ADEQ
Arizona Department of Environmental Quality

Arizona State Implementation Plan

Regional Haze Under Section 308 Of the Federal Regional Haze Rule

Air Quality Division
January 2011

(page intentionally blank)

TABLE OF CONTENTS

FIGURES

TABLES

APPENDICES

CHAPTER I: INTRODUCTION

1.1 Overview of Visibility and Regional Haze

Good visibility is important to the enjoyment of national parks and scenic areas. Across the country, regional haze has decreased the visual range from 140 miles to 35-90 miles in the West, and from 90 miles to 15 -25 miles in the East. Regional haze is air pollution that is transported long distances, causing reduced visibility in national parks and wilderness areas. This haze is composed of small particles that absorb and scatter light, affecting the clarity and color of what we see. The pollutants that create this haze are sulfates, nitrates, organic carbon, elemental carbon and soil dust. Human-caused (anthropogenic) sources include industry, motor vehicles, agricultural and forestry burning, and windblown dust from roads and farming practices.

There are 156 national parks and wilderness areas that have been designated by Congress as "mandatory federal Class I areas" (referred to herein as Class I areas) (Figure 1.1). The Clean Air Act contains a national goal of reducing man-made visibility impairment in all Class I areas. To meet this goal, the Environmental Protection Agency (EPA) adopted the Regional Haze Rules in July 1999. These rules complement and are in addition to "Phase I" visibility rules adopted by EPA in 1980.

