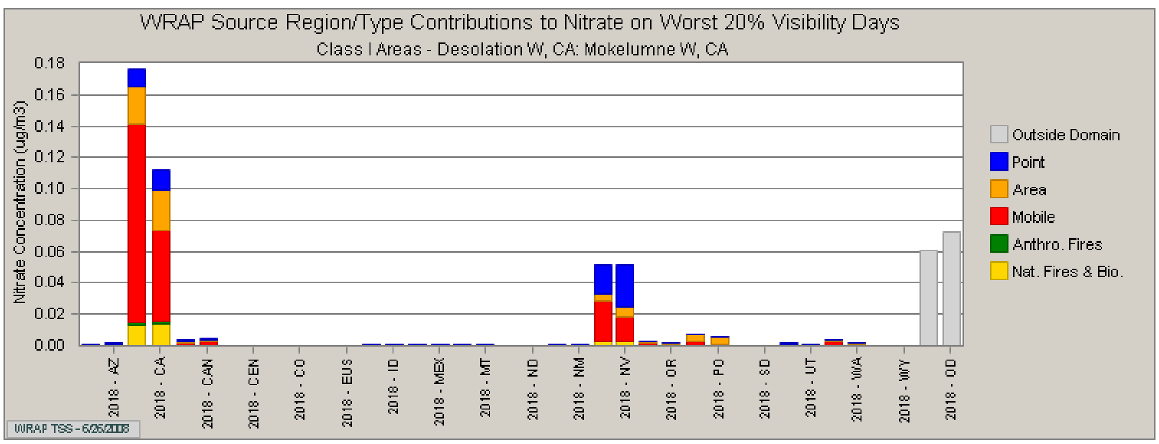


FIGURE 4-19

NITRATE PSAT SOURCE REGION BAR CHART FOR WORST DAYS
<u>2002 AND 2018 AT DESOLATION WILDERNESS AREA</u>



4.3.4 Organic Aerosol Source Apportionment for Jarbidge Wilderness Area

The PSAT algorithm was also used in a limited application to track natural and anthropogenic species of organic aerosols at each Class I area. Source area (e.g., no state or regional) attribution was not performed for the aerosol source apportionment. The organic aerosol tracer tracked both POA and SOA. POAs are primary organics resulting form direct organic aerosol emissions from anthropogenic and biogenic sources. SOAs are further subdivided to include anthropogenic secondary organics resulting form aromatic VOCs such as xylene, toluene and cresols, as well as biogenic secondary organics resulting from biogenic VOCs such as terpenes. The purpose of the organic aerosol tracer tool is to investigate the contribution of primary and secondary anthropogenic and biogenic sources on modeled OC at Class I areas.

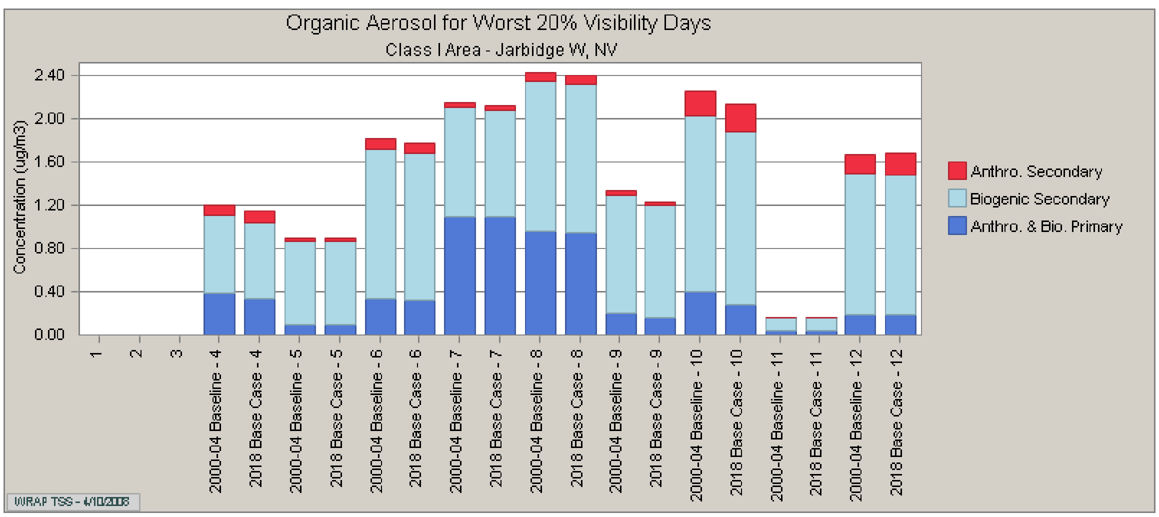
A wide variety of sources contribute to POAs, from cooking of meat to diesel emissions and combustion byproducts from wood and agricultural burning (e.g., emissions from area sources, on-road and off-road mobile sources, fugitive dust sources and fire sources). Nevada's POA emissions inventory is dominated by natural fire emissions as described in Chapter 3 (see 3.8.4) and shown in Figure 3-17 and Table 3-10.

4.3.4.1 Organic Aerosol PSAT for Worst Days 2002 and 2018

Figure 4-20 displays the monthly organic aerosol concentration for the baseline period (2000 through 2004) and 2018 in pairs for the worst days at the JARB1 monitor. The organic aerosol PSAT tracks anthropogenic SOA (in red), biogenic SOA (in sky blue) and anthropogenic/biogenic POA (in blue). The chart provides details on the relative anthropogenic and biogenic concentration for each month of the baseline period and the future contribution in 2018. None of the worst days for the baseline period or for 2018 occurred during the winter or early spring months of January, February or March.

FIGURE 4-20

MONTHLY ORGANIC AEROSOL PSAT BAR CHART FOR
WORST DAYS 2002 AND 2018

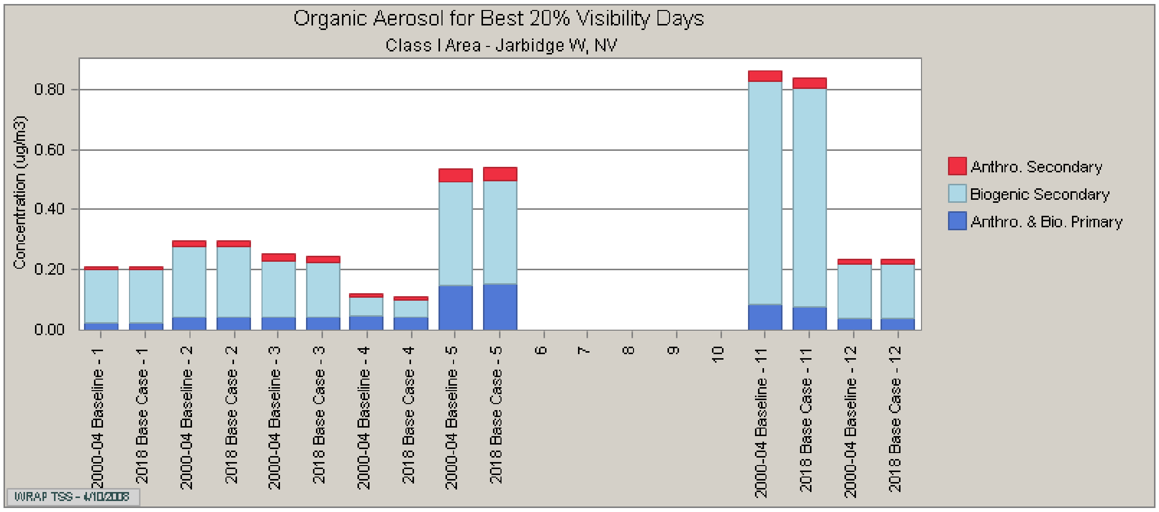


4.3.4.2 Organic Aerosol PSAT for Best Days 2002 and 2018

Figure 4-21 displays the monthly organic aerosol concentration for the baseline period (2000 through 2004) and 2018 for the best days at the JARB1 monitor. None of the best days during the baseline period or for 2018 occurred in the summer or early fall months of June, July, August, September or October.

FIGURE 4-21

MONTHLY ORGANIC AEROSOL PSAT BAR CHART FOR BEST DAYS 2002 AND 2018



4.3.4.3 Organic Aerosol PSAT for All Days 2002 and 2018

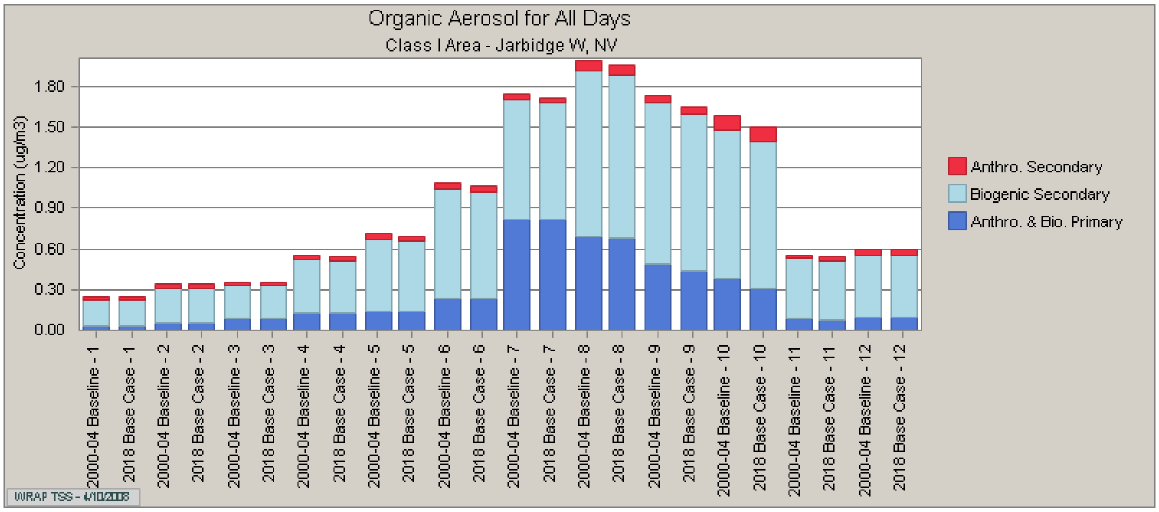
Figure 4-22 displays the monthly organic aerosol concentrations for the baseline period (2000 through 2004) and 2018 for all days at the JARB1 monitor. This figure shows the strong seasonal influence of biogenic and fire emissions on visibility at the Jarbidge WA. The bar chart indicates biogenic SOA (in sky blue) is the dominant source of organic aerosol for all months of the year and it occurs at much higher concentrations during the summer and early fall months of June, July, August, September and October when temperatures are warmer and vegetative growth is most prolific. Significant POA concentrations are indicative of the contribution of natural fire emissions occurring in the months of July, August, September and to a lesser degree October.

4.4 WEIGHTED EMISSIONS POTENTIAL ANALYSES RESULTS

The Weighted Emissions Potential (WEP) tool is an analysis technique that identifies the predominant emission source regions contributing haze-forming pollutants at each Class I area based on 5 years of historical meteorology for both the 20 percent best and worst days, as described in Chapter One.

FIGURE 4-22

ORGANIC AEROSOL PSAT BAR CHART FOR ALL DAYS 2002 AND 2018



The WEP analysis results in two graphical displays of the data: WEP maps of normalized, weighted emissions; and WEP bar charts of normalized, residence time- and distance-weighted annual emissions. The maps show the location of the Jarbidge WA with a green star surrounded by 100 km and 200 km radius concentric circles. The areas shaded in different colors identify those 36 km grid cells with the potential of contributing emissions to JARB1 for the worst days in 2018. Geographical regions and individual grid cells with greater potential to impact the Jarbidge WA are easily distinguished in the maps by the darker shaded grid cells, while the white areas denote those grid cells with negligible emission potential.

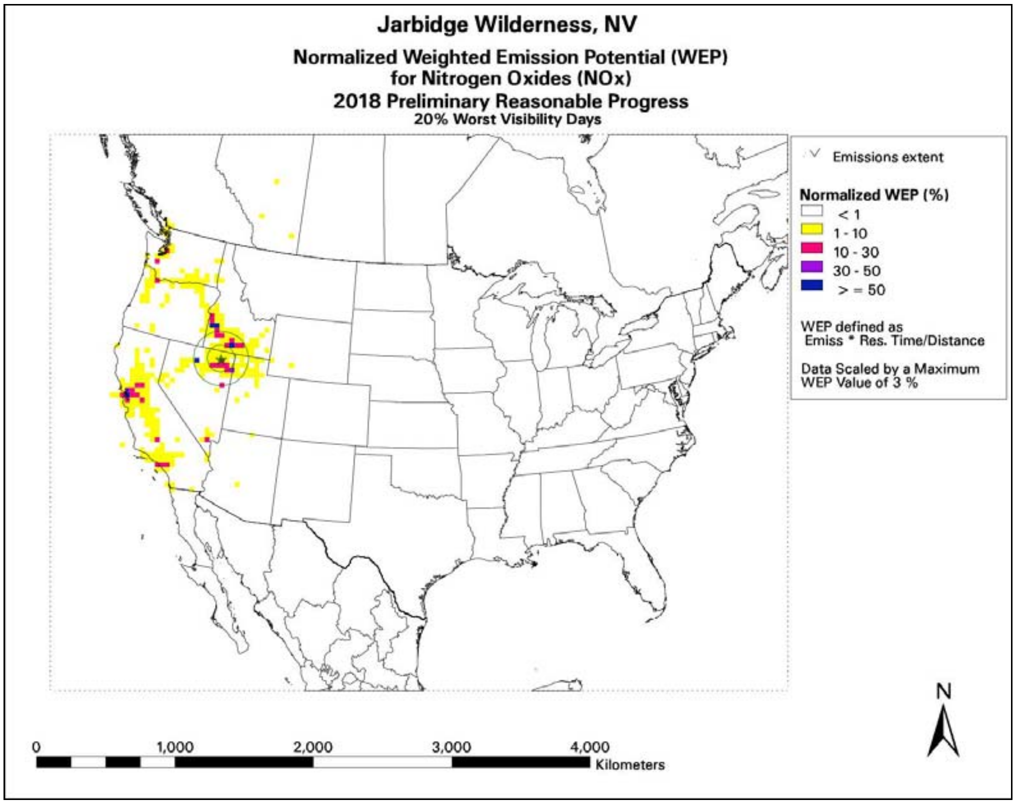
Geographic source areas and source categories are also easily distinguished on the bar charts, which identify twelve source categories: windblown dust, fugitive dust, road dust, off-road mobile, on-road mobile, off-shore, oil and gas, area, biogenic, natural fire, anthropogenic fire and point. Two different modeling simulation emission scenarios (using the Plan02d and PRP18a emission inventories) were used to produce the WEP maps. Only the PRP18a emission scenario maps for the worst days are presented below.

4.4.1 Nitrogen Oxides – Regional WEP Analysis for 2018 Worst Days

Figure 4-23 shows the normalized regional contributions to residence time- and distance-weighted NO_x emissions for JARB1. The WEP bar charts, shown as Figure 4-24, display normalized (unitless), residence time- and distance-weighted 2018 annual NO_x emissions values, by emissions source region.

FIGURE 4-23

REGIONAL NO_x WEP FOR 2018 WORST DAYS



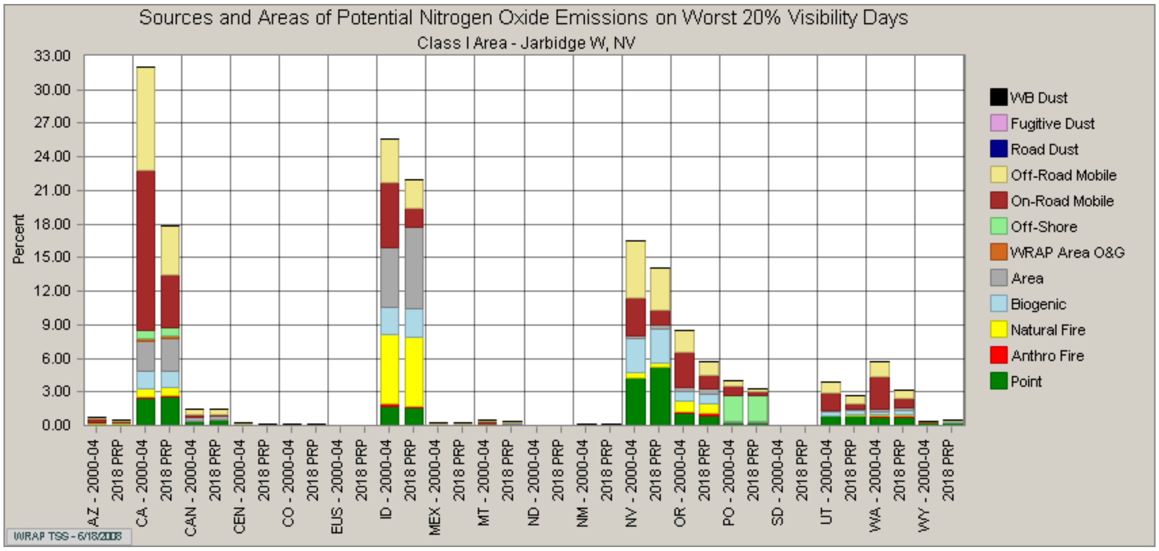
Examination of Figures 4-23 and 4-24 shows the point source contributions from the industrialized portions of northern Nevada and along the Snake River Plain of Idaho, as well as more distance areas in southern Nevada and portions of California, including the Bay Area, Central Valley and Los Angeles area to 2018 NO_x concentration at JARB1. These figures also show the contribution of mobile sources, both on-road and off-road, from the main transportation corridors and population centers along I-80 in Nevada and Utah, I-84 in Utah, Idaho, and Oregon, and I-5 in California to NO_x emissions at JARB1.

4.4.2 Sulfur Oxides – Regional WEP Analysis for 2018 Worst Days

Figure 4-25 shows the normalized regional contributions to residence time- and distance-weighted SO_2 emissions for JARB1. The WEP bar charts, shown as Figure 4-26, display normalized (unitless), residence time- and distance-weighted annual SO_2 emissions values, by emissions source region. Examination of Figures 4-25 and 4-26 shows the large point source contributions from the industrialized portions of northeastern Nevada and along the Snake River Plain of Idaho, as well as more distance areas in the Bay Area of California to 2018 SO_2 concentration at JARB1. These figures also show the contribution of natural fires in Idaho to SO_2 emissions at JARB1.

FIGURE 4-24

SOURCES AND AREAS OF POTENTIAL HAZE-CAUSING NO_x
EMISSIONS FOR JARB1 2002 AND 2018 WORST DAYS



4.4.3 Organic Carbon – Regional WEP Analysis for 2018 Worst Days

Figure 4-27 shows the normalized regional contributions to residence time- and distance-weighted organic carbon (POA) emissions for JARB1. The WEP bar charts, shown as Figure 4-28, display normalized (unitless), residence time- and distance-weighted annual OC emissions values, by emissions source region. Examination of Figures 4-27 and 4-28 shows the large, natural fire source contributions from diffuse areas of California, Idaho, northern Nevada, Oregon, Utah and Washington to 2018 OC concentration at JARB1. These figures also show the contribution of area sources from population centers along the Snake River Plain of Idaho, the Central Valley and Bay Area of California, the Portland area of Oregon and the Seattle area of Washington.

4.4.4 Elemental Carbon – Regional WEP Analysis for 2018 Worst Days

Figure 4-29 shows the normalized regional contributions to residence time- and distance-weighted primary EC emissions for JARB1. The WEP bar charts, shown as Figure 4-30, display normalized (unitless), residence time- and distance-weighted annual primary EC emissions values, by emissions source region. The contribution distribution shown by EC is very similar to that shown by OC. Examination of Figures 4-29 and 4-30 shows the large, natural fire-source contributions from diffuse areas of California, Idaho, northern Nevada, Oregon, Utah and Washington to 2018 EC concentration at JARB1. Figure 3-22 in Chapter Three more clearly shows that the EC emissions in Nevada are primarily due to natural fire events. These figures also show the contribution of area and off-road mobile sources from population centers along the Snake River Plain of Idaho, the Central Valley and Bay Area of California, the Portland area of Oregon and the Seattle area of Washington.

FIGURE 4-25

REGIONAL SO_2 WEP FOR 2018 WORST DAYS

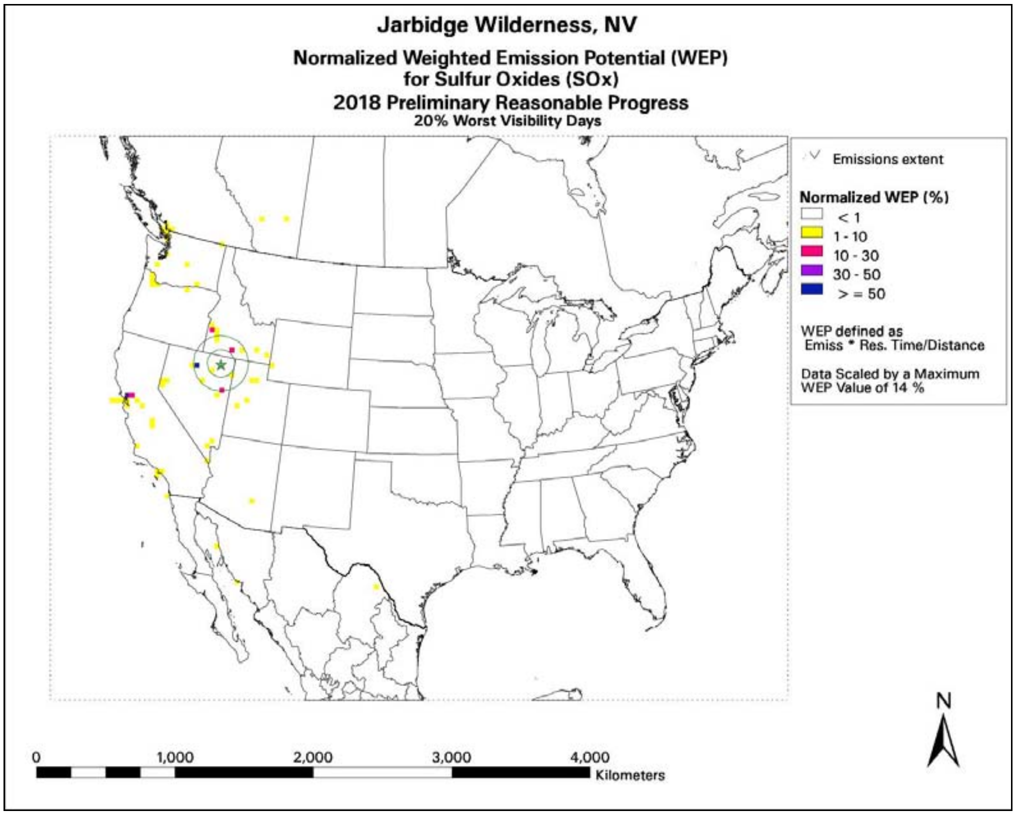


FIGURE 4-26

SOURCES AND AREAS OF POTENTIAL HAZE-CAUSING SO_2
EMISSIONS FOR JARB1 2002 AND 2018 WORST DAYS

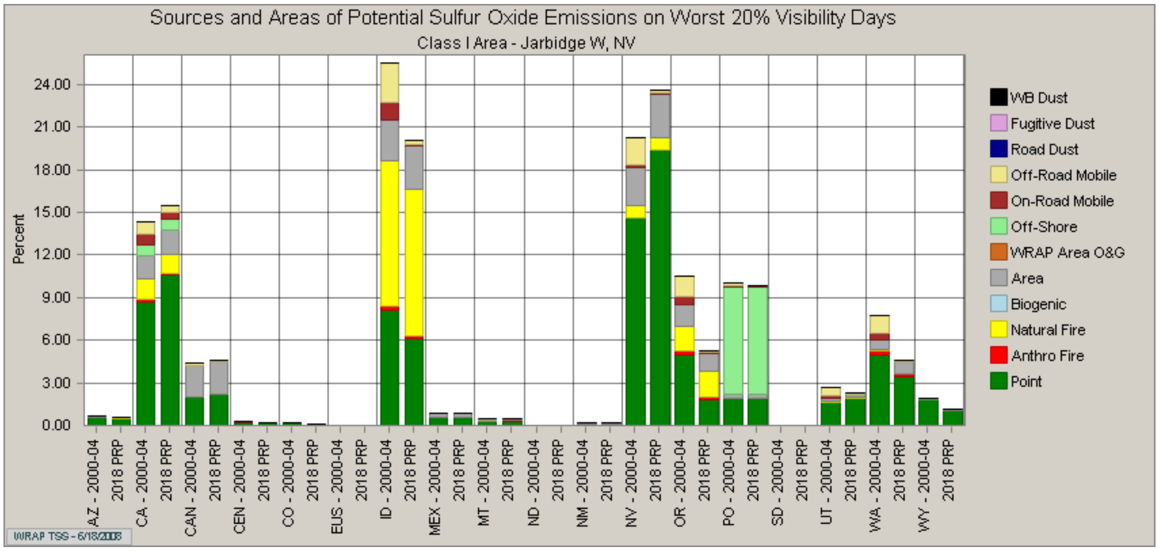


FIGURE 4-27

REGIONAL ORGANIC CARBON WEP FOR 2018 WORST DAYS

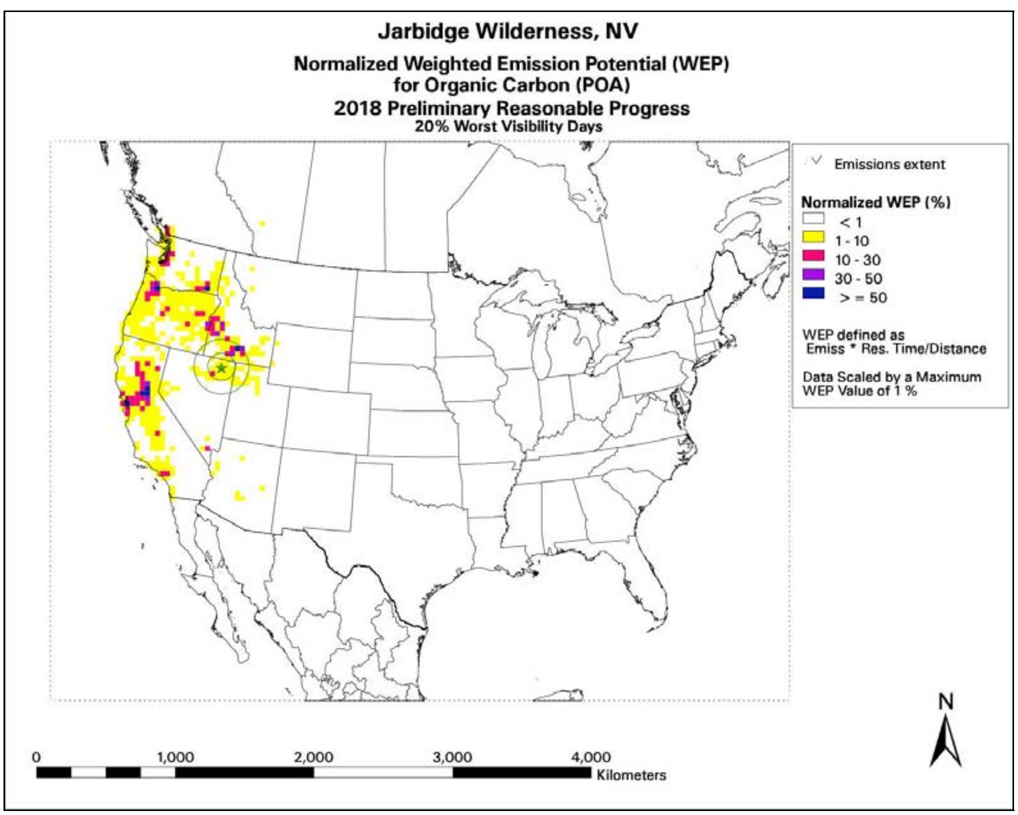


FIGURE 4-28

SOURCES AND AREAS OF POTENTIAL HAZE-CAUSING ORGANIC CARBON EMISSIONS FOR JARB1 2002 AND 2018 WORST DAYS

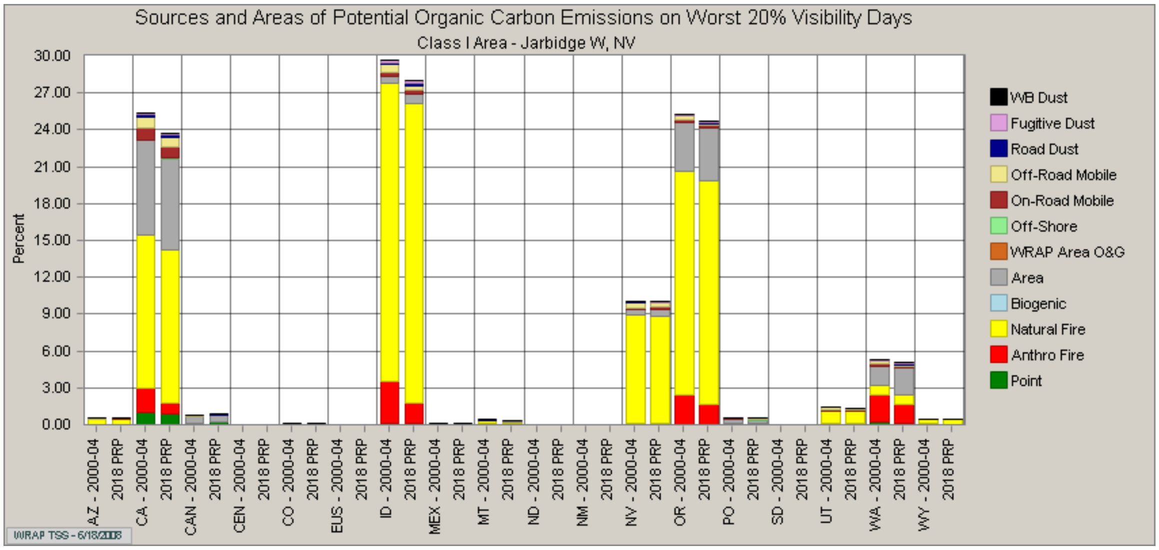


FIGURE 4-29

REGIONAL ELEMENTAL CARBON WEP FOR 2018 WORST DAYS

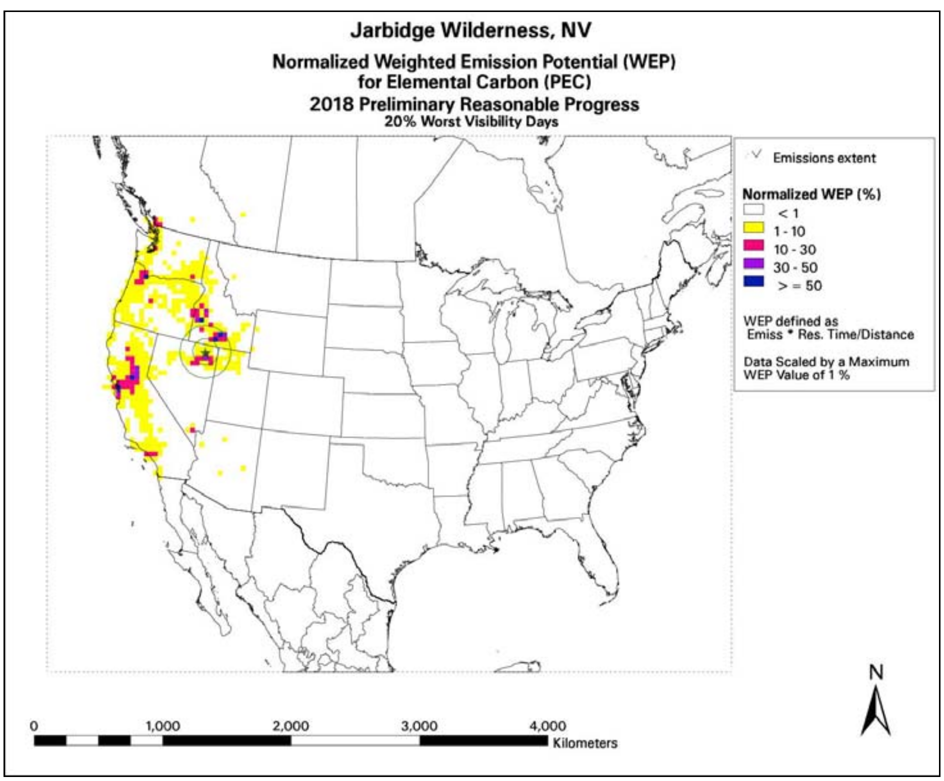
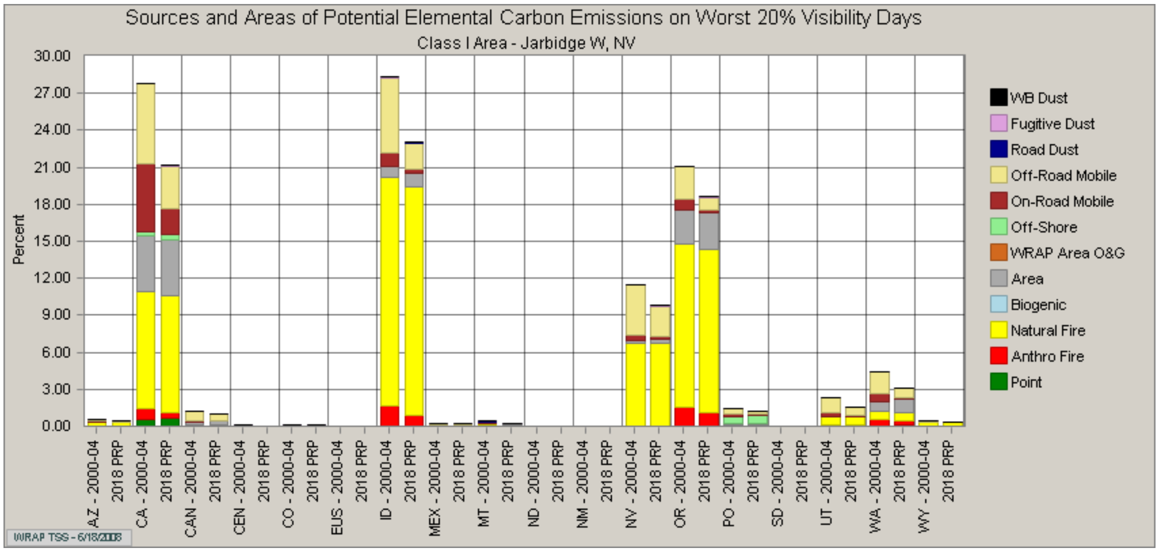


FIGURE 4-30

SOURCES AND AREAS OF POTENTIAL HAZE-CAUSING ELEMENTAL CARBON EMISSIONS FOR JARB1 2002 AND 2018 WORST DAYS



4.4.5 Particulate Matter Fine – Regional WEP Analysis for 2018 Worst Days

Figure 4-31 shows the normalized regional contributions to residence time- and distance-weighted PMF emissions for JARB1. The WEP bar charts, shown as Figure 4-32, display normalized (unitless), residence time- and distance-weighted annual PMF emissions values, by emissions source region.