Figure 1.1 – Federal Class I Areas within the United States

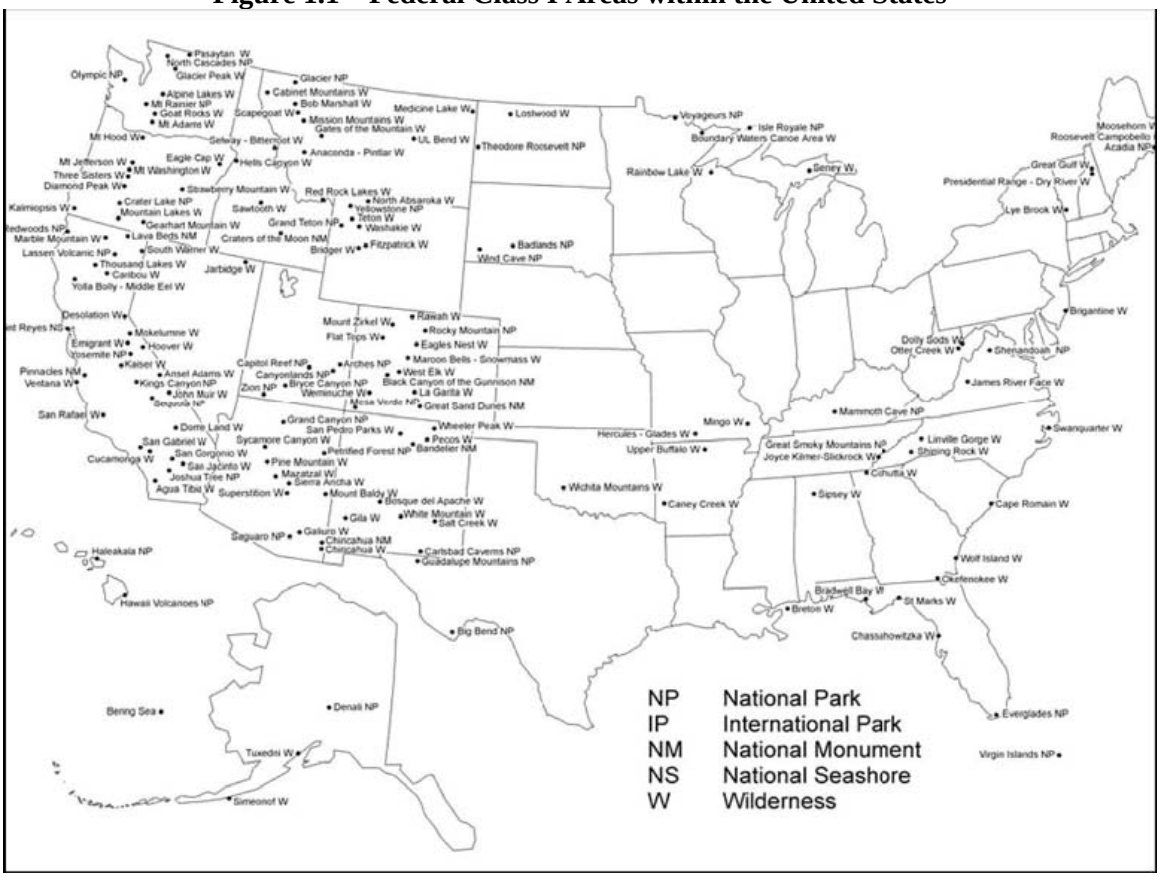


Figure 1.2 – Class I Areas in the Western Region

1.2 Arizona Class I Areas

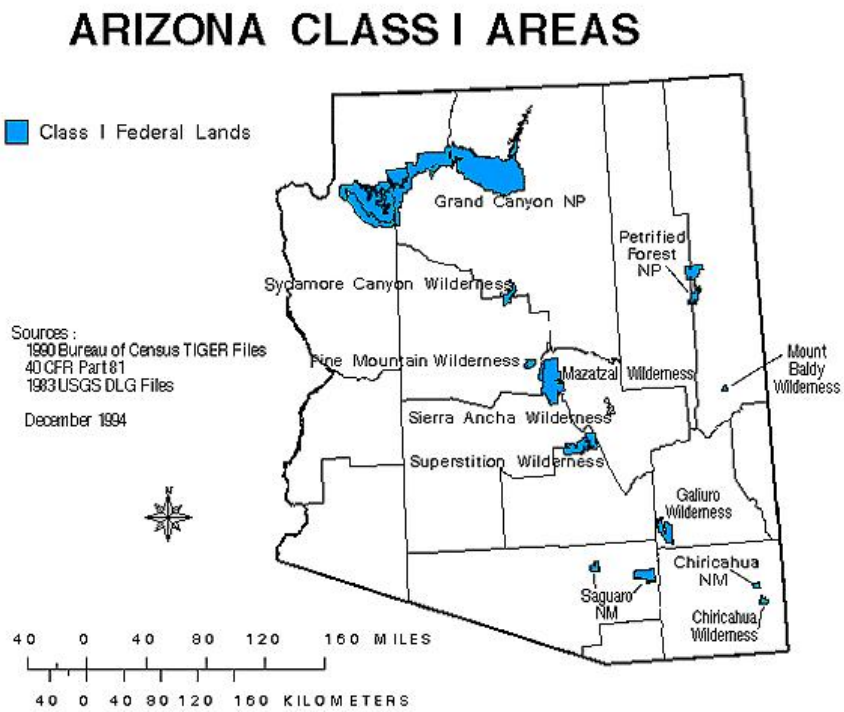
Arizona has 12 Class I areas: Chiricahua National Monument, Chiricahua Wilderness, Galiuro Wilderness, Grand Canyon National Park, Mazatzal Wilderness, Mount Baldy Wilderness, Petrified Forest National Park, Pine Mountain Wilderness, Saguaro National Park, Sierra Ancha Wilderness, Superstition Wilderness, and Sycamore Canyon Wilderness. To protect visibility, Congress designated in 1977 all wilderness areas over 5,000 acres and all national parks over 6,000 acres as mandatory federal Class I areas and subject to the visibility protection requirements in the Clean Air Act.

Table 1.1 – Arizona Class I Areas

Class I Area	Acreage
Chiricahua National Monument	11,985
Chiricahua Wilderness	87,700
Galiuro Wilderness	76,317
Grand Canyon National Park	1,218,375
Mazatzal Wilderness	252,390

Class I Area	Acreage
Mount Baldy Wilderness	7,000
Petrified Forest National Park	93,532
Pine Mountain Wilderness	20,061
Saguaro National Park	84,000
Sierra Ancha Wilderness	20,850
Superstition Wilderness	160,200
Sycamore Canyon Wilderness	55,937

Figure 1.3 – Map of Arizona Class I Areas



1.3 Background on the Regional Haze Rule

1.3.1 The 1977 Clean Air Act Amendments

National Visibility Goal

In 1977, Congress amended the Clean Air Act to include provisions to protect the scenic vistas of the nation's national parks and wilderness areas. In these amendments, Congress declared as a national visibility goal:

The prevention of any future, and the remedying of any existing impairment of visibility in mandatory class I Federal areas which impairment results from manmade air pollution. (Section 169A)

To address this goal, the EPA developed regulations to reduce the impact of large industrial sources on nearby Class I areas. It was recognized at the time that regional haze, which comes from a wide variety of sources that may be located far from a Class I areas, was also a part of the visibility problems. However, monitoring networks and visibility models were not yet developed to the degree necessary to understand the causes of regional haze.

Prevention of Significant Deterioration

The 1977 Clean Air Act Amendments established Prevention of Significant deterioration (PSD) requirements, which included protecting visibility in national parks, national wilderness areas, national monuments, and national seashores. The PSD program includes area specific (Class I, II, and III) increments or limits on the maximum allowable increasing air pollutants (particulate matter or sulfur dioxide) and a preconstruction permit review process for new or modifying major sources that allows for careful consideration of control technology, consultation with FLMs on visibility impacts and public participation in permitting decisions.

Best Available Retrofit Technology

Under Section 169A(b), Congress established new requirements on major stationary sources in operation within a 15-year period prior to enactment of the 1977 amendments that can be reasonably attributed to cause visibility impairment in a mandatory Class I federal area must install best available retrofit technology (BART) as determined by the state. In determining BART, the state must take into consideration the costs of compliance, the energy and non-air quality environmental impacts of compliance, any existing pollution control technology in use at the source, the remaining useful life of the source, and the degree of improvement in visibility which may reasonably be anticipated to result from the use of such technology.

1.3.2 Phase I Visibility Rules – The Arizona Visibility Protection Plan

In 1980, EPA adopted regulations to address "reasonably attributable visibility impairment" (RAVI), or visibility impairment caused by one or a small group of man-made sources generally located in close proximity to a specific Class I area. These became known as EPA's "Phase I" visibility rules. At that time, EPA deferred writing rules to address regional haze, because they lacked the monitoring, modeling, and scientific information needed to understand the nature of long-range transport and formation of regional haze. EPA adopted "Phase II" rules on regional haze in July 1999.

To address RAVI, the State of Arizona promulgated Article 16, R18-2-1601 through R18-2-1606.

1.3.3 The 1990 Clean Air Act Amendments

Although the 1980 regulation addressed reasonably attributable visibility impairment from specific sources, it did not adequately address visibility impairment from large collections of sources whose emissions are mixed and transported over long distances. In the 1990 amendments to the Clean Air Act, Congress established the requirements to address regional haze. They gave EPA the authority to establish

visibility transport commissions and promulgate regulations to address regional haze. The 1990 amendments also established a visibility transport commission to investigate and report on regional haze visibility impairment in the Grand Canyon National Park and nearby Class I areas.

Grand Canyon Visibility Transport Commission Finding and Recommendations

The 1990 Clean Air Act Amendments created the Grand Canyon Visibility Transport Commission (GCVTC). The GCVTC was given the charge to assess the currently available scientific information pertaining to adverse impacts on visibility from potential growth in the region, identify clean air corridors, and recommend long-range strategies for addressing regional haze for Class I areas on the Colorado Plateau. The GCVTC completed significant technical analyses and developed recommendations to improve visibility in the 16 mandatory federal Class I areas on the Colorado Plateau. These 16 Class I areas are as follows: Arches National Park, Black Canyon of the Gunnison Wilderness, Bryce Canyon National Park, Canyonlands National Park, Capital Reef National Park, Flat Tops Wilderness, Grand Canyon National Park, Maroon Bells Wilderness, Mesa Verde national Park, Mount Baldy Wilderness, Petrified Forest national Park, San Pedro Parks Wilderness, Sycamore Canyon Wilderness, Weminuche Wilderness, West Elk Wilderness, and Zion National Park.

The GCVTC found that visibility impairment on the Colorado Plateau was caused by a wide variety of sources and pollutants. A comprehensive strategy was needed to address all of the causes of regional haze. The GCVTC submitted these recommendations to EPA in a report dated June 1996 for consideration in rule development. These recommendations were:

Air Pollution Prevention. Air pollution prevention and reduction of per capita pollution was a high priority for the Commission. The Commission recommended policies based on energy conservation, increased energy efficiency and promotion of the use of renewable resources for energy production.

Clean Air Corridors. Clean air corridors are geographic areas that provide a source of clean air to the 16 Class I areas of the Colorado Plateau. For these areas, the Commission primarily recommended careful tracking of emissions growth that may affect air quality in these corridors, and ultimately the 16 Class I areas.

Stationary Sources. For stationary sources, the Commission recommended closely monitoring the impacts of current requirements under the Clean Air Act and ongoing studies. It also recommended regional targets for SO_2 emissions from stationary sources, starting in 2000. If these targets are exceeded, a regional cap and market-based emission trading program should be implemented.