Examination of Figures 4-31 and 4-32 shows the large windblown dust-source contributions from diffuse areas of southern Idaho, northern Nevada, eastern Oregon and northern Utah to 2018 PMF concentration at JARB1. These figures also show lesser fugitive dust contributions from the same diffuse areas of Idaho, Nevada, Oregon and Washington, as well as the contribution of area sources from population centers along the Snake River Plain of Idaho, the Central Valley and Bay Area of California, and the Portland area of Oregon.

FIGURE 4-31

REGIONAL PARTICULATE MATTER FINE WEP FOR 2018 WORST DAYS

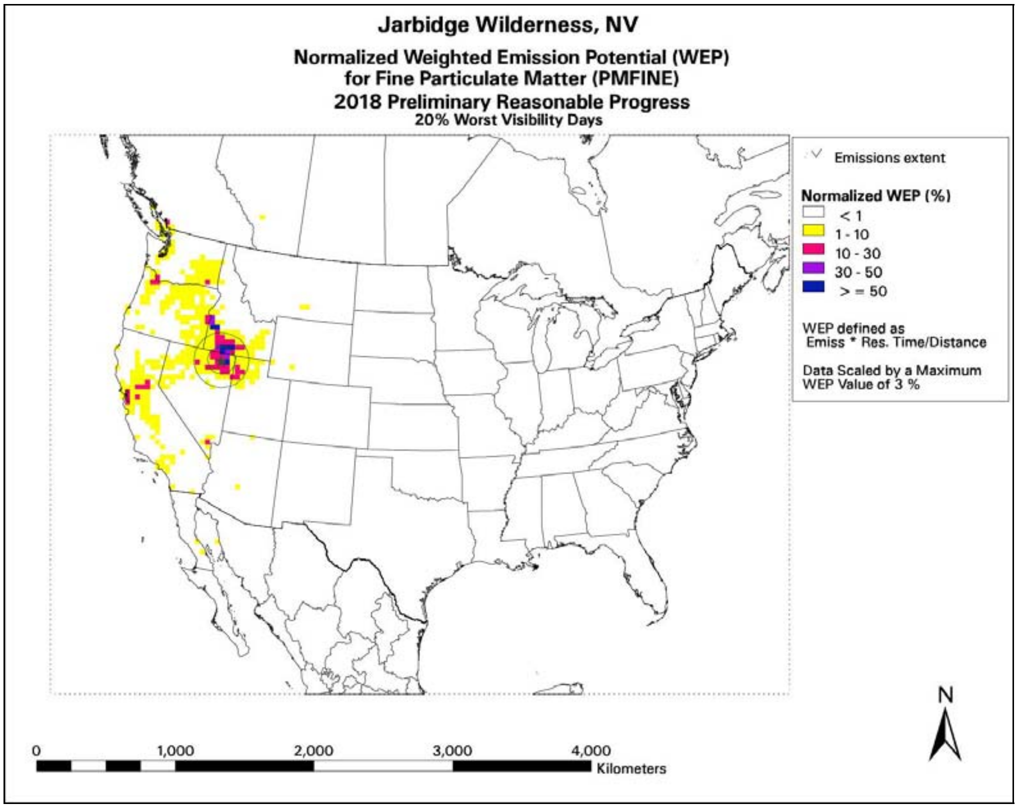
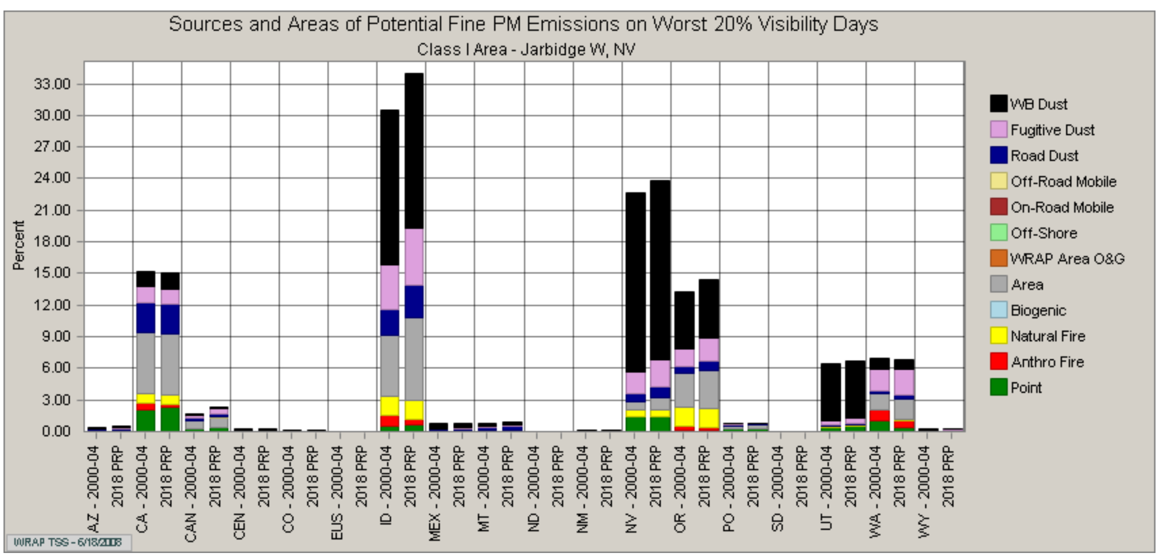


FIGURE 4-32

SOURCES AND AREAS OF POTENTIAL HAZE-CAUSING PARTICULATE MATTER FINE EMISSIONS FOR JARB1 2002 AND 2018 WORST DAYS



4.4.6 Particulate Matter Coarse – Regional WEP Analysis for 2018 Worst Days

Figure 4-33 shows the normalized regional contributions to residence time- and distance-weighted PMC emissions for JARB1. The WEP bar charts, shown as Figure 4-34, display normalized (unitless), residence time- and distance-weighted annual PMC emissions values, by emissions source region. The contribution distribution shown by PMC is very similar to that shown by PMF. Examination of Figures 4-33 and 4-34 shows the large windblown dust source contributions from diffuse areas of southern Idaho, northern Nevada, eastern Oregon and northern Utah to 2018 PMF concentration at JARB1. These figures also show lesser fugitive dust contributions from the same diffuse areas of Idaho, Nevada, Oregon and Washington, as well as the contribution of area sources from population centers along the Snake River Plain of Idaho, the Central Valley and Bay Area of California, and the Portland area of Oregon. Road dust is an important contributor from areas of California and Idaho.

FIGURE 4-33

REGIONAL PARTICULATE MATTER COARSE WEP FOR 2018 WORST DAYS

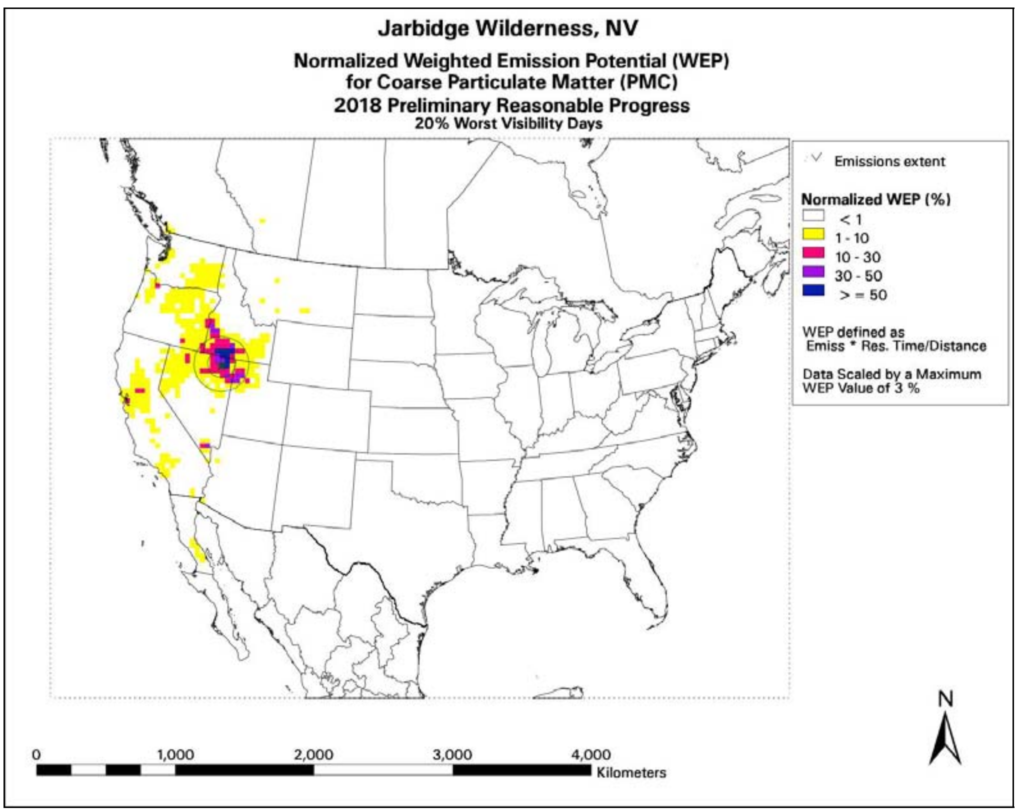
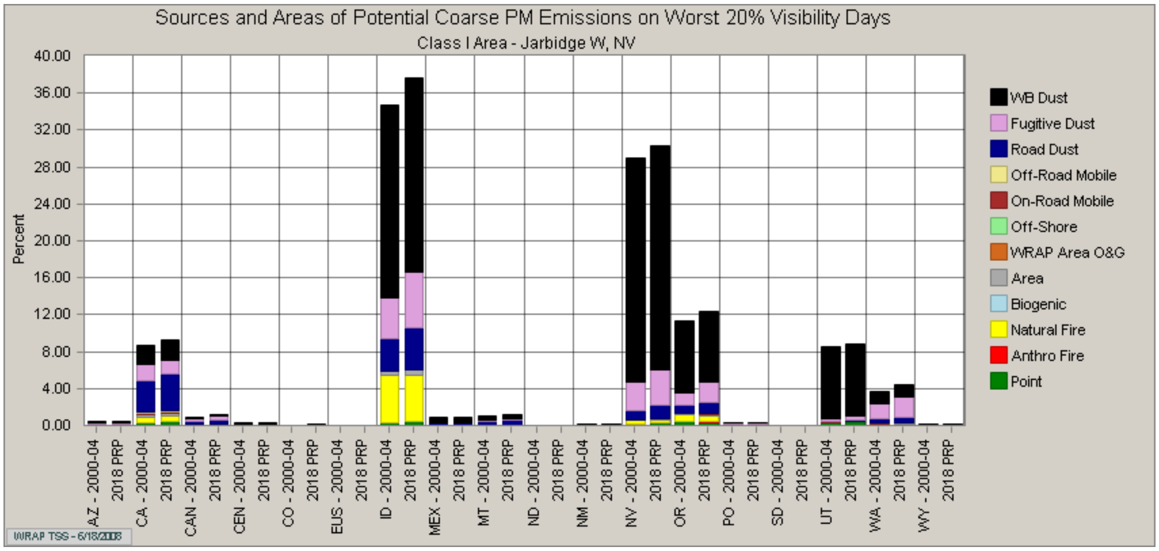


FIGURE 4-34

SOURCES AND AREAS OF POTENTIAL HAZE-CAUSING PARTICULATE MATTER COARSE EMISSIONS FOR JARB1 2002 AND 2018 WORST DAYS



4.5 VISIBILITY AND SOURCE APPORTIONMENT MODELING SUMMARY

Results of the CMAQ visibility modeling forecasts indicate the Jarbidge WA will meet the URP for 2018 for the worst days with no degradation of best days.

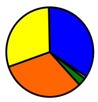
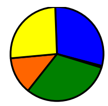
Results of the PSAT source apportionment modeling identify the source areas contributing to sulfate and nitrate extinction at the JARB1 monitor. Table 4-5 lists the four source areas with the highest contribution of SO_2 and NO_x to JARB1 based on the source apportionment modeling. The area with the greatest sulfate contribution is Outside Domain (or boundary conditions), which has contributions four times greater than any other source area. Point, area and natural fire sources all contribute approximately one-third to visibility impairment at the Jarbidge WA. Nevada is not a significant contributor of sulfate at the Jarbidge WA.

Idaho, closely followed by Outside Domain, is the largest source area contributor to nitrate at JARB1. Nevada and Utah also contribute significantly to modeled nitrate concentrations in the Jarbidge WA. Point, mobile and area sources contribute subequally to nitrate, with a lesser contribution from natural fire sources.

Boundary conditions represent the background concentrations of pollutants that enter the edge of the modeling domain. Emissions can be transported great distances and represent international emissions beyond the portions of Canada and Mexico that lie within the modeling domain. Boundary conditions represent emissions from sources beyond the jurisdiction of United States regulatory agencies and are uncontrollable for the purposes of Nevada's regional haze SIP.

TABLE 4-5

SUMMARY OF 2018 MODEL RESULTS FOR JARBIDGE WILDERNESS AREA

2018 Sulfate PSAT - 20% Worst Days 4 Regions with Greatest Contribution to Jarbidge					2018 Nitrate PSAT - 20% Worst Days 4 Regions with Greatest Contribution to Jarbidge				
Sources*	1st	2nd	3rd	4th	Sources*	1st	2nd	3rd	4th
	Outside Domain	Idaho	Oregon	Pacific Offshore		Idaho	Outside Domain	Nevada	Utah
	43.8%	10.3%	7.2%	6.9%		30.3%	27.5%	13.1%	10.6%

* Outside Domain not included in pie charts

Point Sources
Mobile Sources
Natural Fire Sources
Area Sources

Table 4-6 lists the 2002 to 2018 change in modeled particulate sulfate and nitrate concentrations at the Jarbidge WA for the worst days. The 2018 PSAT modeling forecasts overall decreases in total sulfate and nitrate concentrations (i.e., “Total SO_4” and “Total NO_3” columns of Table 4-6) at the JARB1 monitor. However, the modeled contributions to sulfate at JARB1 due to Nevada sources (NV SO_4 column) increased by 14 percent, while modeled nitrate contributions due to Nevada sources (NV NO_3 column) decreased by 12 percent. The PSAT modeling used the Plan02c and Base18b emission inventories, as discussed in Chapter One.

TABLE 4-6

CHANGE IN WORST DAYS MODELED CONCENTRATIONS
OF SULFATE AND NITRATE

Class I Area	Year	Total SO_4 (ug/m^3)	NV SO_4 (ug/m^3)	NV Share SO_4	NV [SO_4] Change	Total NO_3 (ug/m^3)	NV NO_3 (ug/m^3)	NV Share NO_3	NV [NO_3] Change
Jarbidge Wilderness Area	2002	0.529	0.0241	4.6%		0.308	0.0358	11.6%	
	2018	0.507	0.0275	5.4%	+14%	0.240	0.0314	13.1%	-12%

Figure 4-35 summarizes the Nevada Plan02c and Base18b SO_2 inventories, while Figure 4-36 summarizes the Nevada Plan02d and PRP18a SO_2 inventories. Figures 4-37 and 4-38 summarize the same data for NO_x.

FIGURE 4-35

NEVADA SO_2 PLAN02c AND BASE18b
EMISSION INVENTORY COMPARISON

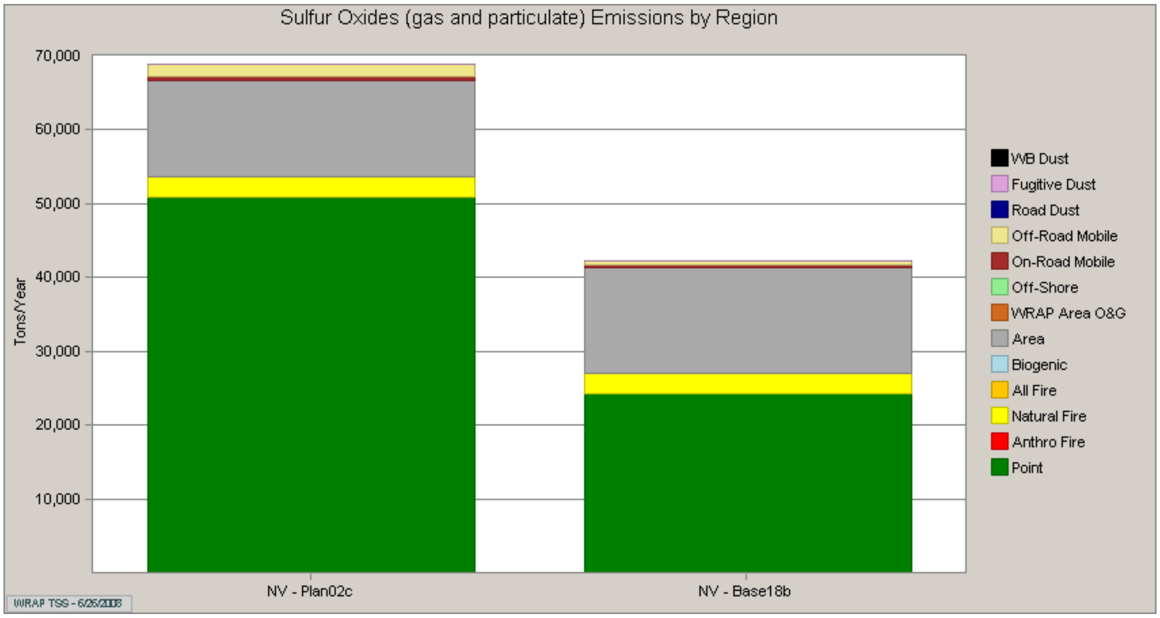


FIGURE 4-36

NEVADA SO_2 PLAN02d AND PRP18a
EMISSION INVENTORY COMPARISON

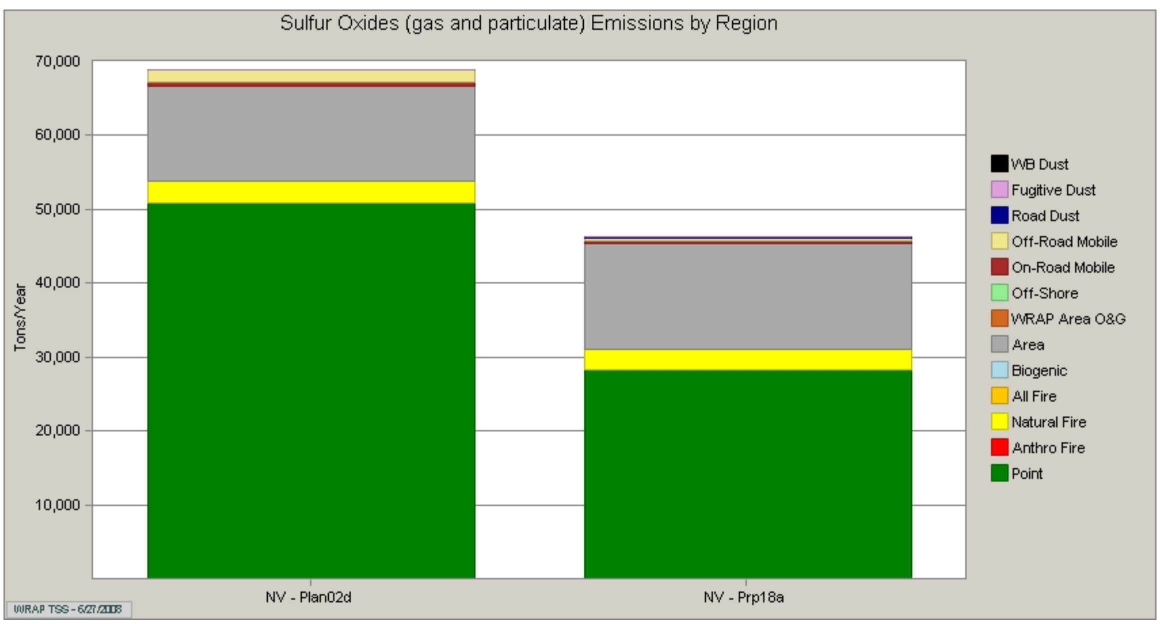


FIGURE 4-37

NEVADA NO_x PLAN02c AND BASE18b
EMISSION INVENTORY COMPARISON

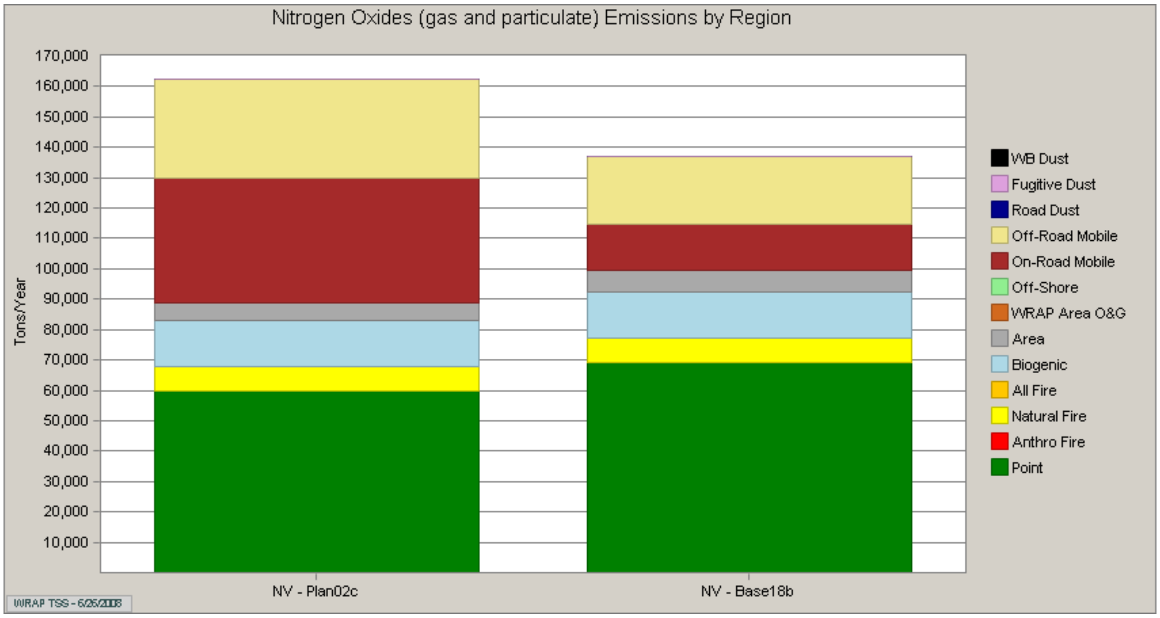
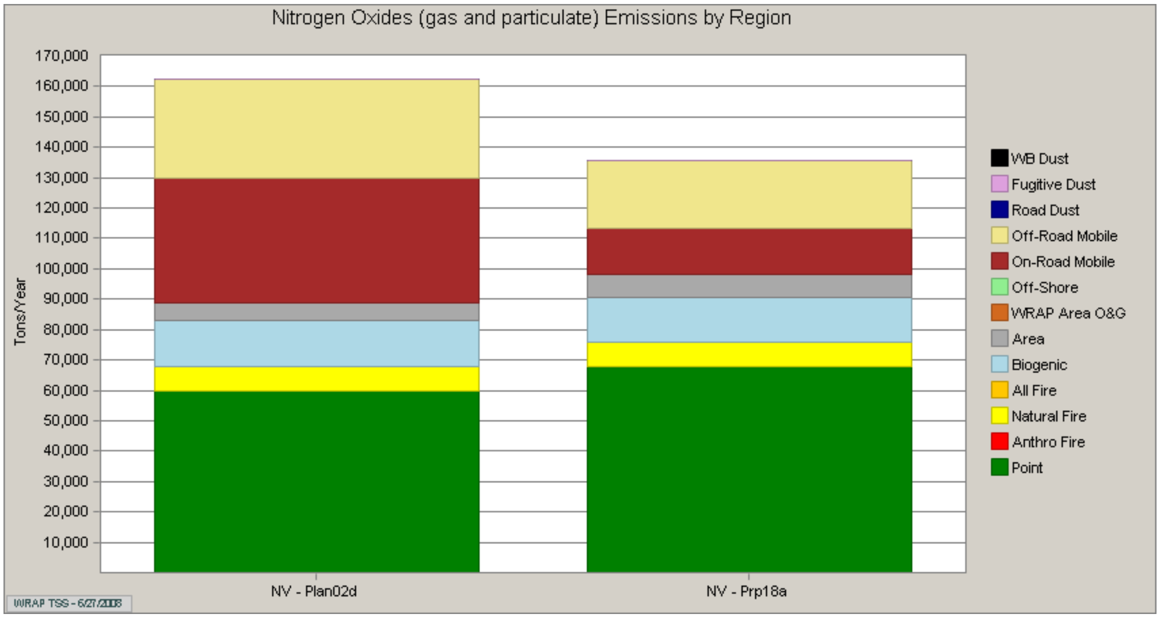


FIGURE 4-38

NEVADA NO_x PLAN02d AND PRP18a
EMISSION INVENTORY COMPARISON



The projected 2018 emissions inventories for both SO_2 and NO_x show substantial overall reductions from the 2002 baseline inventories. However, the PRP18a SO_2 projected inventory does not show as great reductions from 2002 for point sources as the Base18b and less total SO_2 reductions. For NO_x emissions, the total projected reductions are very similar, with a slight reduction in the PRP18a point source projection.

Comparison of the Plan02d and PRP18a emission inventories shows Nevada's total SO_2 emissions decreased by 33 percent from the baseline period to 2018, while SO_2 point source emissions decreased by 44 percent (see Table 3-7). Similarly, Nevada's total NO_x emissions decreased by 17 percent from the baseline to 2018, while NO_x point source emissions increased by 13 percent (see Table 3-8).

The projected overall particulate sulfate and nitrate concentration reductions at JARB1, shown on Table 4-6, are due to Nevada's and regional reductions of SO_2 and NO_x emissions. Organic aerosol PSAT results identify primary and secondary biogenic organic aerosol emissions as the dominant contributor to projected OC concentrations at JARB1 for 2018. These results also indicate primary organic aerosol emissions due to wildland fire are seasonally significant.

Regional WEP analyses appear to confirm the important contributions of projected sulfate and nitrate emissions from point sources in Idaho and Nevada, as well as the influence of nitrate emission from mobile sources in the states adjacent to Nevada to visibility impairment at JARB1 in 2018. These analyses also indicate the significant contributions of natural sources due to natural fire emissions of OC and EC and windblown dust emissions of PMF and PMC to visibility impairment at JARB1.

The results of the projected 2018 visibility and source apportionment modeling indicate the RPG for the Jarbidge WA will exceed the URP and identifies Nevada point sources of SO_2, as well as point and mobile sources of NO_x, as source area candidates for consideration of additional control measures during future regional haze planning periods.

Chapter Five – Best Available Retrofit Technology

5.1 OVERVIEW OF THE BART PROCESS

5.2 BART-ELIGIBLE SOURCES IN NEVADA

5.3 EXEMPTION MODELING SETUP AND ANALYSIS

5.4 SUMMARY OF EXEMPTION MODELING RESULTS

5.4.1 Subject-to-BART Sources
5.4.2 BART-Exempt Sources

5.5 SUMMARY OF BART CONTROL ANALYSES

5.5.1 BART at Tracy
5.5.2 BART at Fort Churchill
5.5.3 BART at Reid Gardner
5.5.4 BART at Mohave
5.5.5 Cumulative Emissions Reductions

5.6 VISIBILITY IMPROVEMENT DUE TO BART IMPLEMENTATION

5.6.1 Tracy
5.6.2 Fort Churchill
5.6.3 Reid Gardner
5.6.4 Mohave

5.1 OVERVIEW OF THE BART PROCESS

The Regional Haze Rule (RHR) at 40 CFR 51.308(e) requires the installation of Best Available Retrofit Technology (BART) controls on a specific set of existing sources as one tool to meet the CAA visibility protection provisions. A BART-eligible source is one which meets the following criteria:

1. Contains an emission unit from one of 26 source categories identified in the CAA and regulations,
2. The emission unit was in existence on August 7, 1977; however, not in operation before August 7, 1962.
3. The potential emissions from all the emission units identified in steps 1 and 2 are currently 250 tons per year or more of any air pollutant.

A BART-eligible source that is responsible for a 1.0 deciview (dv) change or more is considered to "cause or contribute" to visibility impairment. Although the appropriate threshold may vary, the USEPA guidelines indicate that the cause or contribute threshold used for BART applicability should not exceed 0.5 dv. Thus, Nevada considers a BART-eligible source that is responsible for a 0.5 dv increase or more to cause or contribute to visibility impairment. Any BART-eligible source determined to cause or contribute to visibility impairment in any mandatory Class I area is subject to a BART determination.

To assess visibility impairment from BART-eligible sources in Nevada, an individual source attribution approach was used to predict single source contribution. The USEPA guidelines direct that states review sulfur dioxide (SO_2), nitrogen oxides (NO_x) and particulate matter (PM) emissions in determining whether sources cause or contribute to visibility impairment. States may use their best judgment to determine whether volatile organic compounds or ammonia emissions are likely to have an impact on visibility in an area.

Sources identified as subject to BART are required, through a BART engineering analysis, to identify what types of controls, if any, should be placed on the source. The RHR also requires states to consider the following factors in making BART determinations:

1. The technology available,
2. The costs of compliance,
3. The energy and nonair quality environmental impacts of compliance,
4. Any existing pollution control technology in use at the source,
5. The remaining useful life of the source, and
6. The degree of improvement in visibility which may reasonably be anticipated to result from the use of such technology.

Upon determination of BART, each source is required to install and operate BART as expeditiously as practicable, but in no event later than 5 years after approval of the SIP.

5.2 BART–ELIGIBLE SOURCES IN NEVADA

The BART-eligible sources were identified using the methodology in the *Guidelines for BART Determinations under the Regional Haze Rule* or "Guidelines" found in 40 CFR 51, Appendix Y.

Fourteen units at seven facilities were identified as BART-eligible. The BART-eligible facilities are: NV Energy's generating stations at Tracy, Fort Churchill, Reid Gardner and Sunrise; Southern California Edison's (SCE) generating station at Mohave; Nevada Cement Company's Fernley facility; and Chemical Lime Company's Apex facility. BART-eligible sources in Nevada are listed in Table 5-1.