Areas In and Near Parks. The Commission's research and modeling showed that a host of sources adjacent to parks and wilderness areas, including large urban areas, have significant visibility impacts. However, the Commission lacked sufficient data regarding the visibility impacts of emissions from some areas in and near parks and wilderness areas. In general, the models used by the Commission were not readily applicable to such areas. Pending further studies of these areas, the Commission recommended that local, state, tribal, federal, and private parties cooperatively develop strategies, expand data collection, and improve modeling for reducing or preventing visibility impairment in areas within and adjacent to parks and wilderness areas.

Mobile Sources. The Commission recognized that mobile source emissions are projected to decrease through about 2005 due to improved control technologies. The Commission recommended capping emissions at the lowest level achieved and establishing a regional emissions budget, and also endorsed national strategies aimed at further reducing tailpipe emissions, including the so-called 49-state low emission vehicle, or 49-state LEV.

Road Dust. The Commission's technical assessment indicated that road dust is a large contributor to visibility impairment on the Colorado Plateau. As such, it requires urgent attention. However, due to considerable skepticism regarding the modeled contribution of road dust to visibility impairment, the Commission recommended further study in order to resolve the uncertainties regarding both near-field and distant effects of road dust, prior to taking remedial action. Since this emissions source is potentially such a significant contributor, the Commission felt that it deserved high priority attention and, if warranted, additional emissions management actions.

Emissions from Mexico. Mexican sources are also shown to be significant contributors, particularly of SO_2 emissions. However, data gaps and jurisdictional issues made this a difficult issue for the Commission to address directly. The Commission recommendations called for continued bi-national collaboration to work on this problem, as we as additional efforts to complete emissions inventories and increase monitoring capacities. These matters should receive high priority for regional and national action.

Fire. The Commission recognized that fire plays a significant role in visibility on the Plateau. In fact, land managers propose aggressive prescribed fire programs aimed at correcting the buildup of biomass due to decades of fire suppression. Therefore, prescribed fire and wildfire levels are projected to increase significantly during the studied period. The Commission recommended the implementation of programs to minimize emissions and visibility impacts from prescribed fire, as well as to educate the public.

Future Regional Coordinating Entity. Finally, the Commission believed there was a need for an entity like the Commission to oversee, promote, and support many of the recommendations in their report. To support that entity, the commission developed a set of recommendations addressing the future administrative, technical and funding needs of the Commission or a new regional entity. The Commission strongly urged the EPA and Congress to provide funding for these vital functions and give them a priority reflective of the national importance of the Class I areas on the Colorado Plateau.

The Western Regional Air Partnership

The GCVTC recognized the need for a long-term organization to address the policy and technical studies needed to address regional haze. The Western Regional Air Partnership (WRAP) was formed in September 1997 as the successor organization to the GCVTC. The WRAP is made up of western states, tribes and federal agencies. The states are Alaska, Arizona, California, Colorado, Idaho, Montana, New Mexico, North Dakota, Oregon, South Dakota, Utah, Washington, and Wyoming. The WRAP's Charter allow it to address any air quality issue of interests to WRAP members, though most current work is focused on developing the policy and technical work products needed by states and tribes in developing their regional haze state implementation plans (SIPs). The WRAP established stakeholder-based technical and policy oversight committees to assist in managing the development of regional haze work products. Stakeholder-based working groups and forums were established to focus attention on the policy and technical work products the states and tribes need to develop their implementation plans. Additional information about the WRAP can be found on the WRAP web site at http://www.wrapair.org.

1.3.4 History of the Arizona 309 SIP

The Western Governor's Association (WGA) published the *Grand Canyon Visibility Transport Commission (GCVTC) Recommendations for Improving Western Vista*s in June 1996, which represented decades of research and work on visibility impairing pollutant science and regulations. Prior to the 1990 Clean Air Act revisions, several states throughout the country were subject to Federal Implementation Plans (FIPs) since the 1980s. These states argued that a focus on visibility impairment from stack plumes

associated with stationary, point source pollution was insufficient to address the wide range of pollutants and sources that caused or contributed to visibility impairment.

These states pointed to the long-range transport of pollutants over unique geographic areas and under unique meteorological conditions as an argument that visibility impairment was not solely due to reasonably attributable visibility impairment (RAVI); it was also due regional haze. The varied geography and meteorology in the West, coupled with the source base offered a perfect laboratory for the study of regional haze and RAVI.

The research on RAVI and regional haze resulted in the GCVTC recommendations for measures to address impairment on the Colorado Plateau from sources ranging from stationary-point sources and mobile sources (both on-road and off-road) to aerosols from fire and particulate matter from disturbed soils. The pollutants ranged from sulfur dioxide and oxides of nitrogen to elemental and organic carbon and particulate matter, both natural and man-made and both coarse and fine. The Recommendations went further by addressing pollution prevention and energy renewables along with the scientific analysis for naturally occurring clean air corridors. But the cornerstone was the backstop market trading program for sulfur dioxide. This was the first program to establish a regional cap with milestones that allowed optimal flexibility to stationary sources to address reductions in pollution outside of traditional control measures such as BART and BACT.

All the recommendations from the GCVTC were included in the submission of the 2003 Regional Haze SIPs under Section 309 of the 1999 Federal Regional Haze Rule (40 CFR 51.300 through 309). The 309 states – Arizona, New Mexico (also Bernalillo County/Albuquerque), Oregon, Utah, and Wyoming – submitted the plans after four years of work and consultation with tribes, states, affected sources, four EPA regional offices, and federal land managers utilizing analyses from the WRAP, the successor organization to the GCVTC, and extensive and varied stakeholder meetings and hearings. The plans were submitted in good faith and relied upon the legal presumption that the recommendations, when implemented, would constitute reasonable progress toward the national goal of visibility improvement through 2018. The 2003 plans incorporated the history and efforts of the GCVTC, and the intent of the Clean Air Act and its recognition that the approach taken by the plans is appropriate and effective in reducing visibility impairment.

Since the 2003 submittals, the 309 States (Oregon opted out of Section 309 in 2006) have been successfully implementing the Regional Haze State Implementation Plans. Over the past five years these plans have resulted in significant reductions of pollutants, including SO_2 and NO_X from stationary and mobile sources, as well as the development of certified enhanced smoke management programs. The 309 states are implementing the stationary source programs they adopted under the old rule (regardless of the vacatur of the Annex approval) and have documented SO_2 reductions in excess of those anticipated in the submitted plans. As a result of the recent court decision vacating the Clean Air Interstate Rule (CAIR), many states will be forced to re-examine strategies to achieve the regional haze goals. As states reevaluate strategies for CAIR, the Section 309 states will continue to benefit from the programs developed years ago. EPA has the opportunity to recognize the success of the regional haze program by approving all of the state plans originally submitted under the 309 program, with a commitment between EPA and the 309 states to revise those SIPs as expeditiously as possible to reflect changes in the Regional Haze Rule and state programs since the original submittals.

In 2001, ADEQ requested the assistance of stakeholders in the decision for an approach for the regional haze SIP under the Federal Regional Haze Rule (40 CFR 51.300 through 309). Over 300 stakeholders were contacted and 125 responded by attending a series of meetings held throughout the latter part of 2001. The stakeholders decided to pursue the option of developing a plan under Section 309 and began work on drafting legislation to authorize the requirements (Arizona Revised Statute (A.R.S.) 49-458 and

49-458.01, Laws 2002, Ch. 251, § 2). The WRAP, authorized under Section 169B of the Clean Air Act, had already begun developing elements of the backstop trading program for stationary sources of sulfur dioxide (SO_2) along with other forums and committees ranging from fire programs and mobile sources to dust and pollution prevention.

Under Section 309, participating states had the option of meeting reasonable progress to the national goal under Section 169A of the Clean Air Act of remedying visibility impairing and preventing future impairment at the 158 national parks and wilderness areas (mandatory Federal Class 1 areas or C1As) by implementing the recommendations of the GCVTC. The State of Arizona formed stakeholder work groups for all the source categories as well as various committees to facilitate the development of the SIP. Most of the original 125 stakeholders maintained membership in these workgroups and committees as well as becoming members on WRAP's forums and committees throughout the development of the SIP until its submittal in December 2003. In addition to Arizona, four other states submitted SIPs under Section 309 (New Mexico, along with the City of Albuquerque, Oregon, Utah, and Wyoming) with a commitment to submit SIPs for their remaining C1As under Section 309(g) of the Federal Regional Haze Rule. The Section 309(g) SIPs were due at the same time regional haze plans throughout the U.S. were due under Section 308, December 31, 2007.

The submission of the *2003 Arizona State Implementation Plan for Regional Haze* met all the requirements of the 1999 Regional Haze Rule. As required, the 2003 plan contained a commitment to submit the reasonable progress requirements for Class I areas other than the 16 covered by the *Grand Canyon Visibility Transport Commission Report* as a separate SIP under Section 309(g).