TABLE 5-1

BART-ELIGIBLE SOURCES IN NEVADA

Source	Location	Unit	Source Category	Date in Operation	Facility Potential to Emit (tons per year)		
					NO_x	SO_2	PM_{10}
Tracy	Mustang, NV	Boiler 1	Electric Generating Station	1963	1,167	21	125
		Boiler 2		1965			
		Boiler 3		1974			
Fort Churchill	Yerington, NV	Boiler 1	Electric Generating Station	1968	2,221	9	41
		Boiler 2		1971			
Reid Gardner	Moapa, NV	Boiler 1	Electric Generating Station	1965	7,045	1,020	1,343
		Boiler 2		1968			
		Boiler 3		1976			
Sunrise	Las Vegas, NV	Boiler 1	Electric Generating Station	1964	851	1	13
Mohave	Laughlin, NV	Boiler 1	Electric Generating Station	1969	20,267	40,347	1,958
		Boiler 2		1969			

Source	Location	Unit	Source Category	Date in Operation	Facility Potential to Emit (tons per year)		
					NO_x	SO_2	PM_{10}
Nevada Cement Company	Fernley, NV	Kiln 1	Portland Cement Plant	1963	2,065	96	80
		Kiln 2		1967-1968			
Chemical Lime Company	Apex, NV	Kiln 3	Portland Cement Plant	1968	1,121	178	241

5.3 EXEMPTION MODELING SETUP AND ANALYSIS

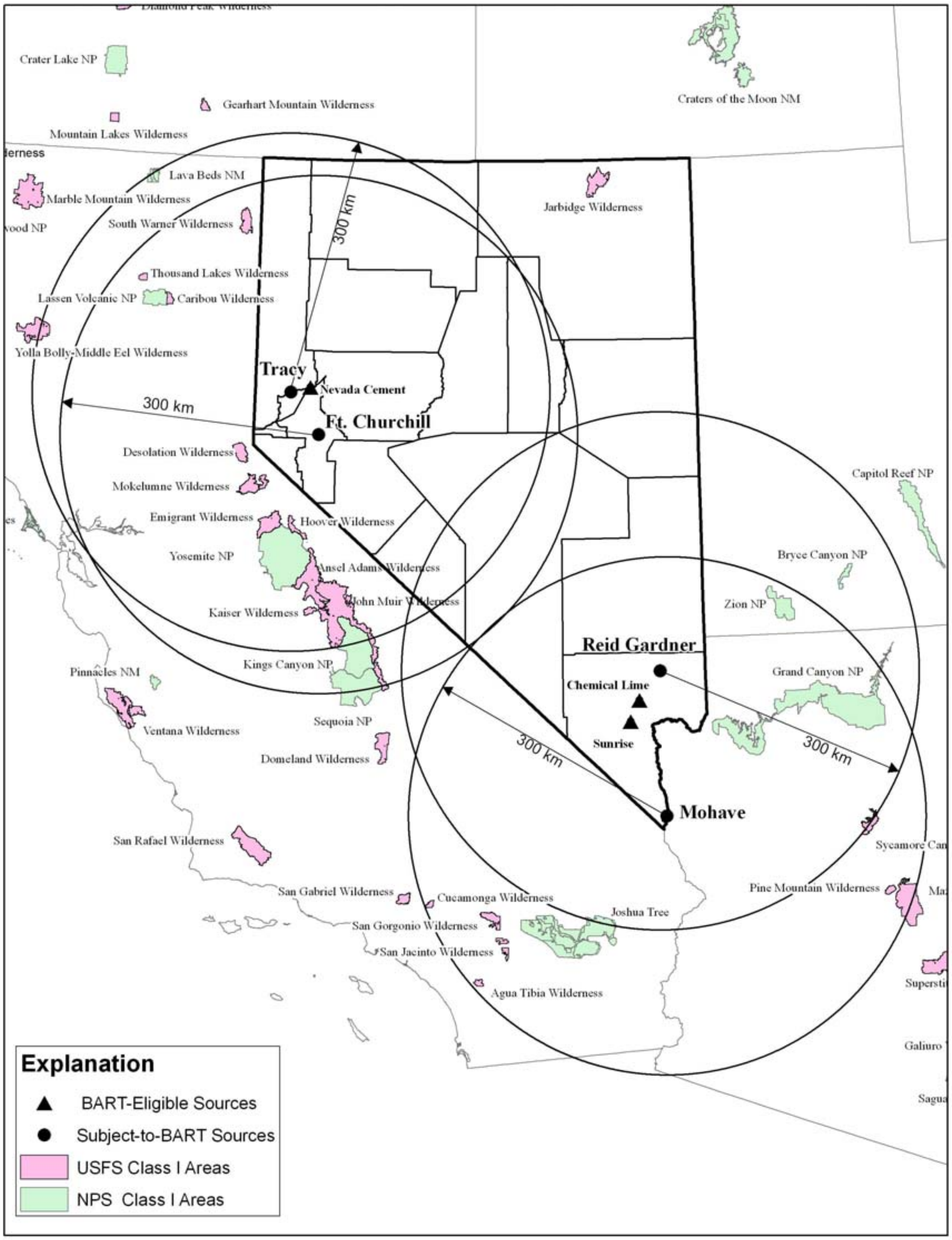
Air quality modeling was conducted by the Western Regional Air Partnership (WRAP) Regional Modeling Center (RMC), at the request of Nevada, to initially assess which BART-eligible sources are subject to a full BART determination and which are exempt. Modeling was conducted for all of the sources listed in Table 5-1 by the WRAP. Nevada Cement Company later exercised their option to conduct their own assessment.

WRAP's BART modeling was performed in accordance with the WRAP Modeling Protocol (2006) and the April 2007 explanation of changes using the CALPUFF modeling system (Version 6). The modeling analysis utilized three years (2001, 2002, 2003) of 36-km MM5 meteorological data, processed through CALMET. Modeled emissions represent the 24-hour average actual emission rate from the highest emitting day of the meteorological period modeled. The results for a given year of meteorology are presented as the 98th percentile delta dv for each Class I area and the number of days that exceed 0.5 delta dv. In other words, the results are based on the eighth highest delta dv results for each year of analysis. Modeled species included SO_2, NO_x and PM_{10}. The modeling procedures used are outlined in the WRAP *BART Modeling Protocol* and *Explanation of Changes in the April 2007 Revised Final Modeling Analysis* available at http://pah.cert.ucr.edu/aqm/308/bart.shtml . The modeling domain included all mandatory Class I areas within 300 km of the BART–eligible sources. Figure 5-1 depicts the location of the facilities and Class I areas.

Nevada Cement developed their own exemption modeling protocol consistent with the WRAP's modeling protocol with the exception of refinements to the meteorological data and the use of the EPA-approved version of the CALPUFF modeling system (i.e., Version 5). Their protocol is available at http://ndep.nv.gov/baqp/planmodeling/rhaze.html.

FIGURE 5-1

LOCATION OF NEVADA'S BART SOURCES



5.4 SUMMARY OF EXEMPTION MODELING RESULTS

BART-eligible sources responsible for a 0.5 dv change or more in visibility at any Class I area are subject to a full BART determination to identify and implement BART. BART-eligible sources that do not cause or contribute to visibility impairment at a threshold greater than 0.5 dv are exempt from further BART determination. The RMC produced BART exemption modeling reports for BART-eligible sources, available at http://ndep.nv.gov/baqp/planmodeling/rhaze.html. Nevada Cement Company conducted their own exemption modeling, and their report is also available at http://ndep.nv.gov/baqp/planmodeling/rhaze.html.

5.4.1 Subject-to-BART Sources

Four BART-eligible facilities modeled above the 0.5 dv "cause or contribute" visibility impairment threshold and are subject to a full BART analysis. These subject-to-BART facilities are the generating stations at Tracy, Fort Churchill, Reid Gardner and Mohave. Table 5-2 lists the Class I areas within 300 km of each source and identifies the 98th percentile dv value for 2001 through 2003 and the number of days the modeled impact exceeded the 0.5 dv threshold. Only those Class I areas impacted by visibility impairment at a value of 0.5 dv or greater are listed.

TABLE 5-2

BART EXEMPTION MODELING RESULTS – SOURCES SUBJECT TO BART[1]

Facility	Class I Area	Distance to Class I Area (km)	98th Percentile dv 2001-2003	Days > 0.5 dv 2001-2003
Tracy	Desolation	81	1.20	47
	Mokelumne	101	0.88	32
	Hoover	142	0.52	11
	Yosemite	153	0.50	11
	Caribou	170	1.03	48
	Lassen Volcanic	175	0.94	44
	South Warner	189	0.99	62
	Lava Beds	286	0.74	25
Fort Churchill	Mokelumne	78	1.24	69
	Desolation	85	1.25	72
	Hoover	99	1.00	32
	Emigrant	100	0.68	25
	Yosemite	112	1.00	29
	Ansel Adams	132	0.70	28
	John Muir	169	0.56	24
	Caribou	226	0.77	34

[1] A summary of the WRAP RMC BART modeling for these facilities is available at http://ndep.nv.gov/baqp/planmodeling/rhaze.html.

Facility	Class I Area	Distance to Class I Area (km)	98th Percentile dv 2001-2003	Days > 0.5 dv 2001-2003
	Lassen Volcanic	231	0.77	33
	South Warner	245	0.72	62
	Thousand Lakes	265	0.60	21
Reid Gardner	Grand Canyon	85	1.72	60
	Zion	148	0.83	38
	Joshua Tree	292	0.88	48
Mohave	Grand Canyon	110	4.61	498
	Joshua Tree	137	4.58	248
	Sycamore Canyon	223	1.51	111
	San Gorgonio	225	1.44	75
	San Jacinto	234	1.62	74
	Zion	262	2.58	270
	Pine Mountain	265	1.21	49
	Dome Land	268	1.97	72
	Mazatal	279	1.19	45
	Agua Tibia	286	1.15	54
	Cucamonga	287	1.38	51

5.4.2 BART-Exempt Sources

Three facilities modeled below the 0.5 dv visibility impairment threshold and are not required to perform a BART determination. These facilities are the Sunrise Generating Station, the Nevada Cement Company facility and the Chemical Lime Company facility. The 98th percentile dv value for 2001 through 2003 and the number of days the dv value exceeded 0.5 dv are presented in Table 5-3.

TABLE 5-3

BART MODELING RESULTS – BART-EXEMPT SOURCES[2]

Facility	Class I Area	Distance to Class I Area (km)	98th Percentile dv 2001-2003	Days > 0.5 dv 2001-2003
Sunrise	Grand Canyon	95	0.20	1
	Zion	207	0.11	0
	Joshua Tree	228	0.16	0
	Dome Land	237	0.08	0
	San Gorgonio	271	0.08	0
	John Muir	282	0.06	0
	Bryce Canyon	284	0.04	0

[2] A summary of the WRAP RMC BART exemption modeling for these facilities is available at http://ndep.nv.gov/baqp/planmodeling/rhaze.html.

Facility	Class I Area	Distance to Class I Area (km)	98^{th} Percentile dv 2001-2003	Days > 0.5 dv 2001-2003
	Sequoia	288	0.04	0
	San Jacinto	290	0.06	0
	Sycamore Canyon	290	0.03	0
Nevada Cement Company	Desolation	101	0.27	3
	Mokelumne	115	0.31	3
	Emigrant	148	0.16	0
	Hoover	150	0.22	0
	Yosemite	161	0.22	0
	Caribou	185	0.48	6
	Ansel Adams	186	0.18	0
	Lassen Volcanic	191	0.46	6
	South Warner	224	0.49	7
	John Muir	224	0.14	0
	Thousand Lakes	254	0.26	4
	Kaiser	267	0.08	0
	Kings Canyon	294	0.11	0
	Lava Beds	294	0.22	0
Chemical Lime Company	Grand Canyon	89	0.05	0
	Zion	185	0.03	0
	Joshua Tree	254	0.04	0
	Dome Land	256	0.02	0
	Bryce Canyon	263	0.01	0
	John Muir	290	0.01	0
	Sycamore	292	0.01	0
	Sequoia	296	0.01	0
	San Gorgonio	297	0.02	0

5.5 SUMMARY OF BART CONTROL ANALYSES

A full BART determination was completed for the generating stations at Tracy, Fort Churchill, Reid Gardner and Mohave. Emission limitations for BART were established on a case-by-case basis taking into consideration the technology available, the costs of compliance, the energy and non-air quality environmental impacts of compliance, any pollution control equipment in use or in existence at the source or unit, the remaining useful life of the unit and the degree of improvement in visibility which may reasonably be anticipated to result from the use of control technology.

The control measures identified by Nevada as BART will be installed and operating for NV Energy's generating stations at Tracy, Fort Churchill and Reid Gardner on or before January 1, 2015 or no later than 5 years after approval of Nevada's RH SIP by the USEPA, whichever occurs sooner. SCE's generating station at Mohave is temporarily shut down; they must have

BART installed and operating at the time each unit resumes operation.[3] The designated BART controls, emission limits and compliance deadlines are enforceable through Nevada state regulation R190-08, adopted on February 11, 2009[4] (see Appendix A). BART will be incorporated into the NV Energy facilities' Title V operating permits over the normal course of renewals. A modification to Mohave's Title V permit incorporating BART was submitted in December 2008 and is being reviewed.

NV Energy and SCE prepared BART determinations for the eligible units at their respective facilities. Based on the data presented by NV Energy, Nevada determined that the BART conclusions proposed for Tracy and Fort Churchill were not supported for NO_x, but were acceptable for SO_2 and PM_{10}. The BART conclusions for Reid Gardner were not supported for NO_x, whereas for SO_2 and PM_{10}, the proposed control technologies were acceptable, but the emission limits were not supported. Mohave's BART determination was fully accepted by Nevada. Detailed BART determination reports from the facility for each of these sources and Nevada's BART determination reviews of NV Energy's reports are available at http://ndep.nv.gov/baqp/planmodeling/rhaze.html (see Appendix B).

Where facility BART determinations were not accepted, the state made its own determinations using the facility reports as a foundation. NDEP prepared BART determination reviews for each of the NV Energy facilities including an economic analysis summary. The economic analysis summaries are presented in Table 1 in each of NDEP's BART determination review reports.

NDEP established baseline emissions representative of actual emissions using acid rain data for NO_x and, where available, for SO_2. For PM_{10}, annual emissions data reported to NDEP were used to establish a baseline. Nevada used the NDEP baseline data in its cost analyses and NO_x BART control technology determinations. The NDEP baseline data were also used to establish the BART emission limits for PM_{10} at Reid Gardner and NO_x at all three NV Energy facilities. An alternative dataset was used in conjunction with the baseline emissions to establish the BART SO_2 emission limits for Reid Gardner. Finally, the NDEP baseline heat input was used in conjunction with the BART emission limits to calculate the post-BART-control annual emissions for the NV Energy facilities. The following describes how Nevada established baseline emissions for the NV Energy facilities.

For Tracy and Fort Churchill, NDEP established baseline emission scenarios for NO_x and SO_2 using acid rain data reported for calendar years 2002 through 2007. These years were determined to be most representative of operations for these units since they are load-following and not base-load units. For Mohave, a base-load unit, NDEP used acid rain data reported for calendar years 2001 through 2005 for the SO_2 and NO_x baseline. Mohave suspended operation at the end of 2005. Reid Gardner is also a base-load unit; therefore, NDEP used acid rain data

[3] On June 10, 2009, the owners of the Mohave Generating Station, including Southern California Edison (SCE), announced the decision to decommission the station and remove the generating facility from the site. The SCE news release states that in 2010, the plant's generating equipment will be removed and its operating permits terminated (http://www.edison.com/pressroom/pr.asp?bu=sce&year=2009&id=7234).

[4] In response to public comments on the draft RH SIP (contained in Appendix D), Nevada is revising the BART requirements at NV Energy's Reid-Gardner Generating Station. A regulatory amendment lowering the SO_2 emission limits for units 1, 2 and 3 from 0.25 to 0.15 lb/MMBtu, 24-hour average, has been submitted to the State Environmental Commission for presentation at their December 9, 2009 Hearing. See Appendix A.

for NO_x and SO_2 reported for calendar years 2001 through 2007 to calculate baseline emissions. The baseline emissions scenario for PM_{10} was established from the annual emissions data reported to NDEP for the calendar years indicated above for each facility.

Consistent with the calculation of baseline emissions for the Prevention of Significant Deterioration program, the average of the highest two consecutive years of annual emissions, on a pollutant-by-pollutant basis, were used to establish a baseline emission scenario for each pollutant, except Reid Gardner, which was established as follows. The SO_2 acid rain data for Reid Gardner contained periods (Q1, 2003) of invalid data due to O_2 monitor problems identified by NDEP during a compliance investigation, which lead to the joint NDEP/EPA enforcement action and consent agreement described in Chapter Six, section 6.5.2.2. Therefore, NDEP omitted the invalid data from the calculation of baseline SO_2 emissions. The omission of the invalid data effectively lowered the baseline emissions, in lb/MMBtu, by nearly half.

The baseline annual heat input and baseline annual emissions were used to calculate baseline emission rates in lb/MMBtu. The control efficiencies provided by NV Energy were then applied to the baseline NO_x emission rates to calculate the BART emission limits in lb/MMBtu and the post-BART annual emissions, as shown in Table 1 of the NDEP BART reviews.

Nevada initially (for the January 2009 FLM review draft) used the NDEP baseline in its determination of the BART SO_2 emissions limits for the three units at Reid Gardner. The 98^{th} percentile emissions value, after discarding the invalid data, was determined to be the SO_2 BART emission limit for Reid Gardner's units. These BART emission limits allowed for future operation within 98 percent of historical emissions (after discard of the invalid data) and provided some flexibility under a new post-BART operating scenario including operation under a balanced draft versus forced draft scenario due to the installation of fabric filters and a potential change in coal type.

However, in late 2008 and early 2009, fabric filters required by the consent decree described in section 6.5.2.2 of this SIP were installed at Reid Gardner upstream of the existing wet soda ash FGD, resulting in a new dataset to evaluate the proposed SO_2 BART emission limit. NDEP conducted further review of NV Energy's BART analyses and the acid rain dataset. Because the acid rain data is not compliance data, Nevada incorporated the recent 40 CFR Part 60 CEMS emissions compliance data into the evaluation. These data represent actual operations of the fabric filter controls coupled with the existing wet soda ash FGD system and provided the basis of the SO_2 BART emission limit for all three units at Reid Gardner.

A comparison of the post-BART annual emissions from the 2001 through 2003 WRAP baseline and the NDEP baseline are presented for each facility below. The WRAP calculated baseline emissions using the highest 24-hour emissions rate from each unit at each facility for the period 2001 through 2003. The WRAP emissions rates result in an inflated annual baseline emissions scenario because the units did not operate at the highest 24-hour rate consistently for the full year. Nevada deems the NDEP baseline annual emissions as more representative of actual baseline emissions from each unit at each facility on a per pollutant basis than those of the WRAP. The BART control technologies, emissions limit for each unit and the estimated emissions reductions upon implementation of BART are presented for each facility below.

5.5.1 BART at Tracy

For units 1 and 2, BART for NO_x is low NO_x burners (LNB) with flue gas recirculation (FGR) with emission limits of 0.15 lb/MMBtu and 0.12 lb/MMBtu, based on a 12-month rolling average, respectively. For unit 3, BART for NO_x is LNB with selective non-catalytic reduction (SNCR) with an emission limit of 0.19 lb/MMBtu, based on a 12-month rolling average. For all units at Tracy, BART for SO_2 is pipeline natural gas (PNG) and/or No. 2 fuel oil with an emission limit of 0.05 lb/MMBtu, based on a 24-hour averaging period. For PM_{10}, BART is also PNG and/or No. 2 fuel oil, but with an emission limit of 0.03 lb/MMBtu, based on a 3-hour averaging period, for all units.

The emission reductions resulting from the installation of BART control technologies and the associated emission limits are shown below. NDEP used the NDEP baseline heat input and BART emission limits to calculate the post-BART annual emissions for NO_x, SO_2 and PM_{10}. Table 5-4 shows the annual emission reductions from the WRAP baseline, as well as emission reductions from the NDEP baseline.

TABLE 5-4

TRACY: BART EMISSIONS REDUCTIONS IN TONS PER YEAR

	WRAP				**NDEP**		
	Baseline Emissions	**Emissions after BART Controls**	**Emission Reductions**		**Baseline Emissions**	**Emissions after BART Controls**	**Emission Reductions**
Unit 1 - 55 MW							
NO_x	1,361	133	1,228		221	133	88
SO_2	3	44	-41		1	44	-43
PM_{10}	6	27	-21		34	27	7
Unit 2 - 83 MW							
NO_x	1,728	156	1,572		321	156	165
SO_2	2,317	65	2,252		2	65	-63
PM_{10}	836	39	797		70	39	31
Unit 3 - 113 MW							
NO_x	1,587	521	1,066		795	521	274
SO_2	2,720	137	2,583		82	137	-55
PM_{10}	267	82	185		122	82	40
Total NO_x	4,676	810	3,866		1,337	810	527
Total SO_2	5,040	246	4,794		85	246	-161
Total PM_{10}	1,109	148	961		226	148	78

Note: Negative values reflect annual emissions increases.

5.5.2 BART at Fort Churchill

For units 1 and 2 at Ft. Churchill, BART for NO_x is LNB with FGR with emission limits of 0.20 lb/MMBtu and 0.16 lb/MMBtu, based on a 12-month rolling average, respectively. For SO_2, BART is PNG and/or No. 2 fuel oil for all units with an emission limit of 0.05 lb/MMBtu, based on a 24-hour averaging period. For PM_{10}, BART is also PNG and/or No. 2 fuel oil for all units, with an emission limit of 0.03 lb/MMBtu, based on a 3-hour averaging period.

The annual emission reductions resulting from the installation of BART controls and the associated emission limits are shown below. NDEP used the NDEP baseline heat input and BART emission limits to calculate the post-BART annual emissions for NO_x, SO_2 and PM_{10}. Table 5-5 shows the annual emission reductions from the WRAP baseline, as well as emission reductions from the NDEP baseline.

TABLE 5-5

FORT CHURCHILL: BART EMISSIONS REDUCTIONS IN TONS PER YEAR

	WRAP				NDEP		
	Baseline Emissions	**Emissions after BART Controls**	**Emission Reductions**		**Baseline Emissions**	**Emissions after BART Controls**	**Emission Reductions**
Unit 1 - 113 MW							
NO_x	2,509	547	1,962		1,209	547	662
SO_2	3,364	137	3,227		8	137	-129
PM_{10}	110	82	28		166	82	84
Unit 2 - 113 MW							
NO_x	2,405	416	1989		862	416	446
SO_2	3,601	130	3,471		11	130	-119
PM_{10}	231	78	153		160	78	82
Total NO_x	4,914	963	3,951		2,071	963	1,108
Total SO_2	6,965	267	6,698		19	267	-248
Total PM_{10}	341	160	181		326	160	166

Note: Negative values reflect annual emissions increases.

5.5.3 BART at Reid Gardner

For all units at Reid Gardner, BART controls for NO_x are rotating opposed fire air (ROFA) with Rotamix with emission limits of 0.20 lb/MMBtu for units 1 and 2, and 0.28 lb/MMBtu for unit 3, based on a 12-month rolling average. Rotamix is a technology for adding SNCR using ammonia or urea-based reagent. BART controls for SO_2 are wet soda ash flue gas desulfurization on all units with an emission limit of 0.15 lb/MMBtu, based on a 24-hour averaging period. For PM_{10}, BART controls are fabric filter on all units with an emission limit of 0.015 lb/MMBtu, based on a 3-hour averaging period.

The emission reductions resulting from the installation of BART controls and the associated emission limits are shown below. NDEP used the NDEP baseline heat input and BART emission limits to calculate the post-BART annual emissions for NO_x, SO_2 and PM_{10}. Table 5-6 shows the emission reductions from the WRAP baseline, as well as emission reductions from the NDEP baseline.

TABLE 5-6

REID GARDNER: BART EMISSIONS REDUCTIONS IN TONS PER YEAR

	WRAP				NDEP		
	Baseline Emissions	**Emissions after BART Controls**	**Emission Reductions**		**Baseline Emissions**	**Emissions after BART Controls**	**Emission Reductions**
Unit 1 - 100 MW							
NO_x	3,145	982	2,163		2,267	982	1,285
SO_2	1,751	736	1015		621	736	-115
PM_{10}	252	74	178		602	74	528
Unit 2 - 100 MW							
NO_x	3,379	1,050	2,329		2,445	1,050	1,395
SO_2	1,490	788	702		398	788	-390
PM_{10}	234	79	155		653	79	574
Unit 3 - 100 MW							
NO_x	3,207	1,409	1,798		2,268	1,409	859
SO_2	1,734	755	979		422	755	-333
PM_{10}	217	75	142		658	75	583
Total NO_x	9,731	3,441	6,290		6,980	3,441	3,539
Total SO_2	4,975	2279	2,696		1,441	2,279	-838
Total PM_{10}	703	228	475		1,913	228	1,685

Note: Negative values reflect annual emissions increases.

5.5.4 BART at Mohave

Mohave is currently in a temporary period of non-operation and will not operate in the future without first meeting the requirements specified in the Nevada visibility federal implementation plan (FIP) (40 CFR 52.1488). Notably, these requirements are based on the consent decree entered into by SCE and the Grand Canyon Trust, the Sierra Club and the National Parks and Conservation Association on December 15, 1999. The NDEP was not a party to the consent decree. In addition, state regulation requires Mohave to install and operate BART controls prior to the time that each unit resumes operation (Appendix A).

The baseline emissions modeled by the WRAP reflect maximum coal-fired operations at Mohave for 2001 through 2003. SCE has proposed a fuel conversion from coal to natural gas as part of their BART determination. Despite the fuel conversion to natural gas, the Nevada visibility FIP prohibits Mohave from emitting pollutants in amounts greater than that allowed by paragraph (d) of 40 CFR 52.1488. SCE's BART determination proposes that the installation of LNB with OFA will meet or exceed the emission reductions specified in the consent decree and the requirements of the visibility FIP.

For units 1 and 2, BART for NO_x is LNB with OFA and a fuel conversion to PNG with an emission limit of 0.15 lb/MMBtu, on a 12-month rolling average, and a mass emission limit of 788 lb/hr. For SO_2 and PM_{10}, BART is conversion to PNG only with emission limits of 0.0019 lb/MMBtu, on a 30-day rolling average, and 0.0077 lb/MMBtu, on a 3-hour average, respectively.

The emission reductions resulting from the installation of BART controls and the associated emission limits are shown below. NDEP used the NDEP baseline heat input and BART emission limits to calculate the post-BART annual emissions for SO_2 and PM_{10}. The post-control NO_x annual emission rates were calculated using an hourly mass emission rate of 788 lb/hr and applying the annual capacity factor calculated from the acid rain data. Table 5-7 shows the emission reductions from the WRAP baseline, as well as emission reductions from the NDEP baseline.

TABLE 5-7

MOHAVE: BART EMISSIONS REDUCTIONS IN TONS PER YEAR

	WRAP				NDEP		
	Baseline Emissions	**Emissions after BART Controls**	**Emission Reductions**		**Baseline Emissions**	**Emissions after BART Controls**	**Emission Reductions**
Unit 1 - 790 MW							
NO_x	16,342	2,457	13,885		10,761	2,457	8,304
SO_2	27,852	50	27,802		21,507	50	21,457
PM_{10}	1,564	230	1,361		1,317	230	1,114
Unit 2 - 790 MW							
NO_x	15,007	2,423	12,579		10,068	2,423	7,645
SO_2	27,195	49	27,146		21,083	49	21,034
PM_{10}	1,853	200	1,653		1,342	200	1,142
Total NO_x	31,344	4,880	26,464		20,829	4,880	15,949
Total SO_2	55,047	99	54,948		42,590	99	42,491
Total PM_{10}	3,417	403	3,014		2,659	403	2,256

5.5.5 Cumulative Emissions Reductions

Substantial reductions in NO_x, SO_2 and PM_{10} emissions result from the installation of BART controls. Post-BART emissions reductions from the WRAP baseline are calculated to be 40,571 tpy for NO_x, 69,136 tpy for SO_2 and 4,631 tpy for PM_{10}. Comparatively, post-BART emissions reductions from the NDEP baseline, calculated from the reported acid rain data, are 21,123 tpy for NO_x, 41,244 tpy for SO_2 and 4,185 tpy for PM_{10}. Figures 5-2 and 5-3 show cumulative pre-BART and post-BART emissions for NO_x, SO_2 and PM_{10} as calculated from the WRAP and NDEP baselines, respectively.

FIGURE 5-2

CUMULATIVE PRE-BART AND POST-BART EMISSIONS
CALCULATED FROM WRAP BASELINE

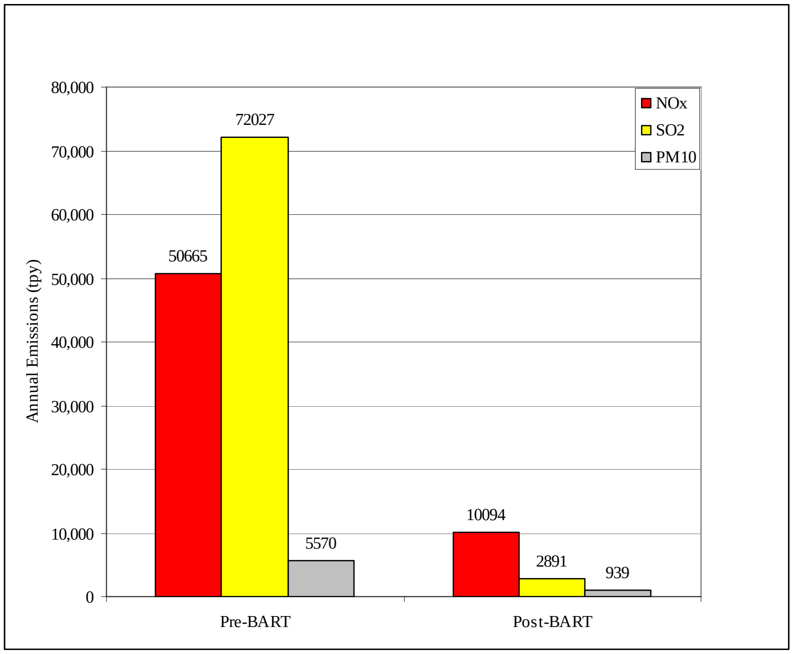


FIGURE 5-3

CUMULATIVE PRE-BART AND POST-BART EMISSIONS
CALCULATED FROM NDEP BASELINE

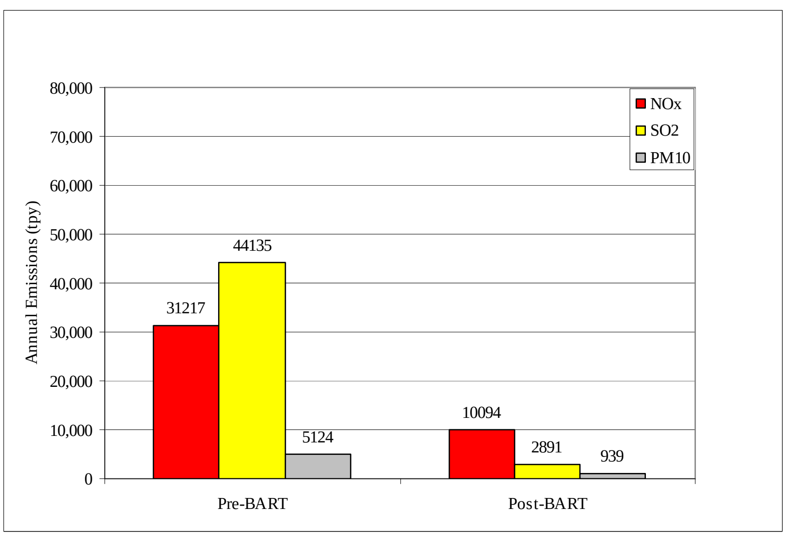


Table 5-8 compares the emission rates in both lb/MMBtu and tons per year for WRAP's BART exemption modeling, NV Energy's modeled rates (discussed in the following section) and the NDEP BART emission limits.

TABLE 5-8

COMPARISON OF EXEMPTION MODELING EMISSION RATES, NVENERGY-MODELED EMISSION RATES AND BART EMISSION LIMITS

Facility and Unit		NO_x (lb/10^6Btu)	SO_2 (lb/10^6Btu)	PM_{10} (lb/10^6Btu)	NO_x (tpy)	SO_2 (tpy)	PM_{10} (tpy)
WRAP Exemption Modeling Rates							
Tracy	Unit 1	0.425	0.001	0.002	1361	3	6
	Unit 2	0.393	0.527	0.019	1728	2317	836
	Unit 3	0.315	0.540	0.053	1587	2720	267
Fort Churchill	Unit 1	0.434	0.582	0.019	2509	3364	110
	Unit 2	0.416	0.623	0.040	2405	3601	231
Reid Gardner	Unit 1	0.591	0.329	0.0474	3,145	1,751	252
	Unit 2	0.635	0.280	0.044	3,379	1,490	234
	Unit 3	0.592	0.320	0.040	3,207	1,734	217
NVEnergy Modeled Rates							
Tracy	Unit 1	0.40	0.05	0.03	269	34	20
	Unit 2	0.40	0.05	0.03	580	73	44
	Unit 3	0.40	0.05	0.03	1,169	146	88
Fort Churchill	Unit 1	0.40	0.05	0.03	1,079	135	81
	Unit 2	0.40	0.05	0.03	1,102	138	81
Reid Gardner	Unit 1	0.46	0.40	0.03	1,962	1,706	128
	Unit 2	0.46	0.40	0.03	2,050	1,783	134
	Unit 3	0.46	0.40	0.03	2,081	1,810	136
NDEP BART Emission Limits							
Tracy	Unit 1	0.15	0.05	0.03	133	44	27
	Unit 2	0.12	0.05	0.03	156	65	39
	Unit 3	0.19	0.05	0.03	521	137	82
Fort Churchill	Unit 1	0.20	0.05	0.03	547	137	82
	Unit 2	0.16	0.05	0.03	416	130	78
Reid Gardner	Unit 1	0.20	0.15	0.015	982	736	74
	Unit 2	0.20	0.15	0.015	1,050	788	79
	Unit 3	0.28	0.15	0.015	1,409	755	75

5.6 VISIBILITY IMPROVEMENT DUE TO BART IMPLEMENTATION

A comparison of the visibility improvement between pre-BART and post-BART controls at the Tracy, Fort Churchill, Reid Gardner and Mohave facilities is presented in Tables 5-9 through 5-12. These comparisons summarize visibility impacts presented in each facility's BART determination report and indicate future visibility improvement based upon installation of BART controls. Nevada anticipates even greater visibility improvement at each Class I area because more stringent final emission limits than those proposed and modeled by NV Energy will be implemented at Tracy and Fort Churchill for NO_x. Likewise, more stringent emission limits for NO_x, SO_2 and PM_{10} will be implemented at Reid Gardner. In general, there is a linear relationship in CALPUFF modeled visibility and emission rates. The emissions data are presented in Table 5-8 above, to provide comparison of the modeled emission rates and BART emission limits. The visibility improvement resulting from BART installation is expected to be proportional to the difference in modeled annual emissions and the annual NDEP BART emissions.

5.6.1 Tracy

Emission reductions due to the installation of BART controls at Tracy result in 82 less days with visibility impacts greater than 0.5 dv at Class I areas with 300 km of the facility, as shown in Table 5-9. In addition, most Class I areas show a decrease in the 98th percentile dv impact, although for some Class I areas the visibility impact remains the same or slightly increases. The improvement in visibility impairment resulting from BART controls is significant. However, Nevada anticipates even greater visibility improvement than that shown in Table 5-9, as the total annual post-control emissions are 50 percent of the modeled emissions.