Litigation has had a major influence on regional haze regulations. Before the 2003 submittals were made, the Federal Regional Haze Rule was challenged in *American Corn Growers Ass'n v. EPA*, 291 F3d 1 (DC Cir. 2002). This case found that EPA's prescribed methods for determining best available retrofit technology (BART) was inconsistent with the Clean Air Act and EPA revised the rule on July 6, 2005 (effective September 9, 2005), to address the court's ruling. The 2005 revisions did not directly affect states submitting plans under Section 309, but it changed the deadline for SIPs under Section 309(g) and Section 308 to an earlier deadline of December 17, 2007. On February 18, 2005, the U.S. Court of Appeals issued a ruling in another case, *Center for Energy and Economic Development (CEED) v. EPA*, 398 F.3d 653 (DC Cir. 2005) that directly affected Section 309 plans. That case granted a petition challenging provisions to the optional emissions trading program for certain western States and Tribes (WRAP's Annex Rule). EPA proposed rule revisions and guidance on August 1, 2005, but due to public comments was forced to re-propose on October 5, 2006. The final rule reflecting new requirements for states choosing the trading option became effective December 12, 2006.

The 2006 rule revisions gave states opting for emissions trading under Section 309 and Section 309(g) to follow the requirements in Section 309(d)(4) to demonstrate that reductions from trading would be better than reductions from the application and operation of BART, and to analyze both BART and non-BART stationary source emitters of oxides of nitrogen (NO_X) and particulate matter (PM) as well. It took nearly a year for states to determine which sources would be affected by the new requirements and to begin revising the SO_2 trading program, all of which would be documented in a revision to the 2003 SIPs, due December 17, 2007.

In July 2007, ADEQ determined that nine facilities were potentially subject-to-BART and were provided with a set of three options: (i) demonstrate that the facility is not BART-eligible; (ii) demonstrate that while the facility is BART-eligible, it is not potentially-subject-to-BART as the facility does not cause or contribute to regional haze; or (iii) agree that the facility is potentially-subject-to-BART and conduct a BART analysis for the facility.

In 2008, using an option in the Regional Haze Rule, the emissions milestones in the SO_2 trading program were revised and coupled with a "better than BART" demonstration. The "better than BART" demonstration used a combination of presumptive BART and reductions projected by the application of controls found in CAIR. By this time, all Western states had missed the December 17, 2007, submittal deadline for both Section 309 SIP revisions and 309(g) SIP submittals.

On January 15, 2009, EPA issued *Findings of Failure to Submit State Implementation Plans* as required by the 1999 Regional Haze Rule (74 FR 2392). Arizona, along with 36 other States, was named in the notice as delinquent. Arizona and New Mexico were found to be delinquent for two elements of the rule: Section 309(d)(4) and Section 309(g). Other states failing to submit specific elements of the rule were Colorado, Michigan, and Wyoming. Alaska, California, Hawaii, Idaho, Montana, Nevada, North Dakota, Oregon, South Dakota, and Washington, failed to submit all rule elements under Section 308 of the 1999 rule.

On January 15, 2009, EPA issued *Findings of Failure to Submit State Implementation Plans* as required by the 1999 Regional Haze Rule (74 FR 2392). Arizona, along with 36 other States, was named in the notice as delinquent. Arizona and New Mexico were found to be delinquent for two elements of the rule: Section 309(d)(4) and Section 309(g). Other states failing to submit specific elements of the rule were Colorado, Michigan, and Wyoming. Alaska, California, Hawaii, Idaho, Montana, Nevada, North Dakota, Oregon, South Dakota, and Washington, failed to submit all rule elements under Section 308 of the 1999 rule.

Normally, EPA has two years to promulgate a Federal Implementation Plan (FIP) beginning 30 days after publication of the notice in the *Federal Register*; the effective date for this action is the same date as the publication, January 15, 2009. The promulgation of a FIP is not required if a state submits the required SIP and EPA takes final action to approve the submittal within two years of the finding. Concurrently, EPA Regional Administrators sent letters to each state outlining the details of the failure to submit; ADEQ received a letter from Deborah Jordan, EPA Region IX, dated January 14, 2009.