TABLE 5-9

TRACY
PRE-BART AND POST-BART CONTROL MODELED VISIBILITY RESULTS

Class I Area	Distance (km)	Unit	98th Percentile			
			NV Energy Baseline		NV Energy Modeled Rate	
			dv	days >0.5 dv	dv	days >0.5 dv
Desolation	81	1	0.22	1	0.26	1
		2	0.52	11	0.30	2
		3	0.57	13	0.33	5
Mokelumne	101	1	0.17	1	0.19	1
		2	0.42	5	0.25	1
		3	0.44	6	0.28	1
Emigrant	139	1	0.09	0	0.09	0
		2	0.23	2	0.13	0
		3	0.27	2	0.16	1
Hoover	143	1	0.10	0	0.11	0
		2	0.23	1	0.15	0
		3	0.25	2	0.18	1
Yosemite	153	1	0.10	0	0.10	0
		2	0.23	2	0.14	0
		3	0.26	2	0.17	0
Caribou	171	1	0.24	1	0.26	1
		2	0.53	9	0.34	3

Class I Area	Distance (km)	Unit	98th Percentile			
			NV Energy Baseline		NV Energy Modeled Rate	
			dv	days >0.5 dv	dv	days >0.5 dv
		3	0.51	9	0.36	5
Lassen Volcanic	176	1	0.22	1	0.25	1
		2	0.54	8	0.32	2
		3	0.45	6	0.28	1
Ansel Adams	182	1	0.06	0	0.06	0
		2	0.17	1	0.08	0
		3	0.19	1	0.095	0
South Warner	190	1	0.18	1	0.19	1
		2	0.44	7	0.25	2
		3	0.46	8	0.30	3
Thousand Lakes	210	1	0.11	0	0.12	0
		2	0.31	5	0.17	0
		3	0.33	6	0.21	1
John Muir	221	1	0.07	0	0.07	0
		2	0.19	0	0.09	0
		3	0.21	0	0.11	0
Kaiser	249	1	0.04	0	0.04	0
		2	0.14	0	0.06	0
		3	0.15	0	0.07	0
Kings Canyon	265	1	0.06	0	0.06	0
		2	0.18	0	0.09	0
		3	0.20	0	0.10	0
Lava Beds	286	1	0.09	0	0.09	0
		2	0.22	1	0.12	0
		3	0.24	1	0.14	0
Yolla Bolly	287	1	0.04	0	0.04	0
		2	0.16	2	0.06	0
		3	0.20	2	0.07	0

5.6.2 Fort Churchill

Emission reductions due to the installation of BART controls at Fort Churchill result in 227 less days with visibility impacts greater than 0.5 dv at Class I areas with 300 km of the facility, as shown in Table 5-10. In addition, all Class I areas show significant decreases in the 98th percentile dv impact (e.g., approximately half of the pre-BART value). The improvement in visibility impairment resulting from BART controls is significant. However, NDEP anticipates substantially greater visibility improvement than that shown in Table 5-10, as the total annual post-control emissions are 53 percent of those modeled.

TABLE 5-10

FORT CHURCHILL
PRE-BART AND POST-BART CONTROL MODELED VISIBILITY RESULTS

Class I Area	Distance (km)	Unit	98th Percentile NV Energy Baseline dv	NV Energy Baseline days >0.5 dv	NV Energy Modeled Rate dv	NV Energy Modeled Rate days >0.5 dv
Mokelumne	79	1	1.07	41	0.58	14
		2	1.08	41	0.58	14
Desolation	86	1	1.02	29	0.54	15
		2	1.02	29	0.53	14
Hoover	99	1	0.55	13	0.27	1
		2	0.56	13	0.27	1
Emigrant	101	1	0.57	14	0.27	3
		2	0.58	15	0.27	3
Yosemite	112	1	0.48	11	0.24	2
		2	0.49	11	0.24	2
Ansel Adams	133	1	0.32	4	0.14	1
		2	0.33	4	0.14	1
John Muir	170	1	0.36	4	0.18	0
		2	0.37	5	0.18	0
Kaiser	200	1	0.22	1	0.09	0
		2	0.24	1	0.09	0
Kings Canyon	212	1	0.36	5	0.17	0
		2	0.37	5	0.17	0
Caribou	227	1	0.48	9	0.25	3
		2	0.50	9	0.26	3
Lassen Volcanic	231	1	0.48	9	0.25	3
		2	0.49	9	0.24	3
South Warner	246	1	0.62	15	0.35	5
		2	0.62	15	0.35	5
Thousand Lakes	266	1	0.36	5	0.17	1
		2	0.37	5	0.17	1
Sequoia	274	1	0.38	4	0.18	1
		2	0.39	4	0.18	1

5.6.3 Reid Gardner

Emission reductions due to the installation of BART controls at Reid Gardner result in only 5 less days with visibility impacts greater than 0.5 dv at Class I areas with 300 km of the facility, as shown in Table 5-11. In addition, most Class I areas show a decrease in the 98th percentile dv impact, although for some Class I areas the visibility impact remains the same or slightly increases. However, NDEP anticipates significantly greater visibility improvement than shown in Table 5-11, as the total annual post-BART control emissions are 50 percent of those modeled. Specifically, the total annual post-BART control NO_x emissions are 57 percent of those modeled, SO_2 is 43 percent and PM_{10} is 57 percent.

TABLE 5-11

REID GARDNER
PRE-BART AND POST-BART CONTROL MODELED VISIBILITY RESULTS

Class I Area	Distance (km)	Unit	98th Percentile			
			NV Energy Baseline		NV Energy Modeled Rate	
			dv	days >0.5 dv	dv	days >0.5 dv
Grand Canyon	86	1	0.85	19	0.83	19
		2	0.86	21	0.73	15
		3	0.79	17	0.73	18
Zion	148	1	0.22	3	0.22	2
		2	0.22	3	0.19	2
		3	0.22	3	0.20	2
Bryce Canyon	227	1	0.13	0	0.12	0
		2	0.13	0	0.12	0
		3	0.13	0	0.13	0
Sycamore Canyon	289	1	0.06	0	0.06	0
		2	0.06	0	0.06	0
		3	0.07	0	0.07	0
Joshua Tree	292	1	0.32	3	0.33	4
		2	0.32	3	0.32	3
		3	0.33	3	0.34	4

5.6.4 Mohave

Emission reductions due to the installation of BART controls at Mohave result in 538 less days with visibility impacts greater than 0.5 dv at Class I areas with 300 km of the facility, as shown in Table 5-12. For many of the Class I areas within 300 km of Mohave the number of days with visibility impact greater than 0.5 dv has been reduced to zero. In addition, the 98th percentile dv impacts are approximately 5 to 15 percent of the pre-BART impacts. The improvement in visibility impairment resulting from BART controls is significant.

TABLE 5-12

MOHAVE
PRE-BART AND POST-BART CONTROL MODELED VISIBILITY RESULTS

Class I Area	Distance (km)	Unit	98th Percentile			
			SCE Baseline		SCE BART Limit	
			dv	days >0.5 dv	dv	days >0.5 dv
Grand Canyon	110	1 2	2.91	194	0.53	8
Joshua Tree	137	1 2	3.96	90	0.76	14
Zion	262	1 2	1.45	80	0.20	0
Sycamore Canyon	223	1 2	1.38	29	0.12	0
Agua Tibia	286	1 2	1.11	19	0.10	0
Cucamonga	287	1 2	1.05	20	0.11	0
San Gorgonio	225	1 2	1.50	27	0.14	1
San Jacinto	234	1 2	1.46	29	0.15	1
Mazatal	279	1 2	0.98	25	0.04	0
Pine Mountain	265	1 2	0.98	23	0.04	0
Dome Land	268	1 2	1.34	26	0.10	0

Significant visibility improvement will be realized in Class I areas within 300 km of Nevada's subject-to-BART sources. Installation of BART controls at Mohave and Reid Gardner result in more than 500 fewer days with visibility impact of greater than 0.5 dv to Class I areas in southern California, Arizona and Utah. Installation of BART controls at Tracy and Fort Churchill result in more than 300 fewer days with visibility impact of greater than 0.5 dv to Class I areas in central and northern California. In addition, because NV Energy sources were modeled at emission rates greater than those identified as BART by Nevada, greater improvement in visibility will be realized than that presented here.

Chapter Six – Reasonable Progress for the Jarbidge Wilderness Area

6.1 INTRODUCTION

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6.3 ESTABLISHING BASELINE AND NATURAL VISIBILITY CONDITIONS

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6.6 ESTABLISHING REASONABLE PROGRESS FOR NEVADA

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6.1 INTRODUCTION

The Regional Haze Rule (RHR) requires states to establish reasonable progress goals for each Class I area within the state (expressed in deciviews) that provide for reasonable progress towards achieving natural visibility conditions by 2064. 40 CFR 51.308(d)(1) USEPA also released guidance, *Guidance for Setting Reasonable Progress Goals Under the Regional Haze Program*, on June 7, 2007 for setting reasonable progress goals. The reasonable progress goals must provide for improvement in visibility for the most-impaired (20 percent worst) days over the period of the SIP and ensure no degradation in visibility for the least-impaired (20 percent best) days over the same time. The planning period for the initial regional haze SIP is 2004 through 2018, with an interim review due five years after submittal of the initial implementation plan.

Chapter Two identifies the uniform rate of progress (URP) for Nevada's only Class I area, the Jarbidge Wilderness Area (Jarbidge WA). Nevada compared baseline visibility conditions to natural visibility conditions to determine the uniform rate of visibility improvement (in deciviews) that would need to be maintained during each implementation period in order to attain natural visibility conditions by 2064, as shown on Table 2-1 and Figure 2-5.

Visibility modeling was used to determine the expected 2018 visibility improvements for the Jarbidge WA resulting from existing federal and state regulations, including presumptive sulfur dioxide (SO_2) Best Available Retrofit Technology (BART) limits for coal-fired electric generating units (EGU) with capacity greater than 750 MW. Visibility modeling indicates that implementation of existing rules coupled with installation of BART controls, as captured by the projected PRP18a emissions inventory, provides for an improvement in visibility better than the URP for the Jarbidge WA on the most-impaired days over the period of the SIP and identifies no degradation in visibility for the least-impaired days over the same period.

The modeled 2018 extinction of 11.05 dv represents Nevada's reasonable progress goal (RPG). Nevada's long-term strategy to achieve this RPG is detailed in Chapter Seven. Given the significant emissions reductions anticipated from Nevada's BART requirements and the implementation of other Clean Air Act (CAA) programs during this planning period, implementation of these programs represents reasonable progress in Nevada for the initial regional haze planning period. The resulting modeled visibility improvement is identified as Nevada's 2018 RPG.

The BART analyses conducted by Nevada were based, in part, on an assessment of many of the same factors addressed in establishing the RPG. The control requirements imposed by Nevada's BART determinations also satisfy the RPG-related requirements for source review in the first planning period. Therefore, Nevada will not require additional emissions controls beyond BART for these sources during the first planning period.

Nevada concludes, based on its assessment of the state's significant emissions reductions in this first planning period, that it achieves reasonable progress toward the national visibility goal for this planning period. Furthermore, Nevada deems it is unreasonable at this time to request additional emission controls on Nevada sources beyond those discussed below due to the negative "…implication of compliance costs to the health and vitality of industries within …" Nevada (USEPA June 2007, p.5-1). It is reasonable for Nevada to defer additional reductions to later planning periods in order to maintain a consistent glidepath toward the long-term goal. Our assessment is consistent with guidance provided in sections 1.2, 4.1, and 5.0 of USEPA's *Guidance for Setting Reasonable Progress Goals under the Regional Haze Program.*

6.2 STEPS FOR DEVELOPING REASONABLE PROGRESS GOALS

The steps in USEPA's guidance for developing a RPG are listed below.

1. Establish Baseline and Natural Visibility Conditions.
2. Determine the Glidepath (or Uniform Rate of Progress).
3. Identify and Analyze the Measures Aimed at Achieving the Uniform Rate of Progress:
   a. Identify the key pollutants and sources and/or source categories that are contributing to visibility impairment at each Class I area.
   b. Identify the control measures and associated emission reductions that are expected to result from compliance with existing rules and other available measures for the sources and source categories that contribute significantly to visibility impairment.
   c. Determine what additional control measures would be reasonable based on the statutory factors and other relevant factors for sources and/or source categories you have identified.
   d. Estimate the improvement in visibility that would result from implementation of the control measures you have found to be reasonable and compare this to the uniform rate of progress.
4. Establish a RPG.

The following sections describe how Nevada's regional haze SIP addresses each of the steps listed above and documents the technical basis of each component of the RPG. The discussion of Step3c, listed above, is deferred to Chapter Seven, which details Nevada's long-term strategy.

6.3 ESTABLISHING BASELINE AND NATURAL VISIBILITY CONDITIONS

Chapter Two, sections 2.2 and 2.3, of this SIP discusses the methodologies employed to identify the baseline and natural visibility conditions for the Jarbidge WA. These data were used to determine the rate of progress needed to attain natural visibility conditions by the year 2064.

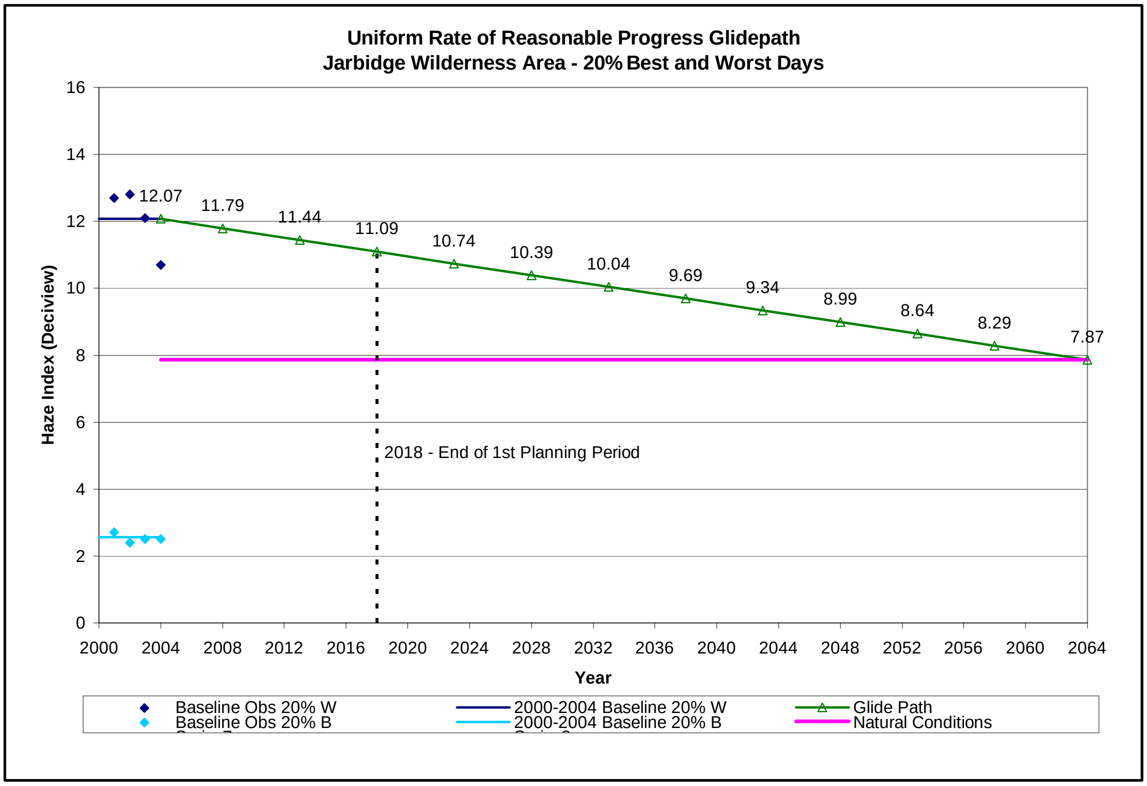
6.4 DETERMINING THE UNIFORM RATE OF PROGRESS

Chapter Two, section 2.4, of this SIP identifies the URP needed to attain natural visibility conditions for the Jarbidge WA. Nevada compared the baseline visibility conditions to natural visibility conditions to identify the uniform rate of visibility improvement that would need to be maintained during each implementation period in order to attain natural visibility conditions by 2064.

The URP or glidepath is shown on Figure 6-1, reproduced from Chapter Two. The baseline conditions for the 20 percent worst days are shown by the upper short line on Figure 6-1, while natural visibility conditions for the worst days are shown by the long horizontal line. The baseline visibility conditions for the 20 percent best days are shown by the short lower line. The diamonds represent the annual average visibility conditions for each of the baseline years for the worst and best days. The URP or glidepath is shown by the sloping line interrupted by open triangles identifying the URP in five-year increments. The 2018 URP for the Jarbidge WA is 11.09 deciviews.

FIGURE 6-1

UNIFORM RATE OF PROGRESS GLIDEPATH



6.5 IDENTIFYING THE MEASURES TO ACHIEVE THE UNIFORM RATE OF PROGRESS

40 CFR 51.308(d)(1)(i)(B) requires states to consider the uniform rate of progress and the emission reductions needed to achieve it for the period covered by the plan. The next step in setting the RPG is identifying and analyzing the measures aimed at achieving the URP, including: identifying the key visibility-impairing pollutants and their sources; identifying the existing control measures and the associated reductions; identifying reasonable additional control measures; and estimating the resulting visibility improvement, as discussed in the following sections.

6.5.1 Key Pollutants and Sources of Impairment

The analyses of the Interagency Monitoring of Protected Visual Environments (IMPROVE) monitor data, as presented in Chapter Two, section 2.5, identify organic matter carbon (OMC) and coarse matter (CM) as the two most significant components of annual average visibility impairment at the Jarbidge Wilderness Area for the worst days of the baseline period. *For the worst days, OMC and CM account for more than sixty percent of the average annual reconstructed extinction at JARB1.* For these days, SO_4 and NO_3 account for less than a quarter of the extinction, as shown on Table 6-1, modified from Table 2-2.

TABLE 6-1

MONITORED CONTRIBUTIONS TO AVERAGE ANNUAL
RECONSTRUCTED EXTINCTION FOR BASELINE PERIOD

	OMC Extinction	CM Extinction	SO_4 Extinction	Soil Extinction	EC Extinction	NO_3 Extinction	Sea Salt Extinction
20% Worst Days							
Average	**40.0%**	**22.3%**	**16.7%**	**9.7%**	**6.5%**	**4.5%**	**0.3%**
20% Best Days							
Average	**26.3%**	**9.2%**	**40.9%**	**2.8%**	**9.4%**	**9.8%**	**1.6%**

Compilation and analyses of baseline (2002) and 2018 emissions inventories, presented in Chapter Three, demonstrate that nearly three quarters of Nevada's total emissions originate from natural (i.e., non-anthropogenic) sources, see Table 3-2. Sulfur oxides (SO_x), nitrogen oxides (NO_x), and ammonia (NH_3) are the only pollutants whose 2018 emissions are dominated by anthropogenic sources, although both particulate matter fine (PMF) and particulate matter coarse (PMC) 2018 emissions are sub-equally divided between natural and anthropogenic sources. Note that the existing 2018 emission inventories do not include reductions resulting from the installation of BART, except for SO_x presumptive limits for subject-to-BART EGU's with capacity greater than 750 MW.

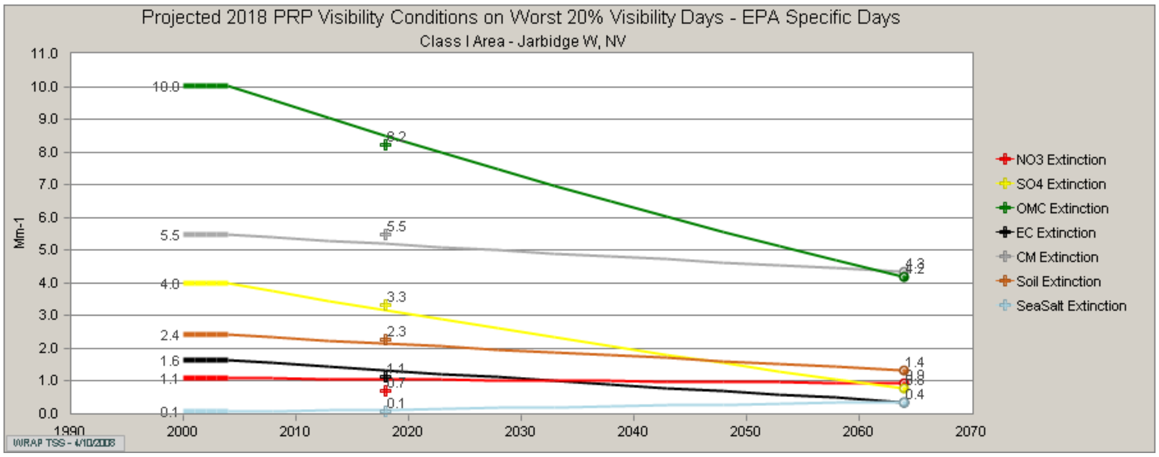
Analyses of the *projected 2018* emissions data have led to the following conclusions.

- The majority of the emissions that form the monitored species OMC, volatile organic compounds (VOC) and primary organic aerosol (POA) emissions, are from biogenic (88 percent) and natural fire (91 percent) sources, respectively.
- Emissions of PMC are predominantly from windblown dust (50 percent) and fugitive dust (36 percent) sources.
- Point sources account for the majority (61 percent) of emissions of SO_x, a component of monitored species SO_4.
- Emissions of PMF are predominantly windblown dust (43 percent) and fugitive dust (30 percent) sources.
- Emissions of elemental carbon (EC) are dominated by natural fire (83 percent).
- Point sources account for the majority (50 percent) of NO_x emissions, a component of monitored species NO_3; although mobile sources are also a significant (27 percent) contributor.

Visibility modeling projections, shown in Figure 6-2, indicate the relative contribution to 2018 visibility impairment at the Jarbidge WA for each visibility impairing species in units of inverse megameters (Mm^{-1}). This graph shows an extinction reduction for each species by the end of the first planning period, except Sea Salt and CM. CM emissions were held constant from the baseline to 2018 and Sea Salt is not an importance component of extinction at JARB1. As noted above, VOC and POA, and CM emissions leading to OMC (shown by the green line on Figure 6-2) and CM (shown by gray line) extinction respectively, are dominated by natural sources.

FIGURE 6-2

CMAQ MODEL PROJECTED EXTINCTION
BY SPECIES FOR JARB1 2018 WORST DAYS



The SO_4 and NO_3 source apportionment modeling identifies the relative concentration due to SO_x and NO_x emissions by source area and source category, as shown in Figures 6-3 and 6-4, respectively. Figure 6-3 shows the dominating effect of uncontrollable emissions from outside the modeling domain (right side of the x axis) on SO_4 concentrations at the Jarbidge WA. Outside Domain contributions are four times greater than any other source category. SO_x emissions from the Pacific Offshore source category (PO on x axis of graph) are also a significant contributor to SO_4 concentrations at JARB1. Emissions from three other states, Idaho, Oregon, and Washington, have larger contributions to the SO_4 concentration than does Nevada for both 2002 and 2018.

Figure 6-4 shows the largest contributor to NO_3 concentrations at the Jarbidge WA is NO_x emissions from Idaho, closely followed by the uncontrollable emissions from outside the modeling domain. Idaho's NO_x contribution to baseline NO_3 formation is largely due to mobile and area sources, with a large increase in the importance of area source emissions for 2018. Emissions from Utah have a larger contribution to NO_3 concentration than does Nevada for 2002, but slightly less than Nevada for 2018 due to mobile source emissions reductions. Note the significant reduction in 2018 concentrations due to reductions in mobile source emissions from all states.

FIGURE 6-3

SULFATE PSAT SOURCE REGION BAR
CHART FOR WORST DAYS 2002 AND 2018

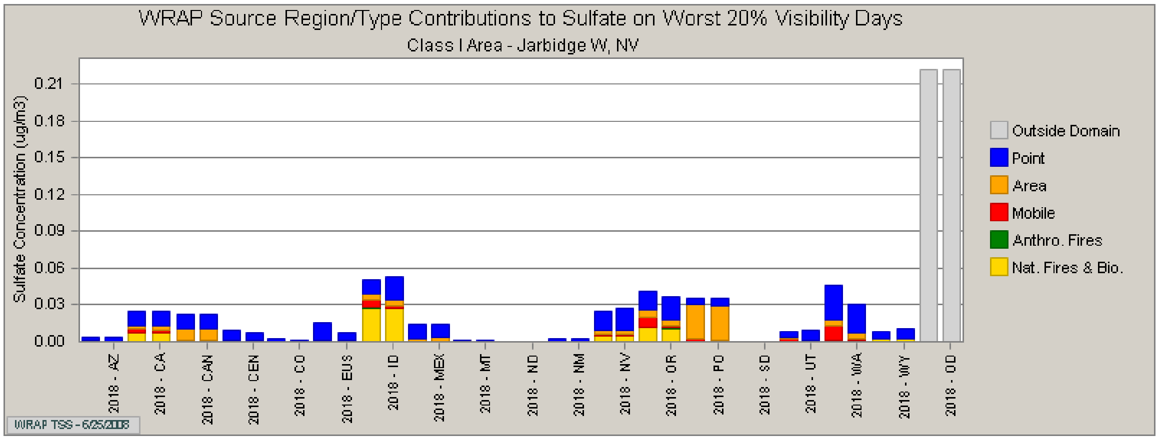
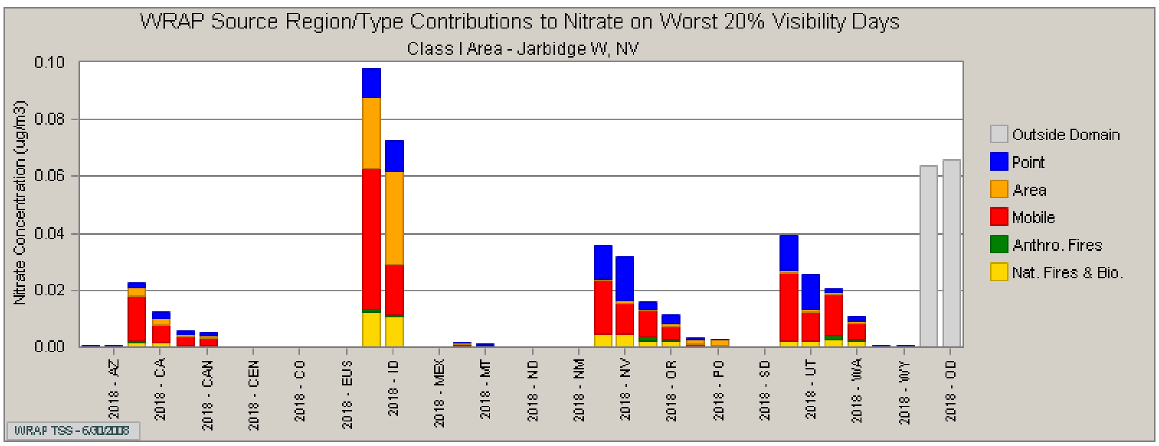


FIGURE 6-4

NITRATE PSAT SOURCE REGION BAR
CHART FOR WORST DAYS 2002 AND 2018



6.5.2 Emissions Reductions due to Existing Air Pollution Control Measures

The RHR requires states to submit a long-term strategy that includes such measures as are necessary to achieve the RPG for each Class I area. RPGs are interim goals that represent incremental improvement over time toward the goal of natural background conditions. Prior to developing a long-term strategy, existing control measures must be assessed. As stated in USEPA guidance (June 2007):

> "One important factor to keep in mind when establishing a RPG is that you cannot adopt a RPG that represents less visibility improvement than is expected to result from the implementation of other CAA requirements. You must therefore determine the amount of emissions reductions that can be expected from identified sources or

> source categories as a result of requirements at the local, State, and federal levels during the planning period of the SIP and the resulting improvements in visibility at Class I areas. Given the significant emissions reductions that we anticipate to result from BART, the CAIR, and the implementation of other CAA programs, including ozone and $PM_{2.5}$ NAAQS, for many States this will be an important first step in determining your RPG, and *it may be all that is necessary to achieve reasonable progress in the first planning period for some States.*" (p. 4-1) *emphasis added*

There are significant control programs being implemented between the baseline period and 2018, on the federal, state and local levels. Emissions reductions from "on-the-way" and "on-the-books" control programs and the implementation of BART, as captured in the PRP18a emission inventory, are projected to achieve substantial visibility improvement by 2018 at the Jarbidge WA and other Class I areas in the west. In fact, the Jarbidge WA represents the only western Class I area where the RPG meets or exceeds the URP for 2018. In general, these programs consist of regulations affecting mobile source emissions and, to a lesser degree, stationary sources. The following sections describe emissions control programs considered in developing the 2018 emissions inventory PRP18a based on control measures that are expected to result from compliance with existing rules and other available measures.

6.5.2.1 Federal Rules

Emissions reductions due to the following federal pollution control programs were incorporated into the PRP18a emissions inventory. These programs affect mobile, point and area source emissions.

Heavy Duty Diesel (2007) Engine Standard (On-road trucks and buses)
The USEPA set a PM emissions standard for new heavy-duty engines of 0.01 grams per brake-horsepower-hour (g/bhp-hr), to take full effect for diesel engines in the 2007 model year. This rule also included standards for NO_x and non-methane hydrocarbons (NMHC) of 0.20 g/bhp-hr and 0.14 g/bhp-hr, respectively. These NO_x and NMHC standards will be phased in together between 2007 and 2010 for diesel engines. Sulfur in diesel fuel must be lowered to enable modern pollution control technology to be effective on these trucks and buses. Pursuant to USEPA rule, a 97 percent reduction in the sulfur content of highway diesel fuel from 500 ppm (low sulfur diesel) to 15 ppm (ultra-low sulfur diesel) became effective in Nevada in October 2006.

Tier 2 Tailpipe (On-road vehicles)
The USEPA mobile source rules include the Tier 2 fleet averaging program, modeled after the California Low Emission Vehicle II standards. Manufacturers can produce vehicles with emissions ranging from relatively dirty to zero emissions, but the mix of vehicles a manufacturer sells each year must have average NO_x emissions below a specified value. Tier 2 standards became effective in the 2005 model year.

Large Spark Ignition and Recreational Vehicle Rule
The USEPA has adopted new standards for emissions of NO_x, hydrocarbons and carbon monoxide from several groups of previously unregulated non-road engines. Included in these are

large industrial spark-ignition engines and recreational vehicles. Non-road spark-ignition engines are those powered by gasoline, liquid propane gas or compressed natural gas rated over 19 kilowatts (25 horsepower). These engines are used in commercial and industrial applications, included 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 will be fully phased in by 2012.

Non-road Diesel Rule
This rule sets standards that will reduce emissions by more than 90 percent from non-road diesel equipment and reduce sulfur levels by 99 percent from current levels in non-road diesel fuel starting in 2007. This step will apply to most non-road diesel fuel in 2010 and to fuel used in locomotives and marine vessels in 2012.

Industrial Boiler/Process Heater MACTs
The USEPA issued final rules to substantially reduce emissions of toxic air pollutants from industrial, commercial, and institutional boilers and process heaters. These rules reduce emissions of a number of toxic air pollutants, including hydrogen chloride, manganese, lead, arsenic and mercury by 2009. This rule also reduces emissions of SO_2 and PM in conjunction with the toxic air pollutant reductions. The applied Maximum Achievable Control Technology (MACT) control efficiencies were 4 percent for SO_2 and 40 percent for PM_{10} and $PM_{2.5}$. The USEPA's industrial boiler MACT rules were vacated on June 8, 2007. WRAP states decided to leave these controls in the modeling since it is believed that by 2018 the USEPA will have re-promulgated a boiler MACT rule or states will have addressed the issue through rulemaking.

Combustion Turbine and Reciprocating Internal Combustion Engines MACT
The projection inventories do not include the NO_x co-benefit of the MACT regulations for Gas Turbines or Stationary Reciprocating Internal Combustion Engines, which the USEPA estimates to be small compared to the overall inventory.

VOC 2-, 4-, 7- and 10-year MACT Standards
Various point source MACTs and associated emission reductions were implemented. Reductions occurring before 2002 were assumed to be accounted for in the 2002 base year inventory.

6.5.2.2 Consent Agreements

The following section describes consent agreements for the Mohave Generating Station (Mohave) and Reid Gardner Generating Station (Reid Gardner). Mohave is owned by Southern California Edison (SCE) and is located in Laughlin, Nevada. Reid Gardner is owned by NV Energy (formerly Nevada Power Company) and is located near Moapa, Nevada. Both facilities are located in Clark Country and permitted through NDEP.

Mohave Generating Station[1]

On February 8, 2002, USEPA promulgated a final rule revising Nevada's federal implementation plan for protection of visibility in Class I areas (visibility FIP; 40 CFR 52.1488). That revision concerned emissions reduction requirements for Mohave. The requirements were based on a consent decree between the owners of Mohave and the Grand Canyon Trust, the Sierra Club and the National Parks and Conservation Association, addressing issues raised by the U.S. Department of the Interior (DOI) regarding Mohave's contribution to visibility impairment at the Grand Canyon National Park (GCNP) from SO_2 emissions. In addition, by incorporating the requirements of the consent decree into the long-term strategy of the Nevada visibility FIP, USEPA argued that there would be allowance for reasonable progress toward the national visibility goal with respect to Mohave's contribution to visibility impairment at GCNP from SO_2 emissions according to the criteria set forth in Section 169A(g)(1) of the CAA.

This rule was USEPA's first report assessing the long-term visibility strategy for Nevada since promulgating the Nevada visibility FIP. USEPA reviewed the long-term strategy only for the purpose of addressing DOI's certification of existing visibility impairment at GCNP and Mohave's contribution to that impairment, and evaluating whether the terms of the Mohave consent decree would make reasonable progress toward the national visibility goal. The revision of the long term strategy of the Nevada visibility FIP was to allow for reasonable progress toward the CAA national visibility goal with respect to Mohave's contribution to visibility impairment at GCNP due to SO_2 emissions. USEPA did not conduct a comprehensive review of the long-term strategy of the Nevada visibility FIP at that time. According to the Federal Register notice (67 FR 6130), federal land managers did not provide any information for such a review and USEPA did not have any evidence that visibility impairment at any other Class I area could be attributed to a specific source or group of sources located in Nevada. USEPA reasoned that the regional haze rule would result in a regional strategy for western states and would provide for additional progress toward the national visibility goal. The National Park Service did review the consent decree and believed that a USEPA rulemaking which adopts the emission limits and other requirements from the decree was an appropriate means of addressing its concerns regarding the impact of SO_2 emissions from Mohave on visibility impairment at GCNP.

The requirements of the visibility FIP were included as an applicable requirement in the schedule of compliance section of Mohave's Title V operating permit:

> Interim Emission Limits - For the period of time between the entry of the decree (December 15, 1999) and the date on which each unit must commence compliance with the final emission limitations set forth in Section VI.A.2.b of the Operating Permit, the following SO_2 and opacity emission limits shall apply:
>
> a. SO_2 emissions shall not exceed 1.0 lb/MMBtu of heat input calculated on a 90 boiler operating day rolling average basis for each unit.

[1] On June 10, 2009, the owners of the Mohave Generating Station, including Southern California Edison (SCE), announced the decision to decommission the station and remove the generating facility from the site. The SCE news release states that in 2010, the plant's generating equipment will be removed and its operating permits terminated (http://www.edison.com/pressroom/pr.asp?bu=sce&year=2009&id=7234).

b. The opacity of emissions shall be no more than 30 percent, as averaged over each separate 6-minute period within an hour, beginning each hour on the hour, measured at the stack, with no more than 375 exceedances of 30 percent allowed per calendar quarter (including any pro rated portion thereof), regardless of reason.

The consent decree required installation of low NO_x burners with over-fire air and fabric filter dust collection devices, but no associated emission limitations for either NO_x or PM/PM_{10}; however, opacity was limited to 20 percent. The consent decree required the controls to be installed and operational by January 1, 2006 or the plant would need to cease operations. The plant has been in a period of temporary shutdown since January 1, 2006.

However, Mohave has maintained their operating permit during this period in anticipation of restarting or selling the facility, and SCE has submitted a BART analysis, discussed in Chapter Five, as Mohave is subject to BART under the RHR as an EGU with capacity greater than 750 MW. As such, the PRP18a emission inventory incorporated the presumptive BART SO_2 limit. The PRP18a inventory has projected SO_2 and NO_x emissions from Mohave of 8,701 tpy and 19,595 tpy, respectively. Mohave emissions represent 19 percent of projected 2018 (18PRPa) statewide SO_2 emissions and 14 percent of projected statewide NO_x emissions.

However, SCE's BART analysis proposes fuel switching from coal to natural gas. Fuel switching will result in significant emissions reductions of SO_2 and NO_x with a greater than 95 percent reduction in SO_2 emissions from the PRP18a projections and a 75 percent reduction in NO_x emissions from the PRP18a projections. The BART emissions limits required by this SIP will be incorporated in future Western Regional Air Partnership (WRAP) visibility modeling and are anticipated to reduce visibility impairment at Class I areas. SCE's BART analysis is discussed in Chapter Five, where a link is provided to the complete analysis.

Reid Gardner Generating Station

The recent action at Reid Gardner was not related to any visibility impairment certification. Rather, the order issued by NDEP and the consent decree issued by USEPA in cooperation with NDEP and Reid Gardner were related to compliance issues at the station, specifically, record keeping and opacity exceedances. Nevertheless, some of the reductions ordered at Reid Gardner may result in visibility improvements.

In a letter and order, dated April 3, 2007, NDEP required Nevada Power Company (now NV Energy) to install natural gas igniters on units 1 through 4 at Reid Gardner no later than July 1, 2009, and install baghouses on units 1 through 3 Reid Gardner no later than July 1, 2010. These requirements were also found in the Reid Gardner consent decree entered into by Nevada Power Company, NDEP and the USEPA on April 3, 2007 and approved by the United States District Court on June 14, 2007. The consent decree further imposed SO_2 limitations beginning on the effective date of the decree: Measured separately, units 1, 2 and 3 shall not have SO_2 emissions in excess of 0.40 lb/MMBtu, based on a 10-day rolling average period.

Installation of the mandated emissions controls will have the effect of reducing projected 2018 (18PRPa) SO_2 emissions by 11 percent or 219 tpy and NO_x emissions by 17 percent or 1822 tpy from the Plan02d inventory. Reid Gardner is also subject to BART under the RHR. Proposed

BART controls for Reid Gardner will result in a 60 percent reduction in NO_x emissions from those projected in the PRP18a emissions inventory but a 30 percent increase in SO_2 emissions from the PRP18a inventory, resulting in an overall reduction of nearly 5,000 tpy of NO_x/SO_x combined. The BART analysis is discussed in Chapter Five where a link is provided to NV Energy's BART report. The BART emissions limits required by this SIP will be incorporated in future WRAP visibility modeling and are anticipated to reduce visibility impairment at Class I areas.

6.5.2.3 Other Air Pollution Control Measures

Additional air pollution control measures were incorporated in the PRP18a emissions inventory to account for emissions reductions due to all on-the-way or on-the-books control programs. Some of these programs are specific to Nevada, while others have broader application in the WRAP states. These programs are identified below:

- Emissions reductions resulting from smoke management programs were accounted for by applying emissions reduction techniques to the 2000 to 2004 average fire emissions.
- Emissions reductions resulting from state oil and gas emissions control programs for Rocky Mountain States.
- Emissions reductions resulting from the installation of known BART for facilities in Colorado, Utah, North Dakota and one facility in Oregon.
- Application of presumptive SO_2 BART limits for EGU's with capacity greater than 750 MW across the WRAP region.
- Emissions reductions resulting from ozone and PM_{10} SIPs in place across the WRAP region. Nevada's ozone and PM_{10} SIPs are discussed below.

In 2000, Nevada had several nonattainment area SIPs in place. These SIPs are effective in Washoe and Clark Counties, the locations of Reno and Las Vegas, respectively. In NDEP's jurisdiction, the only nonattainment area was the Central Steptoe Valley, which was out of attainment for SO_2 because of emissions from a copper smelter. This area was designated attainment in 2002. Table 6-2 shows the designation status for Nevada's nonattainment areas.

TABLE 6-2

NONATTAINMENT AREA
REDESIGNATION STATUS AS OF SEPTEMBER 2008

Planning 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	Request submitted 9/18/08
Truckee Meadows (Reno) (HA87)	3/3/78 and 11/15/90	USEPA approved 7/3/08
Ozone		
Washoe County	1/6/92 (1 hr) 1/16/01 (1 hr)	6/15/05 1 hr NAAQS revoked; Maintenance plan approved 1/18/08; effective 3/18/08
Clark County	9/13/2004 (8 hr)	
PM_{10}		
Las Vegas Valley (HA212)	11/15/90	
Pahrump Valley[2] (HA162)	does not apply	MOU Sept 2003
Truckee Meadows (Reno) (HA87)	11/15/90	
SO_2		
Central Steptoe Valley (HA179M)	3/3/78	USEPA approved 4/12/02; effective 6/11/02

Clark County

Clark County has PM_{10} and carbon monoxide (CO) SIPs. For many years, the Las Vegas Valley severely violated air quality standards for PM_{10} airborne particulate matter. Fugitive dust contributed substantially to this problem, but there were thousands of PM_{10} sources spanning an area of over 300,000 acres. In an unprecedented strategy, Clark County adopted fugitive dust rules more stringent than any prior program in the country and employed a team of 28 field compliance officers dedicated to enforce fugitive dust regulations. To make its approach effective, the program targeted large construction sites and conducted an extensive public outreach campaign to educate owners of large expanses of vacant residential land. The department also funded new research in PM_{10} paved-road and vacant-land emissions, which provides new techniques with greater accuracy for estimating emissions. Clark County's advanced dust control program serves as a national model and has been integral in leading the Las Vegas Valley to achieve PM_{10} concentrations below the USEPA's standard. In the June 2007 Milestone Achievement Report, Clark County demonstrated achievement of the 24-hour PM_{10} National Ambient Air Quality Standards (NAAQS) and continued attainment of the annual PM_{10} standard. CO control strategies include cleaner burning gasoline, transportation control measures, the state Alternative Fueled Vehicle program and woodstove and fireplace regulations.

[2] Pahrump Valley is not a designated nonattainment area. A Memorandum of Understanding is in place, which defers a nonattainment designation, to accelerate attainment of the PM_{10} national ambient air quality standards.

Washoe County
Washoe County or the Truckee Meadows Hydrographic Area (HA 87) has SIPs for ozone, CO and PM_{10}. Control measures focus on off-road and on-road vehicles, oxygenated fuel, gasoline vapor recovery, transportation control measures, residential wood burning and dust control measures such as the street sweeping program.

This section summarized the significant federal, state, and local control programs that are being implemented between the baseline period and 2018. These control program focus primarily on mobile (both on- and off-road) emissions sources and to a lesser degree area and stationary source emissions. Emissions projections based on implementation of all the described programs have been incorporated into the preliminary reasonable progress emissions inventory (PRP18a). The emission inventory will be updated in late 2008 or 2009 to incorporate BART emissions estimates for further visibility modeling.

6.5.3 Resulting Improvement in Visibility

Utilizing WRAP Regional Modeling Center modeling results, Nevada has estimated the expected visibility improvements by 2018 at the Jarbidge WA resulting from the implementation of existing federal and state regulations discussed above. Figure 6-5 shows the URP glide slope with a modeled 2018 visibility projection of 11.05 dv, although the value in Figure 6-5 has been rounded to one decimal place.

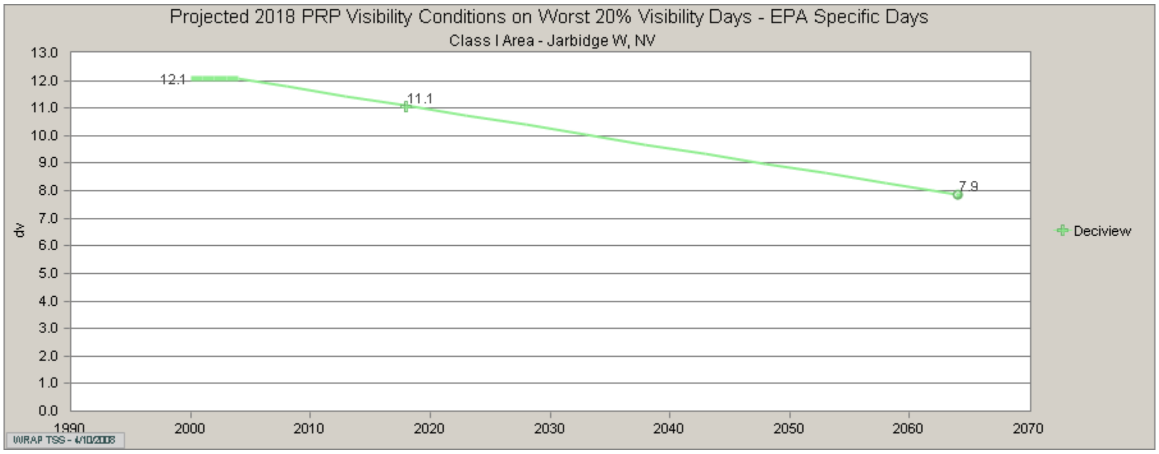
6.6 ESTABLISHING REASONABLE PROGRESS FOR NEVADA

WRAP baseline modeling demonstrates that the 2018 preliminary reasonable progress scenario (PRP18a) provides for an improvement in visibility better than the uniform rate of progress at the Jarbidge WA for the most impaired days over the period of the implementation plan, and ensures no degradation in visibility for the least impaired days over the same period (see Figure 6-5 and Table 6-3). The improvement is the result of the emissions reductions from existing and planned emissions controls due to federal and state programs (i.e., on-the-way and on-the-books), as discussed in Chapter Three.

For the 20 percent worst days, the reasonable progress goal for Jarbidge provides for greater visibility improvement by 2018 than the area's uniform rate of progress, as shown on Table 6-3. For the 20 percent best days, the reasonable progress goal for Jarbidge indicates an improvement of visibility by 2018 greater than current best day conditions. These projections are based on the modeling results discussed in Chapter Four.

FIGURE 6-5

CMAQ MODEL PROJECTIONS IN HAZE INDEX
FOR JARB1 2018 WORST DAYS



Identification of the 2018 reasonable progress goal for Jarbidge is a required element of Nevada's regional haze SIP. Nevada's reasonable progress goal for the Jarbidge WA is 11.05 dv for the 2018 worst days and 2.50 dv for the 2018 best days, as shown in Table 6-3.

TABLE 6-3

SUMMARY OF MODEL PREDICTED PROGRESS
TOWARD 2018 UNIFORM RATE OF PROGRESS AT JARB1

	20% Worst Days				**20% Best Days**		
Mandatory Class I Federal Area	Worst Days Baseline (Deciview)	2018 URP (Deciview)	RPG 2018 Modeling Results (Deciview)	CMAQ Modeling Percent Toward 2018 URP	Best Days Baseline (Deciview)	2018 Modeling Results (Deciview)	CMAQ 2018 Modeling Result Less Than Baseline?
Jarbidge Wilderness Area	12.07	11.09	11.05	104.1%	2.56	2.50	Yes

The background and results of the monitoring, emissions and modeling analyses are discussed in Chapters Two, Three, and Four of this SIP and provide the technical basis for the establishment of Nevada's reasonable progress. Nevada has utilized the technical analyses developed by the WRAP to comply with USEPA's guidance for developing its RPG.

6.7 DEMONSTRATION THAT THE RPG FOR WORST DAYS IS REASONABLE

USEPA guidance (June 2007) indicates, ". . . States may establish a RPG that provides for greater, lesser, or equivalent visibility improvement as that described by the glidepath," (p. 1-3) and goes on to state, "It is reasonable for you to defer reductions to later planning periods in order to maintain a consistent glidepath toward the long-term goal." (p. 1-4) It further states:

> "After determining the amount of emissions reductions of visibility impairing pollutants that may be expected from implementation of other CAA programs, you will be ready to *identify any additional measures that are reasonable (emphasis added).* The RHR gives States wide latitude to determine additional control requirements, and there are many ways to approach identifying additional reasonable measures; however, you must, at a minimum, consider the four statutory factors. Based on the contribution from certain source categories and the magnitude of their emissions *you may determine that little additional analysis is required to determine further controls are not warranted for this category*."(p. 4-2) *emphasis added*

The 2018 RPG identified in Table 6-3 for the 20 percent worst days show an improvement in visibility better than the 2018 URP. For this reason, in conjunction with other evidence and documentation described below and the fact that Nevada is meeting its share of emissions reductions at Class I areas outside of the state (see section 7.9.3.2), Nevada maintains its RPGs are reasonable. The following factors support this conclusion:

1. <u>The 2018 RPG shows better progress than the 2018 URP.</u> As shown in Table 6-3, Nevada's 2018 RPG shows better visibility improvement that the 2018 URP for the worst days and ensures no visibility degradation for the least impaired days of 2018. Therefore, it is reasonable to defer additional emissions reductions to later planning periods in order to maintain a consistent glidepath toward the long-term goal.

2. <u>Reductions in anthropogenic emissions consistent with 2018 URP are reasonable.</u> Meeting the 2018 URP at the Jarbidge WA requires an 8.1 percent reduction in the haze index expressed in deciviews. The PRP18a emission inventory shows a 33 percent reduction of SO_x emissions and a 17 percent reduction of NO_x emissions when compared to the Plan02d inventory. When the installation of BART controls on Nevada sources is taken into account, the reductions increase to 44 percent for SO_x and nearly 33 percent for NO_x from the Plan02d inventory. The WEP emissions projections show a 14.5 percent reduction for NO_x, but a 16.8 percent increase in SO_x by 2018. The SO_x increase is due partly to the siting of a proposed coal-fired EGU in eastern Nevada, as well as the significant SO_x emissions reductions from mobile and point sources in Idaho, which increase the relative contribution of Nevada emissions. This combination of emissions reductions from anthropogenic sources consistent with the required reduction in haze index supports the demonstration of reasonable progress.

3. <u>Reductions in anthropogenic emissions are consistent with Nevada's share of emissions reductions to meet RPGs of Class I areas in other states.</u> Analyses of the relationships between Nevada's SO_x and NO_x emissions, source apportionment modeling, and visibility impairment at Class I areas in adjacent states indicates Nevada's emissions reductions by 2018 represent Nevada's share of the emissions reductions necessary for

these Class I areas to achieve reasonable progress. The analyses are presented in section 7.9.3.2 of Chapter Seven.

4. Major reductions in mobile source emissions. Mobile sources, both on- and off-road, are significant emitters of NO_x and to a lesser degree SO_x. These source categories show a considerable reduction in emissions by 2018, a 63 percent reduction in SO_x and 49 percent reduction in NO_x from 2002 levels. Although these reductions are primarily due to "on-the-books" federal regulations, the emissions reductions are consistent with and support Nevada's demonstration of reasonable progress.

5. Offshore marine shipping and international emissions contribute significantly to visibility impairment. Source apportionment modeling (section 4.3 of Chapter Four) identifies the significant contribution of international and off-shore marine emissions (e.g., source categories Outside Domain, Canada, Mexico, and Pacific Offshore) to visibility impairment at the Jarbidge WA. These source categories are major contributors to SO_4 and NO_3 extinction as shown by the source apportionment modeling results with outside domain, Mexican, and Canadian emissions representing 51 percent of the SO_4 visibility impact and 30 percent of the NO_3 impact at JARB1. Control of international and off-shore sources will likely account for greater improvement in the SO_4 and NO_3 extinction contribution at the Jarbidge WA. Although USEPA has recently addressed off-shore emissions by the Marine Diesel Engine Rule (see section 7.9.2.3 of Chapter Seven), no United States regulatory body has authority to control international emissions.

6. Natural sources contribute significantly to visibility impairment. Nevada's analyses of the monitoring, emissions and modeling data (Chapters Two, Three, and Four) strongly support the finding that the contribution of natural and uncontrollable emissions sources, such as natural fire and windblown dust, and the pollutants associated with these sources (OMC, EC, PMC and PMF), contribute significantly to visibility impairment. The 2018 emission inventory shows increased emissions of these pollutants, except EC, while the emissions of SO_x and NO_x decrease significantly. The role of natural fire is discussed below.

7. Consideration of the costs of compliance, time necessary for compliance, the energy and non-air quality environmental impacts of compliance, and remaining useful life of existing sources that contribute to visibility impairment. In light of the 6 factors listed above, it is Nevada's position that the costs of any additional control measures beyond those documented in this chapter and Chapter Seven are unreasonable at this time and would impose unnecessary burdens on the health and vitality of industries within our state. Since the costs of compliance are unreasonable, no further analysis of these four factors was conducted.

6.7.1 The Role of Natural Fire in Nevada

The role of natural fire contributions to visibility impairment at the Jarbidge WA is undeniable as shown in Figure 6-6, which displays time lines for each visibility impairing species from 1988 to 2006 for all IMPROVE sample days. As noted previously, annual visibility impairment due to OMC emissions from natural fires are highly variable from year to year. Some of the monitored visibility impairment is due to local natural fires, but regional transport of smoke is common, as

2002 demonstrates when large timber fires in Arizona, Colorado and Oregon contributed to elevated OMC extinction at the Jarbidge WA.

The natural fire data presented in Table 6-4 show significant burned acreage in proximity to the Jarbidge WA for 1999, 2006 and 2007. These data were downloaded from the National Interagency Fire Center (http://www.nifc.gov/fire_info/fire_stats.htm) list of 1997-2007 fires greater than 100,000 acres and year-to-date fires for 2008. Only data for fires in northeastern Nevada and southern Idaho within approximately 100 miles of the Jarbidge WA were compiled. Comparison of Figure 6-6 and Table 6-4 demonstrates the correlation of large fires and visibility impairment at the Jarbidge WA for 1999 and 2006. No fires in excess of 100,000 acres were recorded in Nevada from 2000 to 2005.

FIGURE 6-6

SPECIES TIME SERIES EXTINCTION FOR PERIOD OF RECORD
AT THE JARBIDGE WILDERNESS AREA

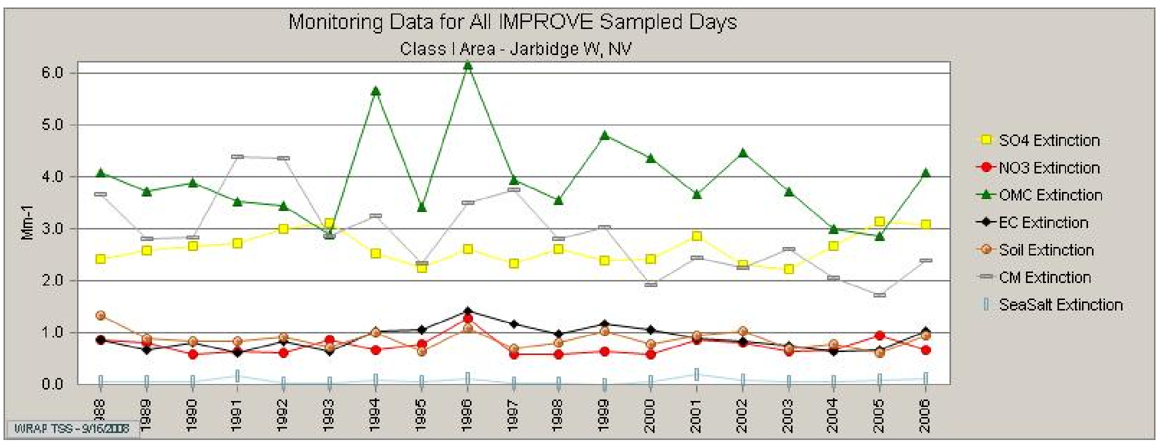


TABLE 6-4

LARGE NATURAL FIRES NEAR THE JARBIDGE WILDERNESS AREA 1999 - 2008

Year	Fire Name	State	Acreage
1999	Dun Glen Complex	Nevada	288,220
1999	Sadler Complex	Nevada	224,509
1999	Battle Mountain Complex	Nevada	169,608
1999	Jungo Complex	Nevada	169,220
		1999 Acreage	**851,557**
2006	Winters	Nevada	238,458
2006	Charleston Complex	Nevada	190,421
2006	Sheep	Nevada	150,270
		2006 Acreage	**579,149**
2007	Murphy Complex	Idaho	652,016
		2007 Acreage	**652,016**
2008	East Slide Rock Ridge	Nevada	54,549
		2008 Acreage	**54,549**

Figures 6-7 through 6-9, show MODIS fire detections for 2006, 2007 and 2008 in California and Nevada and their proximity to the Jarbidge WA. The yellow depicts areas burned since January 1st of each year. These maps were downloaded from the MODIS Active Fire Mapping Program website at http://activefiremaps.fs.fed.us/activefiremaps.php?op=maps&rCode=cgb .

Figure 6-7 shows the 2006 Winters, Charleston Complex and Sheep fire detections in northeastern Nevada. The Jarbidge WA is located in the northeast corner of Nevada, between the eastern-most large fire shown in Figure 6-7 and the Idaho border. The IMPROVE monitor JARB1 location is depicted in black. Recall that 2006 has a large OMC extinction component that may in part be due to these fires.

FIGURE 6-7

2006 MODIS FIRE DETECTIONS IN CALIFORNIA AND NEVADA

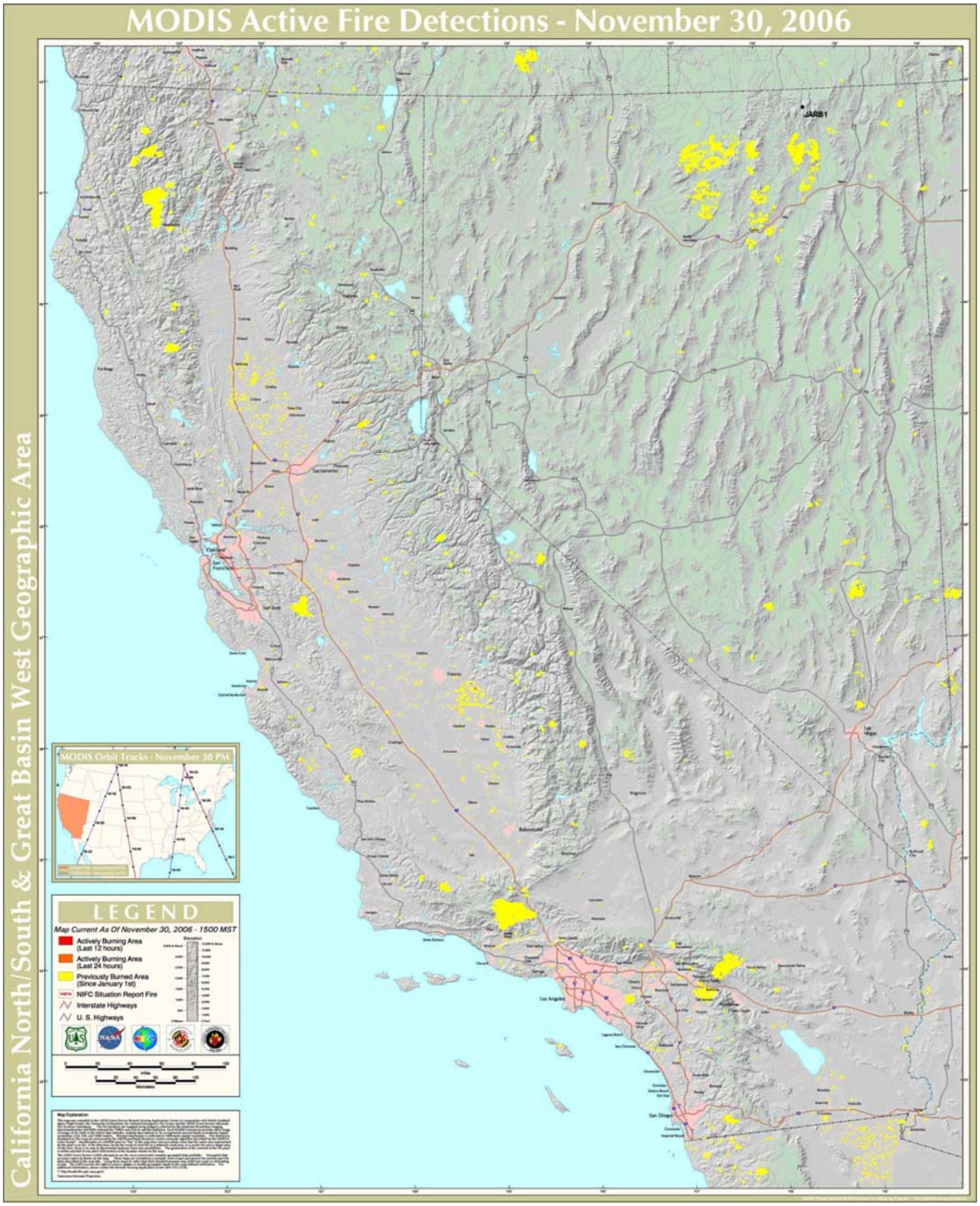


Figure 6-8 shows the Jarbidge WA surrounded by the 2007 Murphy Complex Fire detections on the west, north, and east where nearly two thirds of a million acres burned in this one fire complex.

FIGURE 6-8

2007 MODIS FIRE DETECTIONS IN CALIFORNIA AND NEVADA

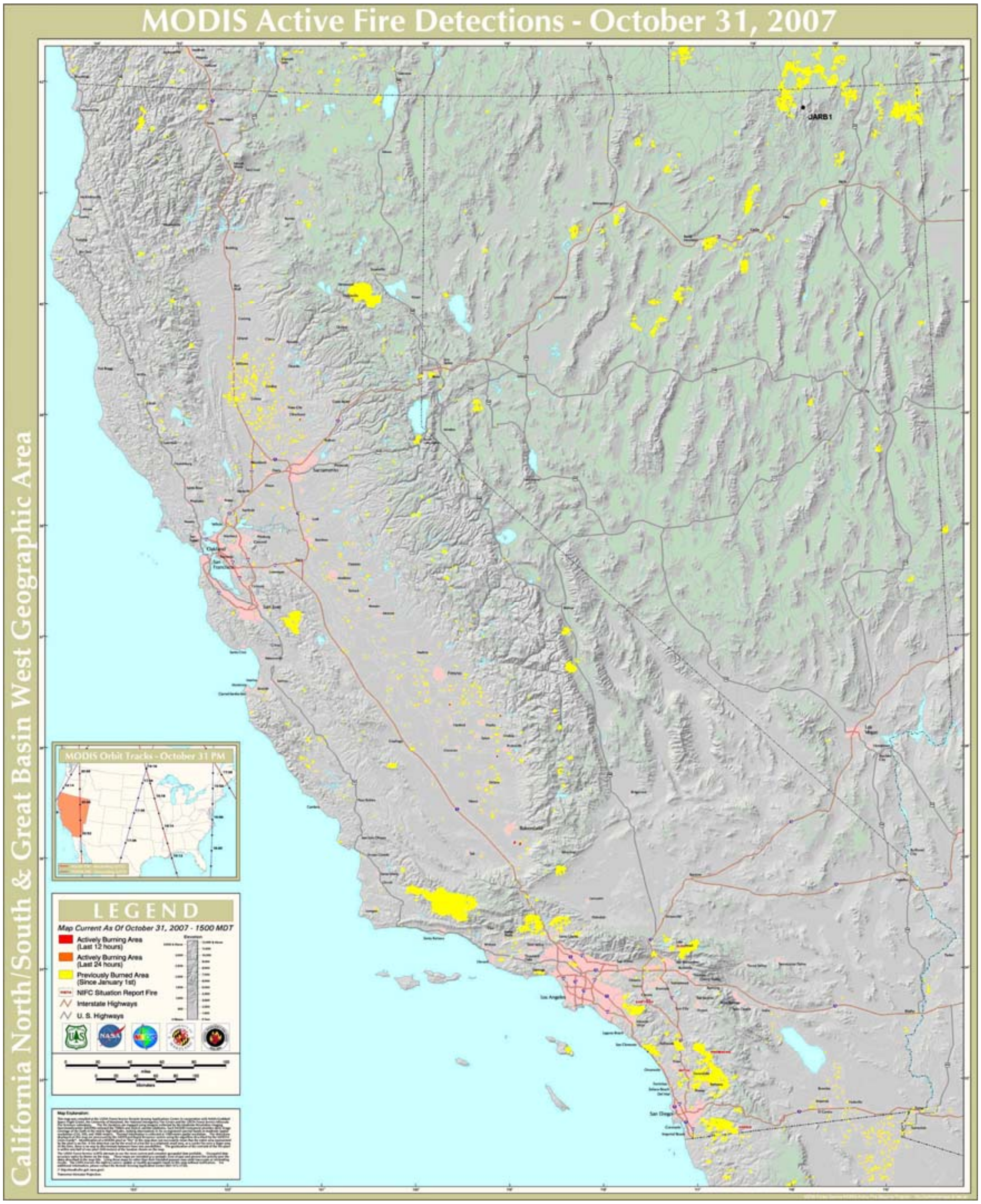
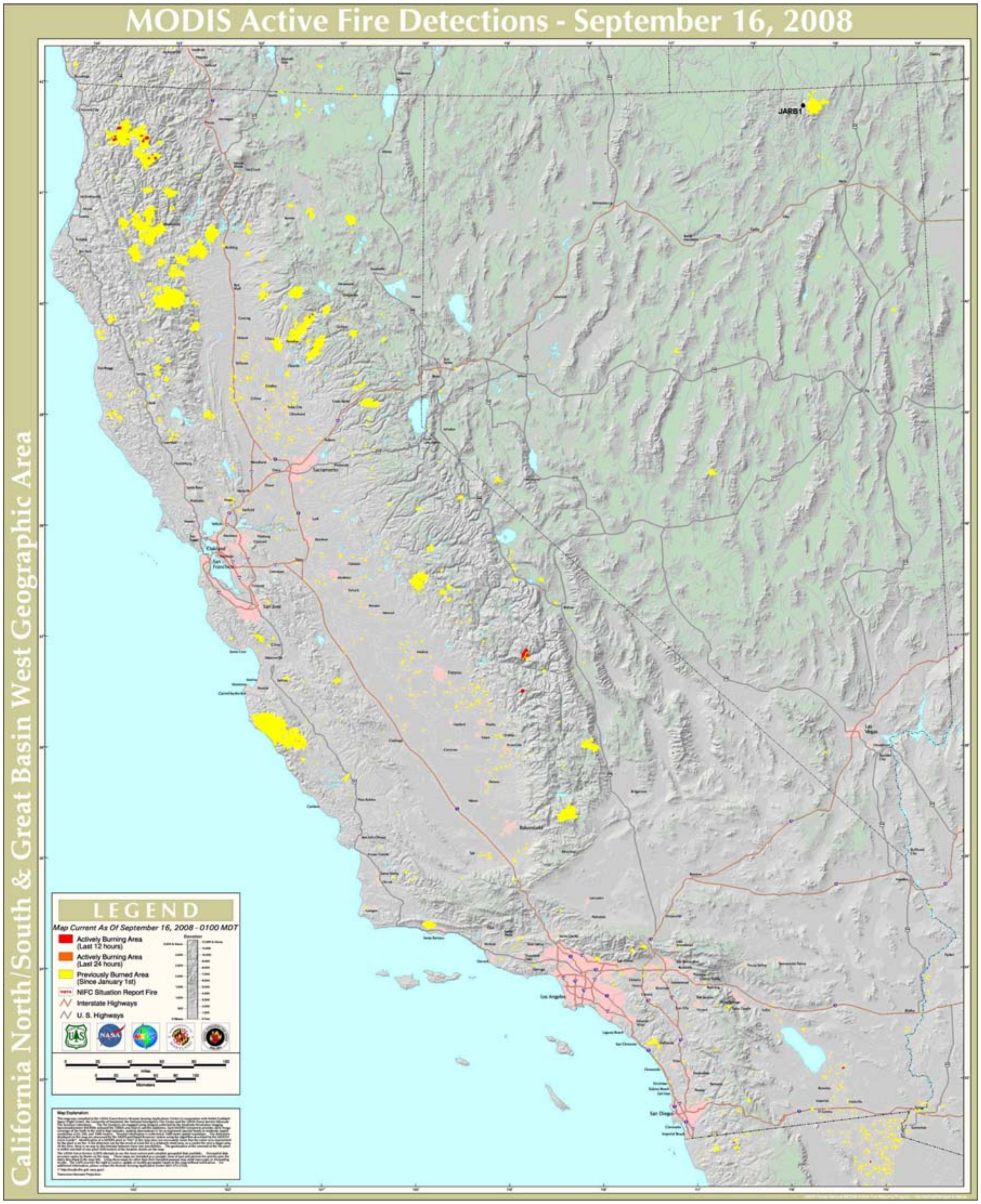


Figure 6-9 shows the 2008 East Slide Rock Ridge fire partially within the Jarbidge WA and burning out of the wilderness area to the east. This long-lived fire started as a lighting strike within the wilderness area and was allowed to burn as wildland fire use fire until it crossed out of the wilderness area and was partially suppressed. The listed acreage does not represent full containment of this fire, as of early October 2008 and the acreage will likely increase.