Originally, Arizona was to submit a SIP addressing both Section 309(d)(4) and Section 309(g); however, it was determined in 2010 that EPA did not approve of the revisions to the milestone program. To avoid a FIP, EPA requested that Arizona submit a plan under Section 308. Arizona agreed but with the understanding that all the work done on the previously submitted plans would be recognized and that the important long-term strategies would be incorporated into the 308 SIP as would have been the case under Section 309(g) except now for all 12 of Arizona's national parks and wilderness areas.

1.4 Purpose of this Document

This Regional Haze SIP has been prepared to meet the requirements of the Federal Regional Haze Rule, Section 40 CFR, Part 51, Section 308. It contains strategies and elements related to each requirement of this federal rule. The appendices provide additional information related to the strategies, including citations of new rules associated with this SIP, technical analysis, and reports prepared by WRAP.

Relation to the WRAP's Regional Technical Support System

The WRAP's Technical Support System (TSS) was the source for the majority of key technical information and data used in the Arizona Section 308 SIP. The TSS contains the emissions information, modeling, methodology, and other information that was utilized to develop the reasonable progress goals and long-term strategies within this plan. The WRAP TSS can be found at http://vista.ciracolostate.edu/tss/

Mandatory Federal Class I Areas Addressed in this SIP

The Regional Haze Rule under 40 CFR 51.308 requires states to address visibility protection for regional haze in Arizona's Class I areas. These areas are listed in Section 1.2 and shown in Figure C.

1.4.1 Basic Plan Elements

Natural Sources of Visibility Impairment

Natural sources of visibility impairment include anything not directly attributed to human-caused (anthropogenic) emissions of visibility-impairing pollutants. Natural events (e.g. windblown dust, wildfire, biogenic emissions) also introduce pollutants that contribute to haze. Specific natural events can lead to high short-term concentrations of visibility-impairing particulate matter and its precursors. Therefore, natural visibility conditions, for the purpose of Arizona's Regional Haze Program, are represented by a long-term average of conditions expected to occur in the absence of emissions normally attributed to human activities. Natural visibility conditions reflect contemporary vegetated landscape, land-use patterns, and meteorological/climatic conditions.

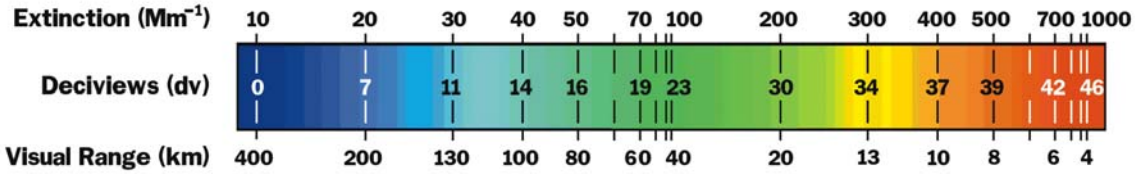
Natural sources, particularly wildfire and windblown dust, can be major contributors to visibility impairment. However, these emissions cannot be realistically controlled or prevented by the states, and therefore the focus of the regional haze strategies in this document are on human-caused (anthropogenic) sources. While current methods of analysis of monitoring data do not provide a clear distinction between natural and anthropogenic emissions, certain pollutant species, such as sulfur dioxide (SO_2) and nitrogen oxide (NOx) are more representative of anthropogenic sources, while organic carbon (OC) and coarse particulate matter (CM or PM_{10}) are more representative of natural sources such as wildfire and dust, respectively.

Human-Caused (Anthropogenic) Sources of Visibility Impairment

Anthropogenic sources of visibility impairment include anything directly attributable to human activities that produce emissions of visibility-impairing pollutants. Examples include industry, transportation, construction, mining, agricultural activities, home heating, and outdoor burning. Anthropogenic sources can be local, regional, or international. Efforts to regulate anthropogenic emissions are mostly limited to inside the United States. Emissions from Mexico, Canada, and off-shore marine shipping emissions in the Pacific Ocean, are examples of anthropogenic sources that have the potential contribute to visibility impairment in Arizona, but like natural sources, are beyond the scope of this planning document.