FIGURE 6-9

<u>2008 MODIS FIRE DETECTIONS IN CALIFORNIA AND NEVADA</u>



Monitor data is not yet available for 2007 to assess the impact of the Murphy Complex fire on visibility at the Jarbidge WA, nor is data for 2008 to assess the impacts of the East Slide Rock Ridge fire and the effects of the prolonged regional transport of smoke from the 2008 northern California fires. Nevada suspects the visibility impacts from natural fires are not limited to OMC and EC emissions, but include CM and SOIL emissions due to windblown transport from the denuded burn areas which may persist for years after a fire. Rehabilitation efforts on the Murphy Complex have been hampered by low soil moisture conditions likely resulting in significant local transport of particulates due to windblown dust. It is clear from Figure 6-6 that the relative extinction contribution of both OMC and CM increased significantly in 2006. The relative contribution of EC and SOIL also increased, although less markedly than OMC and CM. The extinction increases for these species are likely a result of the large acreages burned in northern Nevada during 2006.

The 2006 monitoring data, presented in Figure 6-6, show the visibility impairment resulting from natural sources such as natural fire and windblown dust overwhelms the effects of emissions reductions resulting from additional control of Nevada's anthropogenic emissions. Nevada anticipates a similar result for 2007 and possibly 2008 based on the active fire season in these years.

6.8 REFERENCES

U.S. EPA 2007. Guidance for Setting Reasonable Progress Goals under the Regional Haze Rule. U.S. Environmental Protection Agency, Office of Air Quality and Standards, Research Triangle Park, North Carolina. June 1, 2007 rev.

U.S. EPA 2001. Guidance for Demonstrating Attainment of Air Quality Goals for $PM_{2.5}$ and Regional Haze, Draft Report. U.S. Environmental Protection Agency, Research Triangle Park, North Carolina. January 2, 2001.

U.S. EPA 2007. Guidance on the Use of Models and Other Analyses for Demonstrating Attainment of Air Quality Goals for Ozone, $PM_{2.5}$, and Regional Haze-Draft 3.2. U.S. Environmental Protection Agency, Office of Air Quality and Standards, Research Triangle Park, North Carolina. April, 2007.

Chapter Seven -- Long-Term Strategy for Nevada

7.1 LONG-TERM STRATEGY OVERVIEW

- 7.1.1 Long-Term Strategy Requirements
- 7.1.2 Technical Basis of Reasonable Progress Goal

7.2 BART CONTROLS

7.3 VISIBILITY IMPROVEMEMT

7.4 MITIGATION OF CONSTRUCTION IMPACTS

7.5 EMISSIONS LIMITATIONS AND SCHEDULES OF COMPLIANCE

7.6 SOURCE RETIREMENT AND REPLACEMENT SCHEDULES

7.7 SMOKE MANAGEMENT PROGRAM

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7.9 LONG-TERM STRATEGY

- 7.9.1 Anthropogenic Sources of Visibility Impairment
  - 7.9.1.1 Major and Minor Stationary Sources
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  - 7.9.2.2 Nevada's Renewable Portfolio Standard
  - 7.9.2.3 Marine Diesel Rule
- 7.9.3 Other Considerations
  - 7.9.3.1 Uncertainty
  - 7.9.3.2 Contributions to Impairment at Class I Areas Outside of Nevada

7.10 REASONABLE PROGRESS ASSESSMENT

7.1 LONG-TERM STRATEGY OVERVIEW

The long-term strategy is the compilation of enforceable emissions limitations, compliance schedules, and other measures as necessary to achieve the reasonable progress goals and is the means through which the state ensures that its reasonable progress goal (RPG) will be met (40 CRF 51.308(d)(3) and *Guidance for Setting Reasonable Progress Goals Under the Regional Haze Program*, U.S. EPA, 2007). This chapter discusses Nevada's long-term strategy to restore natural visibility conditions at the Jarbidge Wilderness Area (Jarbidge WA) by 2064 and its relationship to the RPG for the Jarbidge WA.

The long-term strategy must have the capability of addressing existing and future impairment situations as they face the state. Generally, Nevada considers its permitting program meets this requirement for existing major stationary facilities, as well as preventing future impairment from proposed major stationary sources or major modifications to existing facilities. The New Source Review (NSR) and Prevention of Significant Deterioration (PSD) programs are key components of Nevada's regional haze plan designed to improve current visibility on the most impaired days and to protect visibility conditions at Class I areas. The state maintains that its existing regulations, including the Best Available Retrofit Technology (BART) regulations adopted for this SIP, along with the strategies and activities outlined in Chapter Six and below provide for reasonable progress toward the national visibility goal.

The starting point for the identification of additional emission control strategies is the visibility improvement achieved as a result of BART and the implementation of other Clean Air Act (CAA) programs, including measures for attainment of the ozone and $PM_{2.5}$ National Ambient Air Quality Standards. Implementation of some of these CAA control programs was incorporated into the PRP18a emissions inventory and modeling scenario, as was some of the implementation of BART. These programs are described in Chapter Six. Other CAA programs and emissions reduction strategies are described below.

7.1.1 Long-Term Strategy Requirements

USEPA regulations require the state to: 1) develop a long-term strategy; 2) coordinate its long-term strategy with existing plans and goals, including those of FLMs, which may affect impairment in any Class I area; 3) demonstrate why the long-term strategy is adequate for making reasonable progress toward the national goal and state why the minimum factors (listed in the next paragraph) were or were not addressed in developing the long-term strategy; 4) consider the time necessary for compliance as well as the economic, energy, and non-air quality environmental impacts of compliance, the remaining useful life of any affected existing source, as well as the effect of new sources; 5) review its strategy no less frequently than every three years and consult with FLMs during this process; and 6) report to USEPA and the public on progress achieved toward the national visibility goal.

During the development of the long-term strategy the state must consider, at a minimum, the following six factors: 1) emissions reductions due to ongoing air pollution control programs; 2) measures to mitigate the impacts of construction activities; 3) additional emissions limitations and schedules for compliance; 4) source retirement and replacement schedules; 5) smoke management techniques for agricultural and forestry management purposes, including such plans as currently exist within the state for this purpose; and 6) enforceability of emission limitations and control measures. The long-term strategy for regional haze must also address the anticipated net effect on visibility due to projected changes in point, area and mobile source emissions over the period addressed by the long-term strategy.

7.1.2 Technical Basis of Reasonable Progress Goal

NDEP has used the analyses of monitoring, emissions and modeling data in developing Nevada's long-term strategy. Many of the tools and resources used in these analyses were produced by the Western Regional Air Partnership (WRAP) and its contractors and are discussed elsewhere in this document. The analyses discussed in Chapters Two, Three and Four describe the monitoring, emissions, and modeling information and analyses on which Nevada is relying to determine the emissions reductions necessary to achieve reasonable progress toward the national visibility goal by 2018. These analyses provide the technical basis of our long-term strategy.

7.2 BART CONTROLS

The installation of BART controls is an integral part of the long-term strategy and RPG of Nevada's regional haze SIP. Chapter Five describes the BART process, identifies Nevada's seven BART-eligible sources and presents the BART requirements for Nevada's four subject-to-BART facilities. Each source subject to BART is required to install and operate BART as expeditiously as practicable, but in no event later than January 1, 2015 or 5 years after USEPA approval of the implementation plan, which ever occurs first. In addition, each source subject to BART is required to establish procedures to ensure the control equipment is properly operated and maintained.

Seven Nevada facilities were identified as BART eligible: NV Energy's generating stations at Tracy, Fort Churchill, Reid Gardner and Sunrise; Southern California Edison's generating station at Mohave; Nevada Cement Company's Fernley facility; and Chemical Lime Company's facility in Apex, Nevada. Four of these facilities were determined to cause or contribute to visibility impairment at a Class I area and were subject to full BART determinations. These facilities are Fort Churchill, Tracy, Reid Gardner, and Mohave.

Significant emissions reductions will be achieved by the installation of BART controls on these four facilities. Table 7-1 summarizes the emissions reductions resulting from the installation of BART control technologies beyond those incorporated in the PRP18a emissions inventory. These emissions reductions raise the overall reduction from the baseline to 2018 in Nevada's NO_x inventory to 32.9 percent from 16.8 percent and the reduction in the SO_2 inventory to 44.0 percent from 33.0 percent.

TABLE 7-1

ADDITIONAL ANNUAL EMISSIONS REDUCTIONS IN TONS RESULTING FROM IMPLEMENTATION OF BART IN NEVADA

NO_x	SO_x	PM_{10}	Total
26,477	7,611	1,360	35,448

7.3 VISIBILITY IMPROVEMENT

Utilizing WRAP Regional Modeling Center (RMC) modeling results, Nevada has estimated the expected visibility improvements by 2018 at the Jarbidge WA. Two projected 2018 emissions inventories were utilized by RMC, Base18b and PRP18a, to project visibility improvement. These inventories are more fully discussed in Chapter Three.

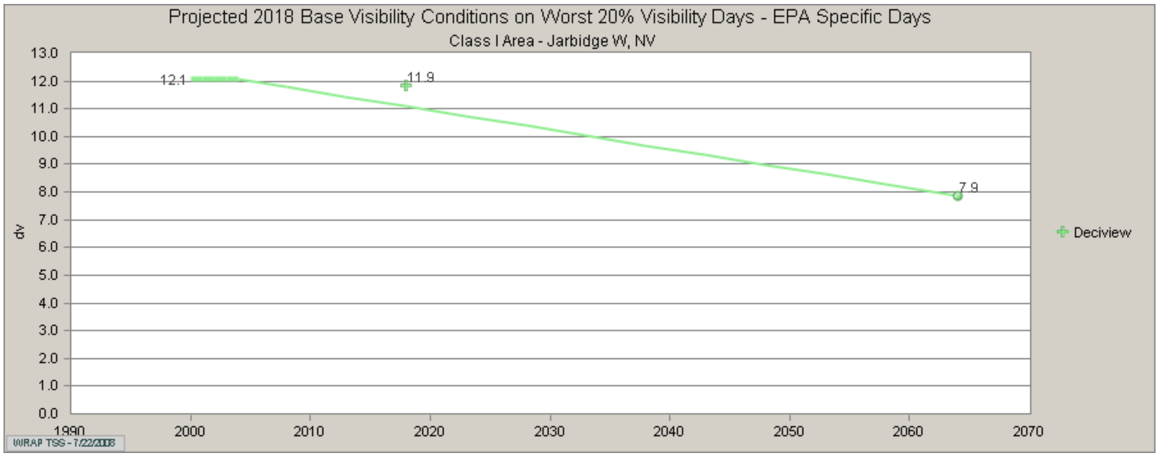
The Base18b inventory included emission reductions due to known controls (i.e., implementation of existing federal and state regulations), consent decree reductions, existing SIP control measures and other relevant regulations that have gone into effect since 2002 or will go into effect before the end of 2018. These controls do not include impacts from any future control scenarios that have yet to be determined, such as the installation of BART.

Figure 7-1 shows the projected 2018 visibility conditions for the worst days at JARB1 resulting from the controls included in the Base18b emissions inventory. The projected visibility is 11.85 dv, reflecting the 0.22 dv or 1.8 percent decrease from baseline visibility conditions resulting from the implementation of existing regulations.

The PRP18a inventory refined the Base18b inventory by applying presumptive BART SO_2 emission limits to BART-eligible coal-fired electric generating unit (EGUs) greater than 750 MW across the WRAP region. BART NO_x limits were not incorporated into this inventory. Other, less significant refinements to the PRP18a inventory are described in Chapter One, section 1.3.2.2. Figure 7-2 shows the modeled 2018 visibility projection of 11.05 deciviews (dv), a 1.02 dv or 8.45 percent reduction in visibility impairment. These results suggest the full implementation of BART across the WRAP-region will result in additional and noticeable improvement of visibility impairment at the Jarbidge WA for the worst days.

FIGURE 7-1

CMAQ 2018 WORST DAYS MODEL PROJECTIONS FOR JARB1
USING BASE18b EMISSIONS INVENTORY



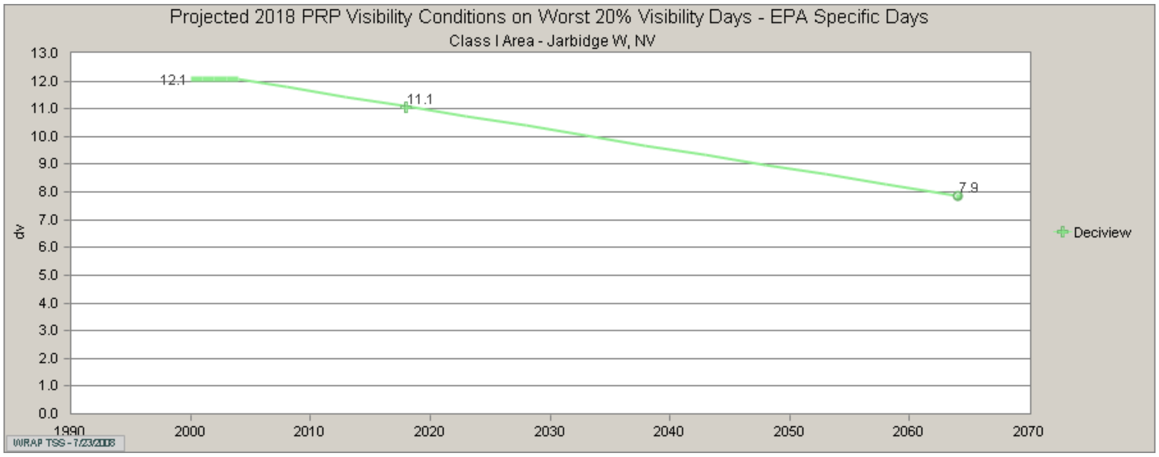
7.4 MITIGATION OF CONSTRUCTION IMPACTS

Nevada manages the release of fugitive dust from construction related activities through the implementation of regulations set forth in the Nevada Administrative Code (NAC).

NAC 445B.22037 requires fugitive dust to be controlled (regardless of the size or amount of acreage disturbed), and requires an ongoing program, using best practical methods, to prevent particulate matter from becoming airborne. All activities which have the potential to adversely affect the local air quality must implement all appropriate measures to limit controllable emissions. Appropriate measures for dust control may consist of a phased approach to acreage disturbance rather than disturbing the entire area all at once; using wet suppression through such application methods as water trucks or water sprays systems to control wind blown dust; the application of soil binding agents or chemical surfactant to roadways and areas of disturbed soil; as well as the use of wind-break or wind-limiting fencing designed to limit wind erosion of soils.

FIGURE 7-2

CMAQ 2018 WORST DAYS MODEL PROJECTIONS FOR JARB1
USING PRP18a EMISSIONS INVENTORY



Furthermore, no person may disturb or cover 5 acres or more of land or its topsoil until he has obtained an operating permit for surface area disturbance to clear, excavate or level the land or to deposit any foreign material to fill or cover the land. In addition to requiring a permit for all disturbances greater than 5 acres, a dust control plan must be submitted for all disturbances greater than 20 acres. The approval of the dust control plan does not limit the permit holder's need to control fugitive dust from the disturbance and its related activities, nor from putting into effect an ongoing program for using the best practical methods of dust control.

In addition to the requirements detailed above, there are guidelines for the Pahrump Valley (HA 162) in southern Nevada. In this area, a dust control plan is required for any disturbance greater than 5 acres. Washoe and Clark counties have their own respective air quality departments and, therefore, are responsible for managing their particular fugitive dust programs (see Chapter Six, section 6.5.2.3).

It is important to note the requirements above do not apply to agricultural activities occurring on agricultural land and mining exploration projects pursuant to Nevada Revised Statute 519A.180.

7.5 EMISSIONS LIMITATIONS AND SCHEDULES OF COMPLIANCE

BART emissions limitations and schedule for compliance is addressed directly by a revision to the Nevada Administrative Code (NAC) adopted on February 11, 2009[1] (Appendix A). The regulation identifies the emission limits and control technologies required as BART. For the NV Energy facilities it identified January 1, 2015 or five years after approval of Nevada's SIP, which

[1] In response to public comments on the draft RH SIP (contained in Appendix D), Nevada is revising the BART requirements at NV Energy's Reid-Gardner Generating Station. A regulatory amendment lowering the SO_2 emission limits for units 1, 2 and 3 from 0.25 to 0.15 lb/10^6 Btu, 24-hour average, has been submitted to the State Environmental Commission for presentation at their December 9, 2009 Hearing. See Appendix A.

ever occurs first, as the schedule for installation and operation of BART; for the Mohave facility, BART must be installed and operating at the time each unit resumes operation.[2]

The CAA programs described in Chapter Six and below have specific emissions limitations and schedules of compliance unique to each program. These limitations and schedules are identified in the specific rules.

7.6 SOURCE RETIREMENT AND REPLACEMENT SCHEDULES

The construction of new sources, which will ensure the early or scheduled retirement of older, less well-controlled sources, can greatly aid progress toward the national visibility goal over the long term. Nevada's continued implementation of NSR and PSD requirements with FLM involvement for Class I area impact review will protect the least impaired days from further degradation and will assure that no Class I areas experience degradation from expansion or growth of a single new source or large scale regional development of stationary sources.

7.7 SMOKE MANAGEMENT PROGRAM

Anthropogenic fire emissions for 2002 were estimated to be approximately 250 tons per year out of nearly 64,000 tons per year of total fire emissions in Nevada or less than 0.5 percent of the total fire emissions in Nevada. Further control of anthropogenic fire emissions within the state maybe of little benefit in improving visibility at Nevada and other Class I areas.

In Nevada, preventing and managing emissions from smoke are achieved through implementation of two separate elements of the air quality program. Open burning is controlled through a comprehensive set of open burning regulations. Prescribed fires used specifically for land management purposes are controlled through implementation of the Nevada Smoke Management Program.

Open burning regulations are found in NAC 445B.22067. The regulations apply to federal, state and private lands equally and prohibit open burning of combustible refuse, waste, garbage, oil or open burning for any salvage operation. Exemptions are granted for open burning conducted for the purposes of weed abatement, conservation, disease control, game or forest management and fire training. Burning for agricultural purposes is exempt, as is the burning of yard waste and untreated wood at single-family residences. Small fires used for cooking, recreation, education or ceremonial purposes are also exempt.

The Nevada Smoke Management Program was developed to coordinate and facilitate the statewide management of prescribed outdoor burning. This program is designed to meet the requirements of Nevada's air quality statutes listed in Nevada Revised Statutes (NRS) 445B.100 through 445B.845, inclusive, and the requirements of the USEPA Interim Air Quality Policy on Wildland and Prescribed Fires (EPA OAQPS, April 23, 1998). It supports the visibility

[2] On June 10, 2009, the owners of the Mohave Generating Station, including Southern California Edison (SCE), announced the decision to decommission the station and remove the generating facility from the site. The SCE news release states that in 2010, the plant's generating equipment will be removed and its operating permits terminated (http://www.edison.com/pressroom/pr.asp?bu=sce&year=2009&id=7234).

protection goals for Federal class I areas in Section 169A of the CAA. The program does not, however, supersede the authority of local governments to regulate and control smoke and air pollution under NRS 244.361 and NRS 268.410 or the authority of the state forester to regulate controlled fires under NRS 527.122 through 527.128.

The Nevada Smoke Management Program is administered by NDEP and compliance is achieved through a Memorandum of Understanding (MOU) between the various state and federal agencies that conduct prescribed burning, including the U.S. Bureau of Land Management, the U.S. Forest Service, the U.S. National Park Service, the U.S. Fish and Wildlife Service and Nevada state agencies. The MOU lists the objectives as well as both the mutual and individual responsibilities of the signatory parties. The MOU has a term of five years and will be renewed in 2011. Land managers recognize the importance of the Nevada Smoke Management Program and provide fiscal support for its continuation through various financial assistance agreements.

The *Smoke Management Plan* (http://ndep.nv.gov/baqp/technical/SMP2005.html) is a collaborative document, written by the signers of the MOU, and is the guiding document of the program. It details the applicability of the program and responsibilities of affected parties. It provides information on open burn variance requirements for those land managers using prescribed fire and wildland fires for land management purposes. It also includes information on air quality monitoring at prescribed fires, burner qualifications and emission reduction methods.

The *Smoke Management Plan* applies to all areas of Nevada except Clark County, Washoe County and Bureau of Indian Affairs trust lands. Applications for open burn variances are processed by NDEP. Applicants must estimate the prescribed fire's PM_{10} emissions. For larger fires, additional information is needed and stricter requirements are imposed. For fires emitting greater than 1 ton but less than 10 tons PM_{10} and located greater than 15 miles from a Class I area, a smoke sensitive area or a nonattainment area, the application must include an estimate of emissions from a model predicting the impact of smoke on smoke sensitive receptors. For prescribed fire projects emitting greater than 25 tons, or more than 10 tons if the burn area is within 15 miles of a Class I area, a smoke sensitive area or a nonattainment area, the application must also include a smoke management plan that lists smoke minimization methods to be used and the model or calculations used to make emission estimates. The plan must have a list of safety and contingency measures, identification of smoke sensitive areas that may potentially be affected, a list of air regulators to be notified and air monitoring to be conducted.

Variance conditions intended to mitigate smoke impacts apply to open burn variances issued by NDEP. These include: variances will be invalid during declared air pollution emergencies and alerts in affected areas; pre-ignition notification and approval is required; best smoke management and emission reduction techniques shall be practiced; and variances are issued with provisions related to supervision, inspection and availability of the variance. Additional restrictions and requirements apply where wildland fires are used to achieve land management objectives including a burn plan, applicable maps, a list of conditions under which burning will be suppressed and a stipulation requiring daily fire evaluation. Burn managers are expected to assess meteorological conditions, obtain a burn day forecast and not proceed to ignition unless conditions are favorable. All personnel conducting prescribed burns must meet burner qualifications.

Agencies conducting prescribed fires in excess of 10 tons of PM_{10} annually are required to supply NDEP with an annual fire activity report. This report provides a summary of fire activities including a listing of: permit number, acreage burned, fuel type, emissions estimates and emission factors used. NDEP is in the process of assessing current fire emission data collection procedures and future data needs. Consideration is being given to augmenting data collection efforts and emission tracking methods for the purposes of enhancing regional haze assessments. This may include participation in the WRAP's Fire Emission Tracking System or use of other fire emission tracking tools.

NDEP's website includes additional information on the Nevada Smoke Management Program and can be found at http://ndep.nv.gov/baqp/technical/smoke.html. Permit applications, an instruction sheet, links to applicable statutes and regulations and contact information are provided.

7.8 ENFORCEABILITY OF EMISSIONS LIMITS

Enforceability of the BART emission limits will be through rule. Amendments to the NAC were approved by the State Environmental Commission during their February 11, 2009 hearing.[3] Where CAA programs specify emissions limits, these limits are enforceable through federal rule. Some state and local pollution control programs do not have enforceable emissions limits but are still effective in reducing emissions of visibility impairing pollutants.

7.9 LONG-TERM STRATEGY

Projected 2018 visibility conditions at the Jarbidge WA are better than the glidepath toward achieving natural visibility conditions by 2064. For this reason and other factors discussed in Chapter Six (see section 6.7) and below, Nevada's long-term strategy will be limited to those pollution control programs described in Chapter Six and below (i.e., the "on-the-books" and "on-the-books" controls included in the PRP18a emission inventory in Chapters Three and Six and the reductions realized from the implementation of BART) that result in the RPG identified in Chapter Six.

For the same reasons, Nevada did not take into consideration the costs of compliance; the time necessary for compliance; the energy and non-air quality environmental impacts of compliance; and the remaining useful life of any non-BART sources in establishing our RPGs for this planning period. Therefore, this SIP does not include a demonstration showing how these factors were taken into consideration in selecting the goals.

[3] In response to public comments on the draft RH SIP (contained in Appendix D), Nevada is revising the BART requirements at NV Energy's Reid-Gardner Generating Station. A regulatory amendment lowering the SO_2 emission limits for units 1, 2 and 3 from 0.25 to 0.15 lb/10^6 Btu, 24-hour average, has been submitted to the State Environmental Commission for presentation at their December 9, 2009 Hearing. See Appendix A.

7.9.1 Anthropogenic Sources of Visibility Impairment

Table 7-2 identifies the relative contribution of each visibility impairing pollutant from anthropogenic and natural emission sources. These data suggest SO_2 and NO_x are the dominant anthropogenic emissions of primary particulate matter from Nevada sources. Natural sources include emissions from the biogenic, natural fire and windblown dust source categories. *Emissions from natural sources represent nearly three-quarters of all emissions originating from within Nevada's borders.* Natural sources are uncontrollable and have little potential for effective control of visibility impairing emissions.

Table 7-3 identifies the relative contribution to visibility impairment by pollutant for the baseline and 2018 and the change in emissions from the baseline period to 2018. Table 7-4 identifies the largest source categories for each pollutant and the change in emissions from the baseline to 2018 by source category. The 2018 emission inventory does not include all emissions reductions related to the full implementation of BART in Nevada or other WRAP states, so additional emissions reductions beyond those shown are likely by 2018. The pollutants are ordered by their relative contribution to the baseline worst days visibility impairment.

TABLE 7-2

SUMMARY OF NEVADA ANTHROPOGENIC AND NATURAL EMISSIONS

Pollutant	2002		2018	
	Anthropogenic Sources	Natural Sources	Anthropogenic Sources	Natural Sources
SO_2	96%	4%	94%	6%
NO_x	86%	14%	83%	17%
EC	27%	73%	17%	83%
PMF	44%	56%	51%	49%
PMC	38%	62%	47%	53%
NH_3	86%	14%	88%	12%
POA (OC)	9%	91%	9%	91%
VOC	10%	90%	10%	90%
Total Emissions	28%	72%	27%	73%

TABLE 7-3

NEVADA'S EXTINCTION CONTRIBUTION AND EMISSIONS BY SPECIES

	Annual Average Baseline Extinction Contribution		Emissions (tpy)		
	Worst Days	Best Days	2002	2018**	Change
*OMC	40.0%	26.3%	24,734	24,822	0.4%
CM	22.3%	9.2%	161,142	188,287	17%
SO_4	16.7%	40.9%	68,989	46,224	-33%
SOIL	9.7%	2.8%	20,969	24,134	15%
EC	6.5%	9.4%	6,409	5,638	-12%
NO_3	4.5%	9.8%	162,475	135,496	-17%

* POA for emissions

** 2018 emissions projection does not include BART reductions

Examination of Table 7-4 shows the largest source categories for four of the visibility impairing pollutants, organic matter carbon (OMC), coarse matter (CM), SOIL and elemental carbon (EC), are natural emissions resulting from natural fire and windblown dust. Point sources are the dominant emission category for ammonium sulfate (SO_4) and ammonium nitrate (NO_3), although area sources are also significant emitters of SO_x; and mobile sources, both on- and off-road, are important emitters of NO_x. Fugitive dust is an important source category for CM and SOIL emissions. The long-term strategy for the first planning period focuses on SO_x and NO_x emissions originating from point and mobile sources. These source categories are discussed below.

TABLE 7-4

NEVADA EMISSIONS SOURCE CONTRIBUTIONS BY SPECIES

	Largest 2018 Source Category	Percent of 2018 Inventory	2002 to 2018 Change for Category	Second Largest 2018 Source Category	Percent of 2018 Inventory	2002 to 2018 Change for Category
*OMC	**Natural Fire**	90.6%	0%	Area	3.1%	13%
CM	**Windblow Dust**	49.9%	0%	Fugitive Dust	36.5%	45%
SO4	Point	61.3%	-44%	Area	30.1%	10%
SOIL	**Windblow Dust**	43.3%	0%	Fugitive Dust	30.0%	44%
EC	**Natural Fire**	82.9%	0%	**Mobile	14.0%	-50%
NO3	Point	50.0%	13%	**Mobile	27.5%	-49.5%

* POA for emissions

** Includes on-road and off-road mobile sources

Bold text indicates natural sources

7.9.1.1 Major and Minor Stationary Sources

Nevada's evaluation of the monitoring, emissions and modeling data suggests that point source emissions of SO_x and NO_x are the most likely candidates for additional control, although these emissions are not the most significant contributors to visibility impairment at the Jarbidge WA. Baseline and 2018 emissions of SO_x and NO_x from within Nevada are dominated by anthropogenic sources, as shown on Table 7-4. Although OMC (formed from Primary organic aerosol (POA) and Volatile organic compound (VOC) emissions), EC, PMC and PMF are significant contributors to visibility impairment, their emissions are dominated by natural and uncontrollable sources. Nevada's SO_x emissions have a greater contribution to visibility impairment at JARB1 than NO_x (see Figures 2-7 and 2-11), although Nevada's NO_x emissions are two to three times greater than SO_x emissions.

As noted in Chapter Three and identified in Table 7-5, the 2018 emissions inventory lists 30 point sources with NO_x emissions greater than 100 tpy and 13 with SO_x emissions greater than 100 tpy. Point sources with emissions greater than 100 tpy represent 97 percent of Nevada's total 2018 point source inventories for SO_x and NO_x.

The 30 NO_x point sources include all four Nevada sources subject to full BART determinations, as well as three other facilities that are BART-eligible but do not cause or contribute to visibility impairment at any Class I area. Also included on the NO_x list are all five future EGUs proposed for Nevada, described in Chapter Three. The 13 SO_x sources include two facilities subject to a full BART analysis, as well as two other facilities that are BART-eligible but do not cause or contribute to visibility impairment at any Class I area. Also included on the SO_x list are three proposed coal-fired EGUs.

TABLE 7-5

SUMMARY OF SO_2 AND NO_X EMISSIONS FROM
NEVADA POINT SOURCES FOR 2018

Annual Emissions (tpy)	SO_2		NO_x	
	Number of Facilities	**Cumulative Percent of Total Point Source Emissions**	**Number of Facilities**	**Cumulative Percent of Total Point Source Emissions**
> 10,000	0	0%	1	29.0%
2,000 to 10,000	3	78.7%	6	76.3%
500 to 2000	3	92.5%	8	90.8%
100 to 500	7	97.7%	15	97.0%

A discussion of the BART process in Nevada can be found in Chapter Five where links to reports documenting the BART analyses are provided. Exemption modeling for one of the BART-eligible facilities, Chemical Lime Company located in Clark County, demonstrated that the maximum visibility impact of 0.245 delta dv occurred at the Grand Canyon approximately 90 miles away, roughly half of the cause or contribute threshold of 0.5 dv. The other BART-eligible facility, Nevada Cement Company, holds a permit to reconstruct a state-of-the-art facility resulting in an overall reduction of emissions.

Nevada Cement Company applied for and received a construction permit to construct a new, state-of-the-art cement production plant. They netted out of PSD review by shutting down and removing their current kilns and other ancillary production-related processes to make room for the new kiln. The new plant is subject to the National Emission Standards for Hazardous Air Pollutants program and will reduce overall emissions, while increasing production capacity. The net permitted (potential to emit) emission decreases for NO_x, SO_2 and PM_{10} are 1,812, 186.59 and 167.29 tons per year, respectively. Actual 2018 emissions reductions at Nevada Cement will be slightly less.

The effects of Nevada's Renewable Portfolio Standard (RPS) on EGU source retirement and replacement schedules are not well known. The portfolio standard requires each electric service provider to generate, acquire or save electricity from portfolio energy systems or efficiency measures in an amount that is not less than 20 percent of the total amount of electricity sold by the provider by 2015. Current 2018 emissions projections include five proposed EGUs for Nevada, as discussed in Chapter Three and shown on Table 3-5. The demand for one or more of these proposed EGUs may be met by renewable energy sources, negating the emissions associated with a projected EGU and therefore reducing 2018 emissions. However, it is impossible to predict at this time which or how many of these proposed EGUs will be constructed.

Many of Nevada's point sources with SO_2 or NO_x emissions greater than 100 tpy are well controlled or will be well controlled through the BART process. In addition, several of the federal pollution control programs described in Chapter Six (see section 6.5.2) address emission from point sources (i.e., Maximum Achievable Control Technology standards). The SO_2 point source inventory for 2018 represents a nearly 60 percent reduction from the baseline inventory, and the 2018 NO_x point source inventory represents a greater than 30 percent reduction from the baseline when proposed BART controls are included. These significant reductions demonstrate reasonable progress from point sources in Nevada.

7.9.1.2 Mobile Sources

Nevada has achieved significant reductions in SO_x and NO_x emissions from mobile sources through the implementation of federal, state and local emissions control programs. Implementation of the federal programs will result in a 49 percent reduction in mobile source NO_x emissions and a 63 percent reduction in mobile source SO_x emissions from the baseline to 2018 (PRP18a). These significant reductions demonstrate reasonable progress from mobile sources, both on-road and off-road, in Nevada.

Table 3-15 shows mobile sources are significant source categories for NO_x and ammonia (NH_3). On-road and off-road mobile sources contribute approximately 25 percent of the total statewide 2018 NO_x emissions inventory and 23 percent of the NH_3 inventory. Many of the federal pollution control programs identified in Chapter Six (see 6.5.2.1) focus on reducing NO_x emissions from mobile sources, both on-road and off-road. In addition, Washoe and Clark Counties have implemented mobile source emissions reduction programs to address non-attainment areas, as discussed in Chapter Six (see 6.5.2.3) and this chapter (see 7.9.2.1). The emissions reductions related to the implementation of these local programs has not been factored into the PRP18a emissions projections or modeling.

7.9.1.3 Area Sources

Area sources are by nature, relatively small emissions sources with diverse characteristics which make effective control difficult. Nevada has not evaluated or addressed emissions reductions from area sources in this, the first planning period of the sixty-year regional haze SIP process.

7.9.1.4 International Emissions

Emissions from outside the modeling domain, as well as those from Canada and Mexico contribute substantially to visibility impairment at the Jarbidge WA and other Class I areas across the WRAP. These emissions are beyond the control by federal, state or local regulatory agencies in the United States. At the Jarbidge WA, international emissions of SO_x and NO_x contribute 51 percent and 30 percent of the 2018 SO_4 and NO_3 visibility impairment at JARB1, respectively.

Emissions from Pacific Offshore sources, as discussed in Chapter Four (see 4.3), although not strictly international, include emissions from international waters of the Pacific Ocean. Emissions of SO_x and NO_x from Pacific Offshore sources contribute 6.9 percent of SO_4 visibility impairment and 1.3 percent of NO_3 visibility impairment at JARB1.

7.9.2 Additional Emissions Control Programs

Nevada has numerous existing emission control programs to improve and protect visibility in Class I areas. Generally, Nevada considers its NSR and PSD programs meet the long-term strategy requirements for preventing future visibility impairment from proposed major stationary sources or major modifications to existing facilities. In addition to Nevada's permitting program, Nevada also has emission control requirements for motor vehicles in Clark and Washoe Counties and residential burning in Washoe Country, as well as PM_{10} nonattainment/maintenance area requirements, dust suppression for construction areas and unpaved roads, and renewable energy requirements.

The state believes that its existing regulations along with the activities outlined below together provide for reasonable progress toward the national visibility goal. Nevada's continued implementation of NSR requirements with FLM involvement for Class I area impact review will protect the least impaired days from further degradation and will assure that no Class I areas with a potential to be impacted by Nevada emissions will experience degradation from expansion or growth of a single new source.

7.9.2.1 State and Local Mobile Source Programs

Nevada's two major metropolitan areas, Clark County (Las Vegas) and Washoe County (Reno), have inspection and maintenance programs per the Clean Air Act requirements for areas that were not attaining the national ambient air quality standards for carbon monoxide (CO). Washoe County has a basic program while Clark County has a low enhanced program. Both reduce CO and VOC emissions from motor vehicles.

Both Washoe and Clark Counties have Stage I and Stage II gasoline vapor recovery regulations. These systems control VOC vapor releases during the refilling of underground gasoline storage tanks and the refueling of motor vehicles. The Stage II system controls the release of VOC, benzene and toxics emitted from gasoline. Both counties have wintertime oxygenated fuel programs that reduce CO emissions.

Nevada statute requires an additional statewide program to reduce emissions of pollutants from motor vehicles, the Alternative Fueled Vehicle program. The Alternative Fueled Vehicle program requires state and local government fleets to operate 90 percent of their fleet vehicles on alternative fuel. This program reduces NO_x, SO_2, CO, VOCs and PM. Nevada also has a statewide regulation prohibiting the emission of smoke from any gasoline powered motor vehicle.

Washoe and Clark Counties were designated nonattainment for CO in 1978, along with the Lake Tahoe Basin. The Nevada portion of the Tahoe Basin and Washoe County have each been redesignated as attainment. Clark County has submitted a CO redesignation request to USEPA.

7.9.2.2 Nevada's Renewable Portfolio Standard

With large-scale geothermal development in Nevada dating back to the mid-1980's and use of hydroelectric energy since the early part of the last century, Nevada's electric utilities have pioneered the use of renewable energy. In cooperation with the utilities, Nevada was one of the first to adopt a RPS in 1997, which is now among the most aggressive in the United States. Nevada's RPS has set the bar high in terms of its percent of renewable energy, timetable and solar quota, requiring that not less than 20 percent of the total electricity sold in 2015 and thereafter be renewable. Power producers have responded by working with renewable energy companies to bring many new renewable projects into operation. As a result, Nevada now leads the nation in both geothermal and solar power per capita.

In 2007, two of the world's largest solar projects began operation in southern Nevada, the 64 MW Nevada Solar One concentrating solar power plant and the 14 MW Solar Star photovoltaic facility at Nellis AFB. Geothermal energy is a renewable resource particularly abundant in Nevada. With three new geothermal plants completed in the past year, and a total of 26 projects under contract, Nevada's main utility, NV Energy, is on-the-books to doubling the geothermal portion of its renewable energy portfolio by 2012 to a total of nearly 500 MW. These efforts to meet the RPS will replace some of the need for fossil fuel fired EGUs in Nevada.

7.9.2.3 Marine Diesel Engine Rule

As part of its National Clean Diesel Campaign, USEPA promulgated a rule to reduce diesel emissions from marine engines less than 30 liters per cylinder effective July 7, 2008. These engines are used to power a wide variety of vessels, from small fishing and recreational boats to large tugs and Great Lakes freighters. They are also used to generate auxiliary vessel power, including on ocean-going ships. The new standards will dramatically reduce PM and NO_x emissions by: tightening emissions standards for remanufactured engines; setting near-term engine-out emissions standards (Tier 3) for newly-built marine diesel engines; and setting longer-term standards (Tier 4) that reflect the application of high-efficiency after-treatment technology.

USEPA estimates 90 percent PM reductions and 80 percent NO_x reductions from Tier 4 engines meeting these standards, compared to engines meeting the current Tier 2 standards. By 2030 this program will reduce annual nationwide emissions of NO_x by about 800,000 tons and PM emissions by 27,000 tons, and those emission reductions continue to grow beyond 2030 as fleet turnover is completed. Additional information regarding this program can be found at http://www.epa.gov/otaq/regs/nonroad/420f08004.htm.

7.9.3 Other Considerations

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 state jurisdiction. Emissions of NO_x and SO_2 from point, mobile and area sources are the predominant anthropogenic pollutants to be addressed through regional haze SIPs in the West.

The largest category of stationary source SO_2 and NO_x emissions is electric generating units, a source category from which substantial reductions have already occurred.

There are significant control programs in place in Nevada and the WRAP region to reduce SO_2 and NO_x emissions between the baseline period and 2018. Most notable of these programs is the implementation of BART requirements, which are anticipated to result in significant reductions of SO_2 and NO_x emissions in the WRAP region. These reductions are in addition to significant emission reductions of SO_2 and NO_x from 2002 to 2006 from EGUs (BART and non-BART sources) in the west, on the order of 30 percent for SO_2 and 10 percent for NO_x.

However, the full impact of these significant emissions reductions has not yet been fully evaluated by Nevada. Therefore, for the 2013 interim review, Nevada will determine refined reasonable progress at the Jarbidge WA in consideration of:

- Evolving modeling and technical analyses;
- Evolving progress on BART and reasonable progress from contributing states; and
- Limited control Nevada has with respect to natural, interstate and international emissions that contribute to visibility impairment at the Jarbidge WA.

WRAP will conduct additional modeling with updated 2018 emissions inventories that reflect additional control measures identified by states. The updated inventories will incorporate the results of Nevada and other WRAP states' BART determinations, as well as other reasonable measures states identify for implementation in the initial review period. Additional reductions to the WRAP-wide, as well as statewide emissions are expected as states move through development of their regional haze programs. These modeling efforts will be scheduled by RMC upon completion of BART determinations by all WRAP states, anticipated in 2009 to 2010.

A complete assessment of Nevada's RPG cannot be made until the effects on visibility impairment resulting from emissions reductions due to full implementation of BART and other RH SIP control programs are determined. However, 2018 reasonable progress measured at the Jarbidge WA is expected to be better than shown by the current modeling projections, which are based on the PRP18a emissions inventory. Nevada will continue to work with the WRAP's ongoing modeling program to refine the RPG for the Jarbidge WA as these data become available. Nevada does not anticipate revision of the RPG based on the updated modeling. The modeling results will, however, provide Nevada with additional tools to evaluate and refine its long-term strategy as part of the mid-course regional haze SIP review.

Under the proposed long-term strategy described herein, there may be some additional visibility improvements that occur by 2018 beyond those reflected in the RPGs identified in Chapter Six. Emissions reductions due to the implementation of some state and local pollution control programs have not been or can not be quantified and have not been included or will not be included in the emissions inventories used for visibility and source apportionment modeling. The following section describes additional control programs in Nevada, the benefits of which have not been included in Nevada's RPG identified in Chapter Six.

7.9.3.1 Uncertainty

Nevada's reasonable progress demonstration and development of a long-term strategy have identified numerous factors affecting the implementation of our long-term strategy and resulting reasonable progress. These factors have important but unknown impacts to all elements of the plan to reduce or contain emissions contributing to regional haze. The most significant factor is the uncertainty of the projected 2018 emission inventories, which may not reflect actual 2018 emissions for Nevada sources. Some of the factors affecting Nevada's reasonable progress are related to projected emissions inventories and the uncertainties associated with growth projections and the implications of future regulatory actions.

Nevada has seen significant reductions in economic and population growth in the last two years, which may compromise the earlier growth projections. The observed slowdown in population growth may reduce actual area and mobile source emissions from projected 2018 values. The current economic slowdown in Nevada has severely curtailed residential and commercial real estate construction, a significant component of off-road mobile source emissions. Likewise, the high fuel costs of 2008 have resulted in lower fuel demand and therefore less on-road mobile source emissions. Current economic forecasts only highlight the uncertainties of projecting emissions based on growth estimates, with some experts predicting several years of slow economic growth.

Nevada acknowledges the many difficulties associated with the projection of area and mobile source emissions, but remains confident the inventories represent the best available data at the time they were developed. However, Nevada also acknowledges there is associated uncertainty with the area source projections, which may over-predict future emissions in light of the current economic times.

Repair and replacement schedules for large point sources of NO_x and SO_2 are difficult for the regulatory community to anticipate. It is also difficult to predict the potential permit revisions for other large sources in response to growth of any particular industry sector. Repair and replacement of current facilities will continue to drive permit revisions at their own pace, but will likely reduce emissions as new technology is incorporated into the facilities.

Another level of uncertainty in the growth projections relates to regulatory uncertainty. The consequences of future regulatory actions are not well known at this time. The Clean Air Mercury Rule was recently vacated by the courts. Whether USEPA will reissue this regulation or what form it will take is not known at this time. The other area of regulatory uncertainty is how USEPA will regulate green house gas emissions and what ancillary benefits to visibility will be realized.

$PM_{2.5}$ and ozone nonattainment SIPs are due 2012 and 2013. Most Nevada sources will not be affected by nonattainment SIPs; however sources in Washoe or Clark Counties maybe subject to nonattainment SIPs. Certainly there will be localized reductions in $PM_{2.5}$ and ozone as SIPs are implemented in nonattainment areas, not only in Nevada, but across the west. Additional control measures resulting from nonattainment SIPs and other regulatory actions will result in direct reductions of visibility impairing pollutants. The co-benefits of implementing additional controls for $PM_{2.5}$ and ozone will also reduce emissions of visibility impairing pollutants.

7.9.3.2 Contributions to Impairment at Class I Areas Outside of Nevada

Tables 4-3 and 4-4 identify Nevada's contribution to visibility impairment at Class I areas in the five states adjacent to Nevada based on the Particulate Matter Source Attribution Tracking modeling discussed in Chapter Four. In order to evaluate whether Nevada's SIP includes all measures necessary to obtain its share of the emission reductions needed to meet the progress goals for those Class I areas, NDEP calculated:

- The visibility reductions needed at these Class I areas to achieve the 2018 URP goal;
- The percentage of the needed reduction achieved based on the Base02d emission inventory and modeling scenario;
- Nevada's emissions reduction share;
- The contribution of Nevada emissions to SO_4 and NO_3 extinction;
- The percentage change in Nevada's emissions from Plan02d to PRP18a; and
- The percentage change in Nevada's weighted emissions potential (WEP) from Plan02d to PRP18a.

This information is presented in Table 7-6 for the Class I area in each adjacent state with the highest modeled SO_4 and NO_3 contribution to visibility impairment for the 2018 worst days (see Tables 4-3 and 4-4). NDEP has included the Hoover Wilderness Area at the request of the FLMs.

Examination of Table 7-6 shows that the percentage of Nevada's emissions reductions or weighted emissions reductions exceed the percentage of Nevada's contribution to visibility impairment at all Class I areas listed. Some of the numbers listed in the WEP change column are negative, reflecting an increase in Nevada's WEP. These increases are an artifact of the WEP methodology, where all the percentages of emission contribution are normalized to the largest valued grid cell. This is especially evident for SO_4 at Hells Canyon Wilderness Area in Oregon, where Nevada's WEP contribution increased by nearly 30 percent. This is due to the significant SO_x emissions reductions achieved by sources closer to Hells Canyon Wilderness Area (i.e. sources in Idaho, Oregon and Washington) and the inverse distance function of the WEP. Chapter One (section 1.3.3.2 Source Apportionment Modeling) describes the WEP methodology and the limitations regarding the use of these data.

In order to more fully understand the significance of the WEP data presented in Table 7-6, the upper portion of Figure 7-3 shows the significant contributions and 2018 reductions for Idaho, Oregon and Washington sources' potential contributions and the relatively small potential contribution for Nevada sources at Hells Canyon Wilderness Area. The lower portion of Figure 7-3 presents the SO_x weighted emission potential map for Hells Canyon Wilderness Area. Note that Nevada has only three grid cells with weighted emission potentials greater than one percent, one of which is LS Power's proposed 1500 MW coal-fired EGU in east central Nevada.

Figures 7-4, 7-5 and 7-6 show similar WEP analyses for the Sawtooth Wilderness Area, Desolation Wilderness Area, and Hoover Wilderness Area, respectively. Review of Chapter Three (section 3.8.1 Nevada SO_x Emission Inventory for 2002 and 2018, Table 3-7) shows that area sources are the only Nevada source category with significant growth (1,243 tons or 10 percent) of SO_2 emissions. Figure 3-10 is a regional map of gridded SO_x emissions, while Figure 3-11 breaks down Nevada's SO_2 emissions by county.

These figures and Table 7-6 are all based on the PRP18a emission inventory, which does not incorporate the full implementation of BART in Nevada or across the WRAP region (see Chapter One 1.3.2 Emissions Analyses and Projections). Table 7-1 identifies the additional emissions reductions from the PRP18a inventory resulting from the full implementation of BART in Nevada.

TABLE 7-6

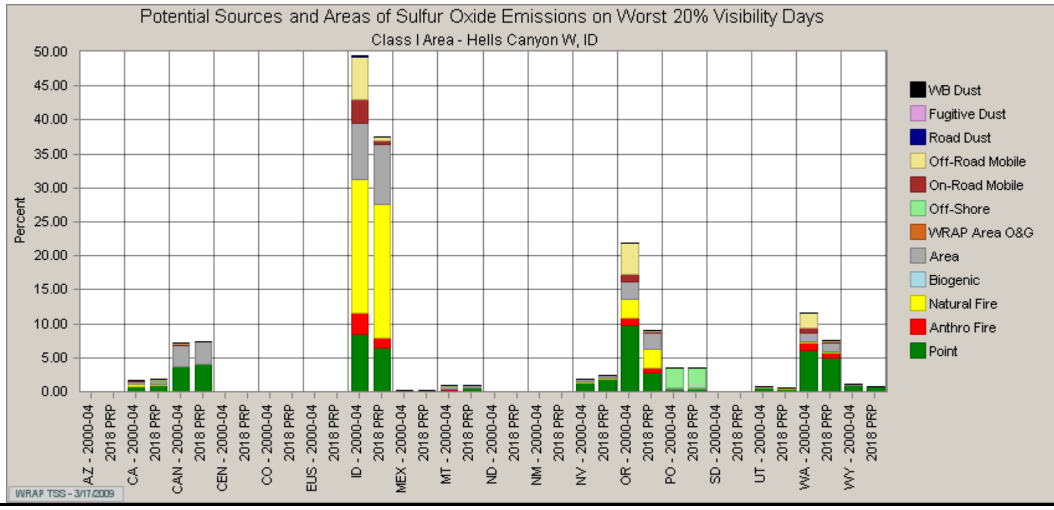
SUMMARY OF VISIBILITY IMPAIRMENT AT NEARBY CLASS I AREAS
AND NEVADA'S EMISSIONS REDUCTIONS

Monitor - Component	Baseline Extinction (dv or Mm^{-1})	2018 URP (dv or Mm^{-1})	Extinction Reduction Needed (percent)	2018 RPG (dv or Mm^{-1})	Reduction Acheived (percent)	2018 Pollutant Contribution by Nevada from PSAT (percent)	Nevada's Emissions Reduction Share (percent)	Reduction in Nevada Emissions Base02d to PRP18a (percent)	Reduction Nevada Weighted Emission Potential* (percent)
Arizona									
GRCA2 - Deciview	11.66	10.58	9.3%	11.10	4.8%				
GRCA2 - SO_4	5.36	4.11	23.3%	4.56	14.9%	2.8%	0.7%	33.0%	65.2%
SYCA1 - Deciview	15.25	13.25	13.1%	15.08	1.1%				
SYCA1 - NO_3	2.03	1.69	16.7%	1.67	17.7%	4.3%	0.7%	16.6%	22.5%
California									
BLIS1 - Deciview	12.63	11.10	12.1%	12.22	3.2%				
BLIS1 - SO_4	5.07	3.96	21.9%	4.90	3.4%	4.4%	1.0%	33.0%	-4.4%
BLIS1 - NO_3	2.38	2.01	15.5%	1.59	33.2%	20.0%	3.1%	16.6%	36.2%
HOOV1 - Deciview	12.87	11.66	9.4%	12.45	3.3%				
HOOV1 - SO_4	5.00	3.91	21.8%	4.61	7.8%	2.6%	0.6%	33.0%	-1.0%
HOOV1 - NO_3	1.63	1.43	12.3%	1.35	17.2%	8.3%	1.0%	16.6%	23.4%
Idaho									
SAWT1 - Deciview	13.78	12.06	12.5%	13.25	3.8%				
SAWT1 - SO_4	3.06	2.50	18.3%	2.62	14.4%	2.5%	0.5%	33.0%	-7.7%
SAWT1 - NO_3	0.63	0.65	-3.2%	0.55	12.7%	3.2%	-0.1%	16.6%	12.0%
Oregon									
HECA1 - Deciview	18.55	16.17	12.8%	16.60	10.5%				
HECA1 - SO_4	8.37	6.35	24.1%	7.41	11.5%	4.0%	1.0%	33.0%	-29.2%
HECA1 - NO_3	28.47	19.69	30.8%	20.56	27.8%	5.5%	1.7%	16.6%	13.8%
Utah									
ZION1 - Deciview	13.24	11.78	11.0%	12.76	3.6%				
ZION1 - SO_4	5.29	4.04	23.6%	4.48	15.3%	5.6%	1.3%	33.0%	43.8%
BRCA1 - Deciview	11.65	10.52	9.7%	11.22	3.7%				
BRCA1 - NO_3	2.52	2.06	18.3%	2.27	9.9%	8.8%	1.6%	16.6%	21.7%

* Anthropogenic source categories only.

FIGURE 7-3

WEIGHTED EMISSION POTENTIAL ANALYSIS FOR HELLS CANYON WILDERNESS AREA



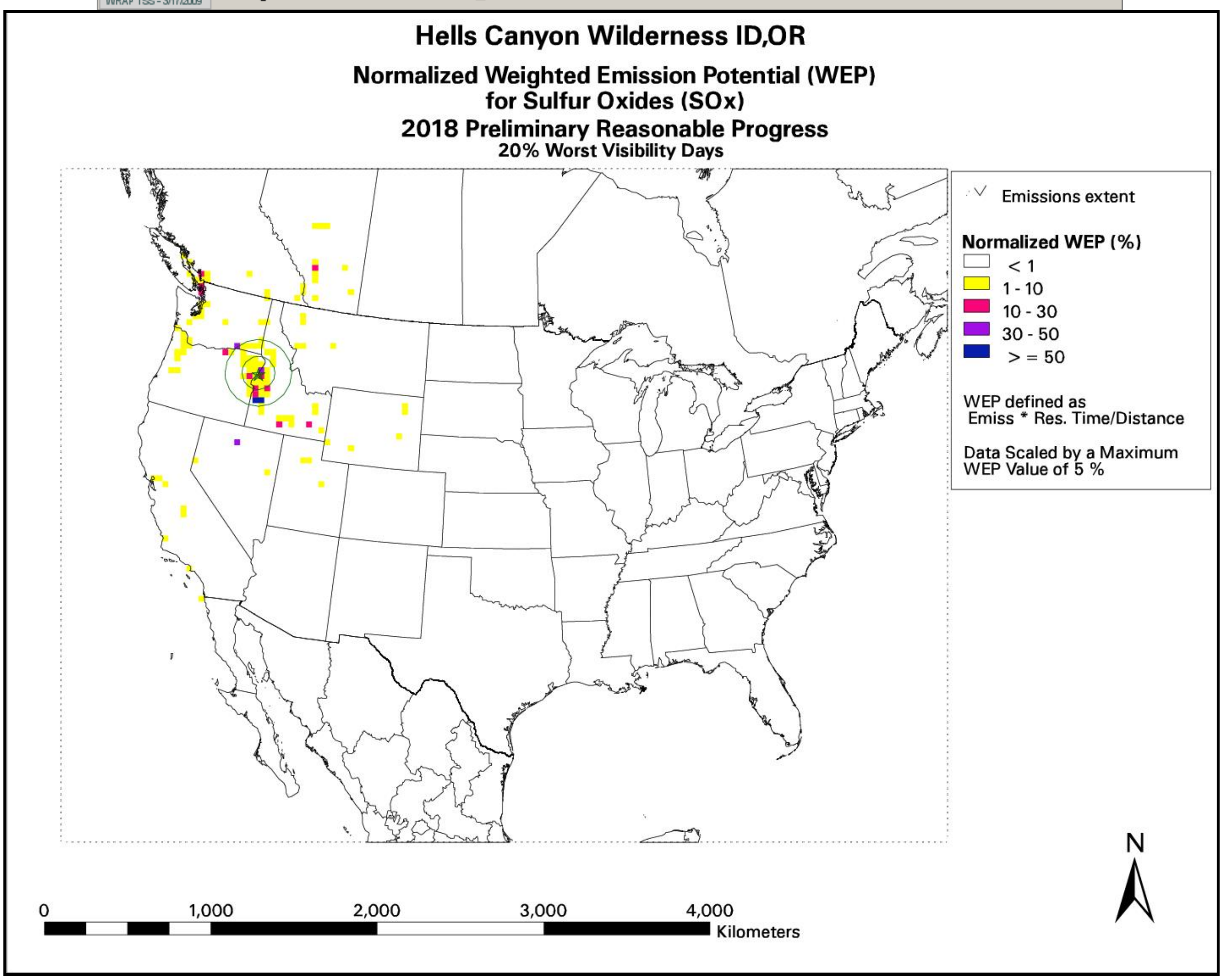


FIGURE 7-4

WEIGHTED EMISSION POTENTIAL ANALYSIS FOR SAWTOOTH WILDERNESS AREA

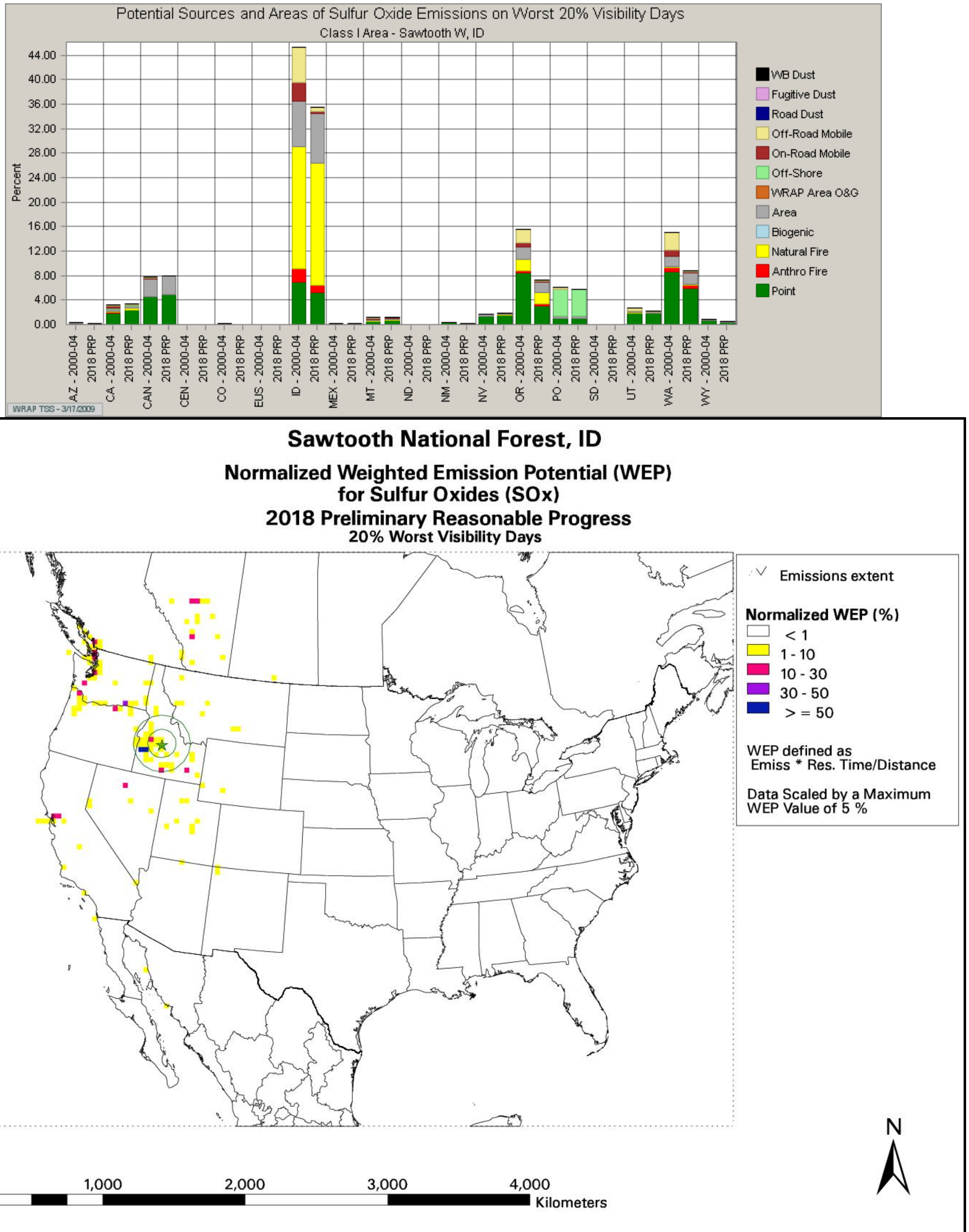
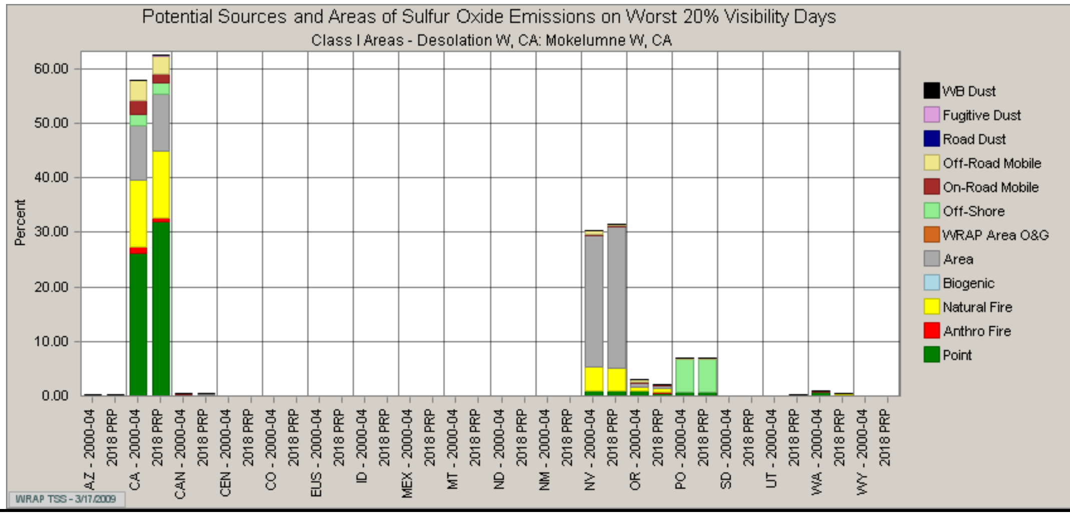


FIGURE 7-5

WEIGHTED EMISSION POTENTIAL ANALYSIS FOR DESOLATION WILDERNESS AREA



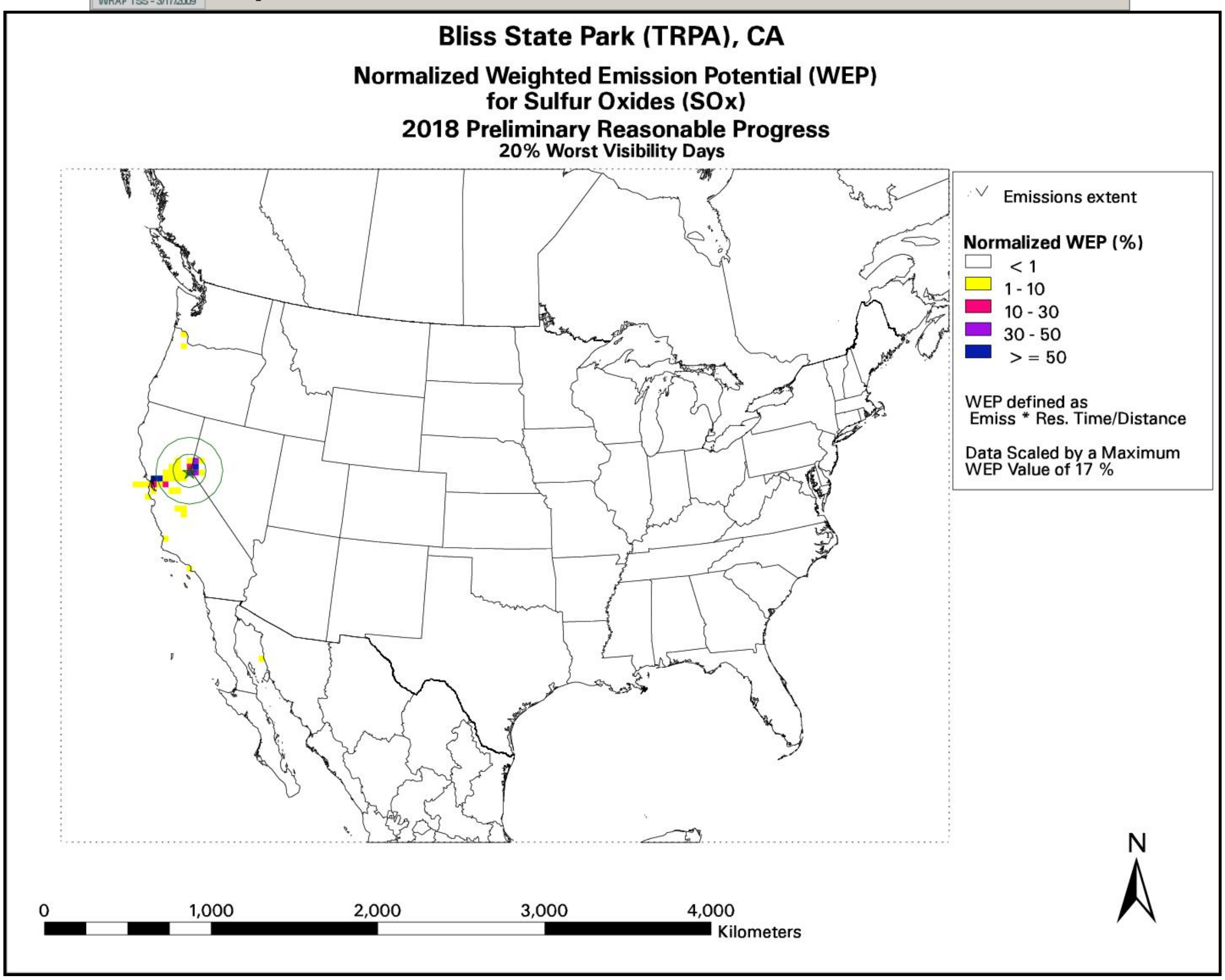
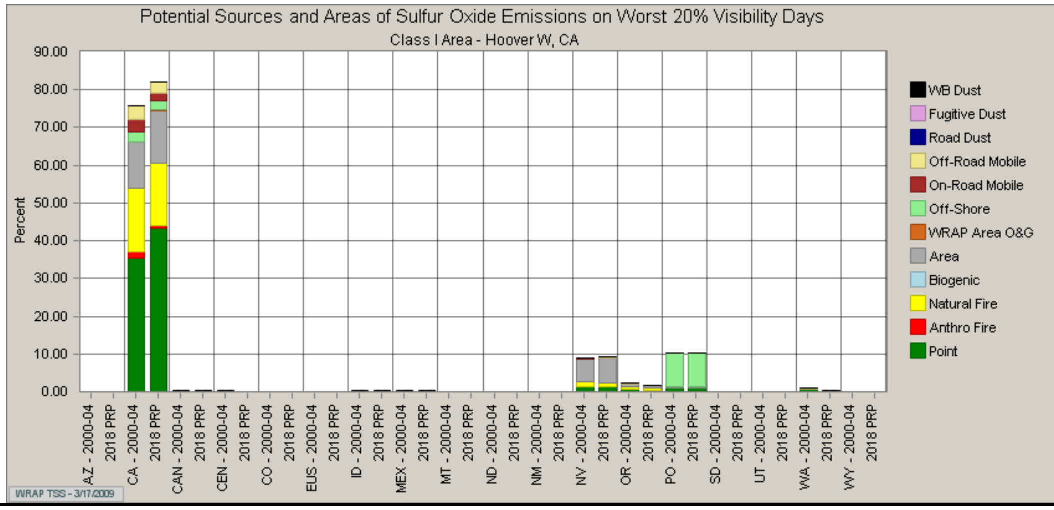
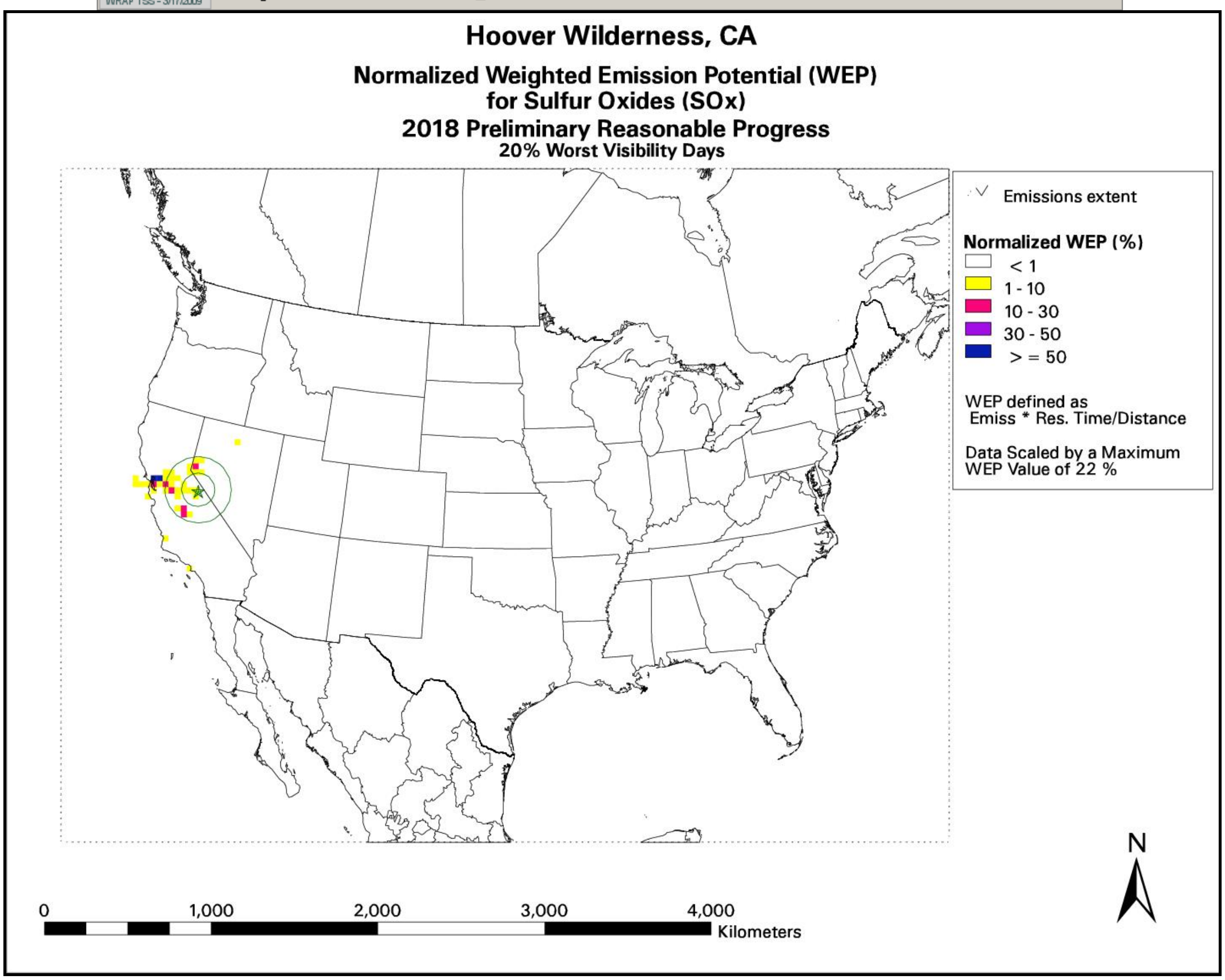


FIGURE 7-6

WEIGHTED EMISSION POTENTIAL ANALYSIS FOR HOOVER WILDERNESS AREA





Baseline and projected annual SO_x emissions for the states adjacent to Nevada are shown in Figure 7-7, while Table 7-7 shows the percentage change in the inventories.

FIGURE 7-7

BASELINE AND PROJECTED SO_x EMISSIONS BY STATE

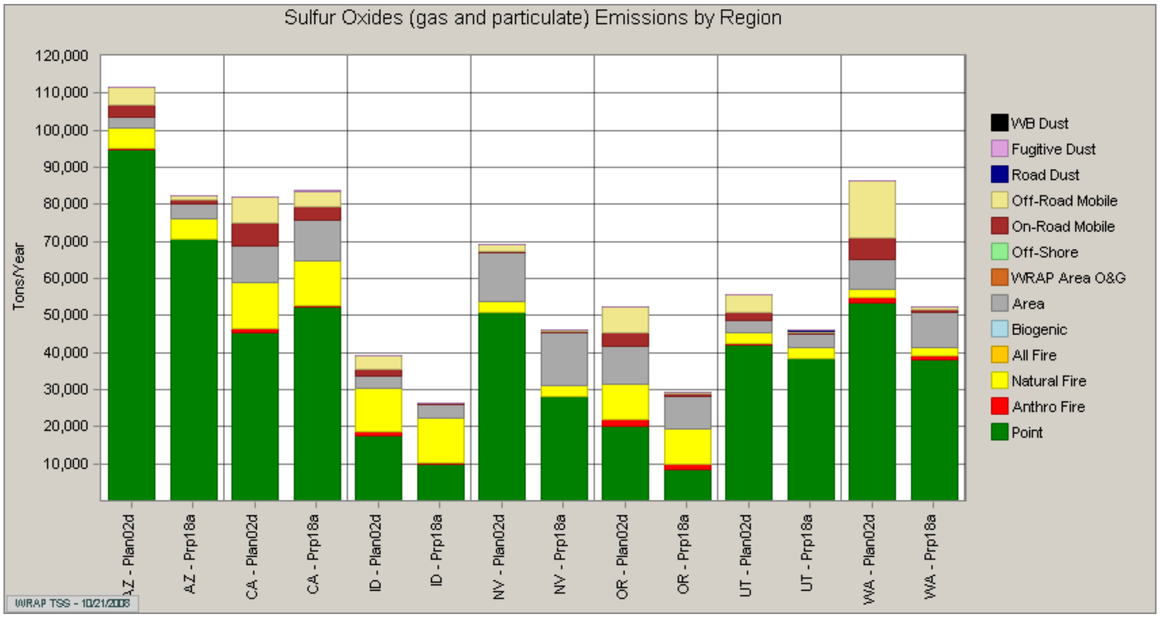


TABLE 7-7

BASELINE AND PROJECTED SO_x INVENTORIES BY STATE

State	Plan02d	PRP18a	Percent Change
AZ	111,709	82,334	26.3%
CA	82,089	83,611	-1.9%
ID	39,163	26,465	32.4%
NV	68,979	46,224	33.0%
OR	52,449	29,336	44.1%
UT	55,640	45,916	17.5%
WA	86,323	52,493	39.2%

7.10 REASONABLE PROGRESS ASSESSMENT

Nevada has concluded that the emissions reductions due to federal, state and local "on-the-books" and "on-the-books" emissions control coupled with those resulting from the installation of BART requirements represent a reasonable long-term strategy for the first regional haze planning period. Modeled visibility improvement at the Jarbidge WA for the 20 percent worst days is expected to be better than the uniform rate of progress by 2018 based on reductions from federal and state "on-the-books" and "on-the-books" emissions controls represented by the 18PRPa emissions inventory. Visibility on the 20 percent best days is also projected to improve in 2018 as a result of the emissions reductions expected from federal and state control programs.

Nevada's 2018 RPG shows better visibility improvement at the Jarbidge WA than the uniform rate of progress. This significant progress parallels the uniform rate of visibility improvement needed to restore natural visibility conditions by 2064 as required by the regional haze rule. Visibility impairment at the Jarbidge WA is dominated by emissions from natural or otherwise uncontrollable sources or areas. Air management agencies are unable to control emissions from natural sources, or emissions from sources beyond the purview of the United States' regulatory authority.

For these reasons, Nevada has concluded the long-term strategy identified and discussed herein makes reasonable progress toward the national goal of remedying existing impairment of visibility in the Jarbidge WA resulting from manmade air pollution for the first planning period. It is reasonable for Nevada to defer reductions to later planning periods in order to maintain a consistent glidepath toward the long-term goal.

Nevada's RPG is an interim goal representing incremental visibility improvement over the first planning period ending 2018. As such, Nevada will take into account the effects of other state and local controls when setting reasonable progress as they become available, even though they may not be federally enforceable programs. Nevada will take other states' SIPs and BART determinations into account during the first review and evaluation of our long-term strategy, modeling results and RPG.

To summarize, the regional haze SIP presented here documents the technical basis to determine our share of emissions reduction obligations necessary to achieve reasonable progress in the Jarbidge WA and other Class I areas affected by Nevada's emissions of visibility impairing pollutants. Nevada considers our progress to incrementally improve visibility at the Jarbidge WA and other Class I areas to be reasonable for the first regional haze planning period. In addition, Nevada has identified several scenarios that suggest additional reductions in Nevada's projected 2018 emissions inventory that will likely result in better projected visibility improvement at the mandatory Class I areas than currently predicted.

Under the long-term strategy described herein, there will be some additional visibility improvements that occur by 2018, beyond those reflected in the RPGs identified in Chapter Six. Beginning in 2009, Nevada will develop procedures and schedules for evaluation of source categories to determine what additional controls are appropriate to achieve further reasonable progress. This evaluation will take into account any new relevant monitoring and modeling information related to the contribution of Nevada anthropogenic sources to Class I impairment, new regulations that may benefit regional haze, and any new guidance related to the identifying additional control measures consistent with reasonable progress requirement of the regional haze rule. Nevada's commitment to progress reports and future plan revisions is discussed in Chapter Nine.

Chapter Eight - Monitoring Strategy

8.1 INTRODUCTION

8.2 NEVADA’S REGIONAL HAZE VISIBILITY MONITORING STRATEGY

8.3 COORDINATION WITH §51.305 MONITORING STRATEGY REQUIREMENT

8.4 ASSOCIATED REGIONAL HAZE MONITORING STRATEGY REQUIREMENTS

8.5 OVERVIEW OF IMPROVE SITE AT THE JARBIDGE WILDERNESS AREA

8.6 COMMITMENT TO FUTURE MONITORING

8.1 INTRODUCTION

The Regional Haze Rule (RHR) at 40 CFR 51.308(d)(4) requires states to submit a monitoring strategy for measuring, characterizing and reporting of regional haze visibility impairment that is representative of all mandatory Class I areas within the state. The regional haze monitoring strategy must also coordinate with the monitoring strategy required in 40 CFR 51.305 for reasonably attributable visibility impairment, as well as provide for a variety of other requirements designed to evaluate reasonable progress toward meeting national visibility goals.

8.2 NEVADA'S REGIONAL HAZE VISIBILITY IMPAIRMENT MONITORING STRATEGY

Visibility conditions are presently measured by the Interagency Monitoring of Protected Visual Environments (IMPROVE) monitoring network. In the mid-1980's, the IMPROVE network was established to measure visibility impairment in mandatory Class I areas throughout the United States. The monitoring sites are operated and maintained through a formal cooperative relationship between the USEPA and Federal Land Managers (FLM) agencies, which include: the National Park Service, the U.S. Fish and Wildlife Service, the Bureau of Land Management and the U.S. Forest Service.

The objectives of the IMPROVE program are:

1. To determine current visibility and aerosol conditions in mandatory Class I areas;
2. To identify chemical species and emission sources responsible for existing human-made visibility impairment;
3. To document long-term trends for assessing progress towards the national visibility goals; and
4. With the enactment of the regional haze program, to provide regional haze monitoring representing all visibility in mandatory Class I areas, where practical.

Given that the IMPROVE monitoring data from 2000 through 2004 serves as the baseline for the regional haze program, the future 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. The data collected at these sites are used by a variety of professionals in industry and at regulatory agencies to better understand and protect the visual air quality resources in mandatory Class I areas. The IMPROVE network documents the visual air quality in wilderness areas and national parks throughout the United States.

Nevada's regional haze monitoring strategy relies on information generated through the IMPROVE network for the Jarbidge Wilderness Area (Jarbidge WA). It is expected that the IMPROVE program will:

1. Maintain a stable configuration of the individual monitors and sampling sites, and stability in network operations for the purpose of continuity in tracking reasonable progress trends;
2. Assure sufficient data capture at each site for all visibility-impairing species;

3. Comply with the USEPA quality control and assurance requirements; and
4. Prepare and disseminate periodic reports on IMPROVE operations.

8.3 COORDINATION WITH §51.305 MONITORING STRATEGY REQUIREMENT

Nevada is subject to a federal visibility protection plan (visibility FIP) as opposed to having an approved visibility protection SIP. Nevada's visibility FIP is found at 40 CFR 52.1488. The visibility monitoring strategy provisions of 40 CFR 52.26 are incorporated into Nevada's visibility FIP. 40 CFR 52.26(c)(1) requires the USEPA in cooperation with the appropriate FLM to monitor visibility within each visibility protection area in the state. Accordingly, the FLMs operate the IMPROVE program which addresses visibility monitoring at the Jarbidge WA, as well as visibility protection areas outside the state, and establishes background visibility for the purposes of the regional haze requirements.

Nevada's regional haze monitoring strategy will coordinate with the Nevada visibility FIP by continuing to utilize the data collected by the IMPROVE program and will promote reasonable progress toward the national visibility goal. Under Nevada's visibility FIP, Southern California Edison's Mohave Generating Station[1] is required to meet certain emission control and limitation requirements for SO_2; emission control and opacity requirements for PM; and emission controls for NO_x. Under this regional haze (RH) SIP, the Mohave Generating Station is subject to Best Available Retrofit Technology (BART). The BART requirements result in substantially greater reductions of SO_2 and PM_{10} emissions than the expected reductions from the visibility FIP. NO_x emissions are also expected to decrease as a result of BART when compared to the visibility FIP. Chapter Five includes a discussion of the BART process for the Mohave Generating Station.

8.4 ASSOCIATED REGIONAL HAZE MONITORING STRATEGY REQUIREMENTS

Other associated monitoring strategy components, as required by 40 CFR 51.308(d)(4)(i-vi) for Nevada's SIP commitment, are presented below. The RHR requirement is shown below in italics, followed by Nevada's response.

The implementation plan must also provide for the following:

(i) The establishment of any additional monitoring sites or equipment needed to assess whether reasonable progress goals to address regional haze for all mandatory Class I Federal areas within the State are being achieved.

Sufficient funding for a complete and representative monitoring network within the IMPROVE program is supported by the USEPA. The IMPROVE site representing Nevada's Class I area at the Jarbidge WA is considered to be sufficiently representative to support a determination of reasonable progress for the Jarbidge WA.

[1] On June 10, 2009, the owners of the Mohave Generating Station, including Southern California Edison (SCE), announced the decision to decommission the station and remove the generating facility from the site. The SCE news release states that in 2010, the plant's generating equipment will be removed and its operating permits terminated (http://www.edison.com/pressroom/pr.asp?bu=sce&year=2009&id=7234).

(ii) *Procedures by which monitoring data and other information are used in determining the contribution of emissions from within the State to regional haze visibility impairment at mandatory Class I areas both within and outside the State.*

Visibility monitoring data is presently processed and maintained through the coordination of the IMPROVE program. 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.

Generally, the Western Regional Air Partnership (WRAP) has analyzed, reduced and provided information on relative contributions to visibility impairment. Nevada has and will continue to use data reported by the IMPROVE program as input into the regional technical support analysis tool found at the Visibility Information Exchange Web System (VIEWS) and WRAP's Technical Support System (TSS), 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 is implemented. If the technical support service that the WRAP has provided for this SIP is not available in the future, Nevada is uncertain how it would fulfill this requirement. Nevada does not have the resources to replace the functions that the WRAP has provided in support of the first planning period for the RH SIP.

Evaluation activities, using the technical support provided by the WRAP as long as possible, will occur no less than every five years in association with 5-year progress reports and 10-year SIP revisions.

(iii) *For a State with no mandatory Class I Federal areas, procedures by which monitoring data and other information are used in determining the contribution of emissions from within the State to regional haze visibility impairment at mandatory Class I Federal areas in other States.*

Because Nevada has a mandatory Class I Federal area (Jarbidge WA), this requirement is addressed in paragraph (ii) above.

(iv) *The implementation plan must provide for the reporting of all visibility monitoring data to the Administrator at least annually for each mandatory Class I Federal area in the State. To the extent possible, the State should report visibility monitoring data electronically.*

Visibility monitoring data is available to the public, states and the USEPA in an electronic format at the following websites: IMPROVE (http://vista.cira.colostate.edu/improve/) and VIEWS (http://vista.cira.colostate.edu/views/). Nevada will depend on the continued routine timely reporting of monitoring data by these programs.

(v) A statewide inventory of emissions of pollutants that are reasonably anticipated to cause or contribute to visibility impairment in any mandatory Class I Federal area. The inventory must include emissions for a baseline year, emissions for the most recent year for which data are available, and estimates of future projected emissions. The State must also include a commitment to update the inventory periodically.

With the support of the WRAP, Nevada has prepared a statewide inventory of emissions that can reasonably be expected to cause or contribute to visibility impairment in mandatory Class I areas. Chapter Three of this SIP summarizes the emissions by pollutant and source category. Nevada commits to updating its statewide emissions inventory periodically. The inventory updates will be used for state tracking of emission changes, determining trends and providing input into the WRAP's evaluation of whether reasonable progress goals are being achieved, as well as other regional analyses.

Nevada will depend upon and participate in additional periodic collective emissions inventory efforts by the WRAP. Further, the state will continue to depend on and use the capabilities of the WRAP-sponsored Regional Modeling Center to simulate the air quality impacts of emissions for haze planning purposes. If the technical support service that the WRAP has provided for this SIP is not available in the future, Nevada is uncertain how it would fulfill the requirement for estimates of future projected emissions.

(vi) Other elements, including reporting, recordkeeping, and other measures, necessary to assess and report on visibility.

Nevada will track data related to those sources for which the state has regulatory authority, and will depend on the IMPROVE program and WRAP-sponsored collection and analysis efforts and data support systems to assess and report on visibility.

8.5 OVERVIEW OF IMPROVE SITE AT THE JARBIDGE WILDERNESS AREA

The Jarbidge WA, described in Chapter One, is the only mandatory Class I area requiring visibility monitoring within Nevada. The IMPROVE monitoring site for the Jarbidge WA is located in the Humboldt National Forest in northeastern Nevada, approximately one kilometer north of the city of Jarbidge in the Jarbidge River drainage. The monitoring site has been maintained and operated by the U.S. Forest Service since 1986. As indicated previously, monitoring data may be obtained from the VIEWS and IMPROVE websites, as well as the WRAP TSS website.

8.6 COMMITMENT TO FUTURE MONITORING

Nevada is committed to continue using the IMPROVE monitoring data. 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. Also, the state commits to continue developing updated emission inventory data to allow for tracking emission increases or decreases as related to regional haze, as funding and resources allow. Nevada updates its point source emission inventory for major sources every year as required by USEPA. In addition, Nevada updates its entire emission inventory every three years (all point sources, area sources and mobile sources) as required by USEPA for the National Emission Inventory. Information collected will be made available on a periodic basis. As part of the periodic RH SIP revision discussed in Chapter 9, Nevada will re-evaluate the adequacy of the existing monitoring strategy.

Chapter Nine - Coordination, Future Commitments and Requirements

9.1 PLAN DEVELOPMENT

9.1.1 Past Coordination and Consultation with FLMs
9.1.2 Past Collaboration with Tribes
9.1.3 Past Consultation with other States

9.2 FUTURE COORDINATION AND CONSULTATION COMMITMENTS

9.2.1 Future FLM Coordination and Consultation
9.2.2 Future Tribal Coordination and Consultation
9.2.3 Future Inter-state Coordination and Consultation
9.2.4 Future Regional Planning Coordination and Consultation

9.3 COMMITMENT TO PROGRESS REPORTS

9.4 DETERMINATION OF CURRENT PLAN ADEQUACY

9.5 COMMITMENT TO FUTURE SIP REVISIONS

9.1 PLAN DEVELOPMENT

The Western Regional Air Partnership (WRAP) represents a collaboration of western states, tribal governments, federal agencies, and industry representatives. The WRAP was formed in 1997 as the successor to the Grand Canyon Visibility Transport Commission. The WRAP's primary focus is to develop and implement the technical and policy tools needed by western states and tribes to comply with the Regional Haze Rule (RHR). The WRAP is administered jointly by the Western Governors' Association and the National Tribal Environmental Council. WRAP activities are conducted by a network of committees and forums composed of WRAP members and stakeholders who represent a wide range of viewpoints. An initial long-term strategic plan was completed by the WRAP in 2003. Through the WRAP, states, tribes, USEPA and Federal Land Managers (FLMs), working with non-governmental organizations, including industry and environmental organizations, developed and implemented numerous air quality policies that have improved the environment in the western United States.

The initial strategic plan: (1) identified major products and milestones; (2) served as an instrument of coordination; (3) provided the direction and transparency needed to foster stakeholder participation and consensus-based decision-making, which are key features of the WRAP process; and (4) provided guidance to the WRAP forums and committees. In March 2008, the 2008-2012 WRAP strategic plan was adopted by the WRAP Board. The 2008-2012 strategic plan (http://wrapair.org/WRAP/documents/WRAP_2008-12_Strategic_Plan3_08final.pdf) addresses implementation of the regional haze (RH) SIPs and a one-atmosphere analysis in the west for the next five years. The 2008-2012 strategic plan also addresses refinement and development of analysis tools for evaluation of ongoing and future control programs for air quality planning focusing on:

1. Ongoing implementation of the regional haze program;
2. Technical and policy support related to other regional air quality issues, such as ozone and particulate matter National Ambient Air Quality Standards, mercury and nitrogen deposition impact on ecosystems, regionally-appropriate emissions management strategies; and
3. Technical and policy support on issues related to climate change and energy.

Through participation in the WRAP, a significant portion of the consultation process with FLMs, tribes and other states has been met. In the WRAP process, stakeholders participated in various forums and workgroups to help develop a coordinated emissions inventory and analysis of the impacts that sources have on regional haze in the West. Coordination and evaluation of monitoring data and modeling processes were also overseen by WRAP participants. Although not a formal member, Nevada has been an active participant in the WRAP since its inception and in the forums, workgroups and committees that were formed to address many elements of this SIP.

9.1.1 Past Coordination and Consultation with FLMs

40 CFR 51.308(i) of the RHR requires coordination between states and the FLMs. Nevada has provided agency contacts to the FLMs as required in 40 CFR 51.308(i)(1).

During development of this SIP, the FLMs were consulted in accordance with the provisions of section 51.308(i)(2). Numerous opportunities were provided by the WRAP for FLMs to participate fully in the development of technical documents developed by the WRAP. This included the opportunity to review and comment on these analyses, reports and policies. Nevada provided additional opportunities for coordination and consultation with FLMs as the SIP was developed through local meetings and stakeholder workshops. The FLM consultation process included the opportunity to discuss their assessment of visibility impairment at the Jarbidge Wilderness Area (Jarbidge WA), and to provide recommendations on reasonable progress goals and the development and implementation of visibility control strategies.

This SIP was submitted to the FLMs on January 5, 2009 for a 60-day review and comment period. Comments were received from the FLMs on March 4 and 6, 2009. As required by 40 CFR 51.308(i)(3), the FLM comments and state responses are included in Appendix C.

A document summarizing the WRAP consultation process is provided on the WRAP web site (http://www.wrapair.org/forums/iwg/meetings/071115c/WRAP_posted_meetings_and_conference_calls_10-11-07.pdf). The purpose of the summary is to gather a consolidated list of each forum, committee and workgroup, its purpose, membership, significant work products and meetings in one place. The draft document, although not inclusive of all the meetings and conference calls held by the WRAP, demonstrates the extent of consultation among the WRAP partners and stakeholders since its inception.

9.1.2 Past Collaboration with Tribes

Nevada sent letters to the WRAP Tribal Caucus Coordinator on September 15, 2006 and March 26, 2008 providing the National Tribal Environmental Council (NTEC) with a contact person for the State of Nevada. These letters also stated that Nevada will work closely with the Nevada Division of Environmental Protection's tribal liaison. As described above, Nevada participated in the collaborative WRAP process where tribes were represented.

9.1.3 Past Consultation with other States

Pursuant to 40 CFR 51.308(d)(1)(iv), Nevada consulted with other WRAP states in development of this SIP. Alaska, Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, North Dakota, Oregon, South Dakota, Utah, Washington and Wyoming agreed to work together to address regional haze in the western continental United States. The majority of state consultation in the development of the RH SIPs was conducted through the Implementation Work Group (IWG) of the WRAP. Nevada participated in the IWG, which took the products of the WRAP technical analysis and consultation process discussed above and developed a process for establishing reasonable progress goals in the western Class I areas. This consultation process ensures that states are aware of each other's reasonable progress goals and long-term strategies.

Nevada has reviewed and analyzed contributions from other states that reasonably may cause or contribute to visibility impairment in the Jarbidge WA. As discussed in Chapter Three, emission sources beyond the control of Nevada, other states or the FLMs include: emissions from outside the WRAP modeling domain; emissions from Canada and Mexico; emissions from wildfires, windblown dust and biogenic emissions; and emissions from offshore shipping. Nevertheless, Nevada anticipates that the long-term strategies adopted by other states in their SIPs and approved by USEPA will include emission reductions from a variety of sources that will reduce visibility impairment in the Jarbidge WA.

9.2 FUTURE COORDINATION AND CONSULTATION COMMITMENTS

Nevada will continue to coordinate and consult with parties as summarized below.

9.2.1 Future FLM Coordination and Consultation

The RHR requires states to submit periodic SIP revisions and progress reports evaluating progress toward the reasonable progress goal for each Class I area. As required by 40 CFR 51.308(i)(4), Nevada will continue to coordinate and consult with the FLMs during the development of these future progress reports and plan revisions, as well as during the implementation of programs having the potential to contribute to visibility impairment in mandatory Class I areas. The progress reports are to occur at five year intervals, with the first report due five years from submittal of the initial RH SIP. Plan revisions are due every ten years beginning in 2018. The consultation process will provide on-going and timely opportunities to address the status of the control programs identified in this SIP, the development of future assessments of sources and impacts, and the development of additional control programs.

Nevada will provide the FLMs an opportunity to review and comment on future SIP revisions, the 5-year progress reports and other developing programs that may contribute to Class I visibility impairment. The consultation will be coordinated with the designated visibility protection program coordinators for the National Park Service, U.S. Fish and Wildlife Service, Bureau of Land Management and the U.S. Forest Service. At a minimum, Nevada will meet with the FLMs on an annual basis through the WRAP, as long as the WRAP continues to provide this forum. All SIP revisions will include a description of how the state consulted with and addressed any comments provided by the FLMs.

9.2.2 Future Tribal Coordination and Consultation

Nevada will continue to remain in contact, via the WRAP, with the NTEC to keep track of possible future impacts from tribes to visibility at the Jarbidge WA and to provide opportunity for consultation regarding any tribal Class I area that Nevada's emissions may reasonably be anticipated to impact.

9.2.3 Future Inter-state Coordination and Consultation

In accordance with 40 CFR 51.308(d)(1)(iv) and 51.308(d)(3)(i), Nevada commits to continue consultation with Arizona, California , Idaho, Oregon and Utah, and any other state which may reasonably be anticipated to cause or contribute to visibility impairment at the Jarbidge WA. Nevada will also continue consultation with any state for which Nevada's emissions may reasonably be anticipated to cause or contribute to visibility impairment in those states' federal Class I areas.

With regard to the established or updated goal for reasonable progress, should disagreement arise between another state or group of states and Nevada, Nevada will describe the actions taken to resolve the disagreement in future RH SIP revisions for USEPA's consideration. With regard to assessing or updating long-term strategies, Nevada commits to coordinate its emission management strategies with affected states and will continue to include in its future RH SIP revisions all measures necessary to obtain its share of emissions reductions for meeting other states' reasonable progress goals.

9.2.4 Future Regional Planning Coordination and Consultation

Nevada commits to continued participation in the WRAP, to the extent appropriate, and to coordinating future plan revisions with other WRAP member states in addressing regional haze. This involvement in the WRAP will contribute significantly to Nevada's inter-state and FLM coordination for future SIP revisions and progress reports.

9.3 COMMITMENT TO PROGRESS REPORTS

40 CFR 51.308(g) requires states to submit a progress report to USEPA every 5 years evaluating progress towards the reasonable progress goal(s). The first progress report is due five years from the submittal of the initial implementation plan and must be in the form of an implementation plan revision that complies with USEPA's public hearing and plan submittal requirements (40 CFR 51.102-103). At a minimum, the progress reports must contain the elements in paragraphs 51.308(g)(1-7) for each Class I area, as summarized below.

1. Implementation status of the current SIP measures for achieving reasonable progress goals;
2. Summary of emissions reductions achieved;
3. Assessment of most and least impaired days;
4. Analysis of emission reductions of pollutants contributing to visibility impairment from all sources within the state based on the most recent updated emissions inventory, with estimates projected forward to account for emission changes during the applicable 5-year period.
5. Assessment of significant changes in anthropogenic emissions that have occurred during the 5-year period that have limited or impeded progress in reducing pollutant emissions and improving visibility;
6. Assessment of the current SIP sufficiency to meet reasonable progress goals; and
7. Review of visibility monitoring strategy and any modifications to the strategy as necessary.

In accordance with the requirements listed in section 51.308(g) of the RHR, Nevada commits to submitting a report on reasonable progress to USEPA every five years following the initial submittal of the SIP. The reasonable progress report will evaluate progress made towards the reasonable progress goal for the Jarbidge WA and in each mandatory Class I area located outside Nevada, which may be affected by emissions from Nevada. Nevada's mid-term review will address each of the required elements listed above, including a reassessment of the uncertainty in the data. The state will also evaluate the monitoring strategy adequacy in assessing reasonable progress goals.

9.4 DETERMINATION OF CURRENT PLAN ADEQUACY

40 CFR 51.308(h) requires a state to make a determination of the adequacy of the current implementation plan as part of its five-year progress report. Based on the findings of the five-year progress report, the state must take one or more of the actions summarized below at the same time the state submits its five-year progress report.

1. If the state finds that no substantive SIP revisions are required to meet established visibility goals, the state shall provide a negative declaration that no implementation plan revision is needed.
2. If the state finds that the implementation plan is or may be inadequate to ensure reasonable

progress due to emissions from sources in another state that participated in a regional planning process, the state shall notify USEPA and the other contributing state(s). The plan deficiency shall be addressed through a regional planning process to develop additional strategies through the planning efforts described in the progress report(s).
3. If the state finds that the implementation plan is or may be inadequate to ensure reasonable progress due to emissions from another country, the state shall notify USEPA and provide the available supporting information.
4. If the state finds that the implementation plan is or may be inadequate to ensure reasonable progress due to emissions from within the state, the state shall revise its implementation plan to address the plan's deficiencies within one year.

Nevada commits, in accordance with 40 CFR 51.308(h), to make an adequacy determination of the current SIP at the same time its five-year progress report is due and to comply with the requirements of 51.308(g). If Nevada determines that the current implementation plan is or may be inadequate due to emissions from within the state itself, Nevada will develop additional strategies to address the plan deficiencies and revise the SIP within one year from the date that the progress report is due. If, on the other hand, Nevada determines that the plan is or may be inadequate due to emissions from other states, Nevada will address the deficiency through a regional planning process.

9.5 COMMITMENT TO FUTURE SIP REVISIONS

In addition to a SIP revision made for plan inadequacy, 40 CFR 51.308(f) requires a state to revise and submit a comprehensive regional haze implementation plan revision to USEPA by July 31, 2018 and every ten years thereafter. Future SIP revisions must evaluate and reassess all of the elements required under 40 CFR 51.308(d) and specifically address the items listed in 51.308(f)(1-3). The plan revision must take into account improvements in monitoring data collection and analysis, control technologies and other relevant factors. Nevada's commitments to comply with RHR requirements for future plans follow.

By July 31, 2018 and every 10 years thereafter, Nevada commits to completing and submitting a comprehensive RH SIP revision to USEPA, evaluating and reassessing all of the elements required under 40 CFR 51.308(d). In evaluating and reassessing these elements, Nevada commits to:

1. Determining current visibility (most recent five year period preceding the required date of the SIP submittal for which data is available) conditions for the most impaired and least impaired days and determine the actual progress made towards natural conditions.
2. Determining the effectiveness of the long-term strategy for achieving the reasonable progress goals for the prior SIP period as well as include enforceable emission limitations and compliance schedules.
3. Affirming or revising the current reasonable progress goals based on assessment of new or updated information, improved technologies and on-going legislation. If the reasonable progress goal is found to be insufficient to attain natural conditions by 2064, Nevada will look at additional or new control measures that may be adopted considering compliance cost, compliance time, the energy and non-air quality environmental impacts of compliance and the remaining useful life of the affected source(s).