Deciview Measurement

The Interagency Monitoring for Protected Visual Environments (IMPROVE) network provides states with a mechanism to monitor and collect data regarding the emissions of haze-impairing pollutants. Each IMPROVE monitor collects particulate concentration data which are converted into reconstructed light extinction through a complex calculation using the IMPROVE equation (see Technical Support Documents for any Class I area). Reconstructed light extinction (referred to as bext) is expressed in units of inverse megameters (1/Mm or Mm^{-1}). The Regional Haze Rule requires the tracking of visibility conditions in terms of the Haze Index (HI) metric expressed in the deciview (dv) unit (40 CFR 51.308(d)(2)). Generally, a one deciview change in the haze index is considered a humanly perceptible change under ideal conditions, regardless of background visibility conditions. The relationship between extinction (Mm^{-1}), haze index (dv) and visual range (mi) are indicated by the following scale:



Baseline and Current Conditions

The Regional Haze Rule requires the calculation of baseline conditions for each Class I area. Baseline conditions are defined as the five year average (annual values for 2000 - 2004) of IMPROVE monitoring data (expressed in deciviews) for the most-impaired (20% worst) days and the least-impaired (20% best) days. For this first regional haze plan submittal, the baseline conditions are the reference point against which visibility improvement is tracked. For future plan progress reports and updates, baseline conditions are used to calculate progress from the beginning of the regional haze program. Current conditions for the best and worst days are calculated from a multiyear average, based on the most recent 5-years of monitored data available. This value will be revised at the time of each periodic plan revision, and will be used to illustrate: (1) The amount of progress made since the last plan revision, and (2) the amount of progress made from the baseline period of the program.

Natural Conditions

The visibility that would exist under natural conditions (absent any man-made impairment) would vary based on the contribution of natural sources and meteorological conditions on a given day. For that reason, natural conditions, as defined in this document, consists of a level of visibility (in deciviews) for both the most-impaired (20% worst) days and the least-impaired (20% best) days. Since no visibility monitoring data exists from the pre-manmade impairment period, these estimates of natural conditions are based on EPA guidance on how to estimate natural conditions (EPA Document: *Guidance for Estimate Natural Visibility Conditions under the Regional Haze Rule*).

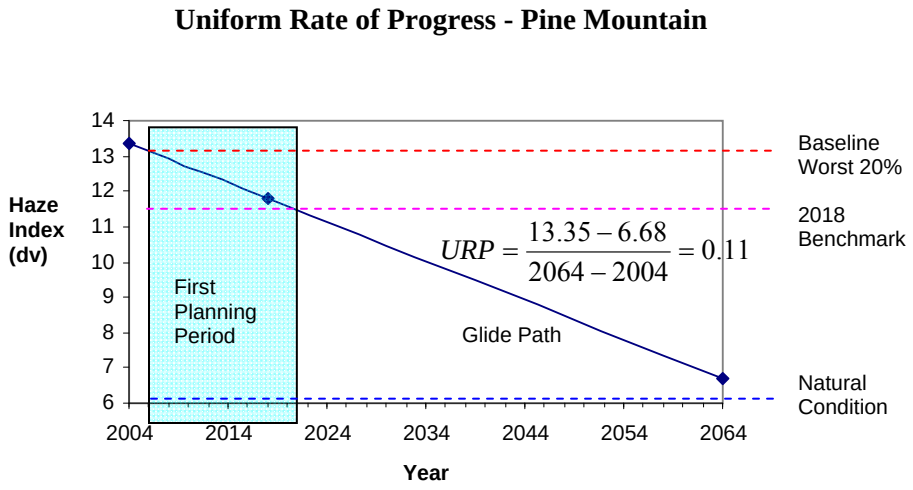
Reasonable Progress Goals

For each Class I area the state must establish goals (measured in deciviews) that provide for reasonable progress towards achieving natural visibility conditions. The reasonable progress goals (RPG) are interim goals that represent incremental visibility improvement over time for the most-impaired (20% worst) days and no degradation in visibility for the least-impaired (20% best) days. The first regional haze plan that states must submit to EPA needs to include RPGs for the year 2018, also known as the "2018 milestone year". The state has flexibility in establishing different RPGs for each Class I area. In establishing the RPG, the state must consider four factors: the costs of compliance; the time necessary for compliance; the energy and non-air quality environmental impacts of compliance; and the remaining useful life of any potentially affected sources. States must demonstrate how these factors were taken into consideration in selecting the goal for each Class I area.

Uniform Rate of Progress

The uniform rate of progress (URP) is the calculation of the slope of the line between baseline visibility conditions and natural visibility conditions over the 60-year period. For the first regional haze plan, the first benchmark is the deciview level that should be achieved in 2018, as indicated in blue below as the first planning period (Figure 1.4). This is the 2018 Milestone, and applies to both the 20% worst days and the 20% best days.

Figure 1.4 – Illustration of Uniform Rate of Progress



- Compare baseline conditions to natural conditions. The difference between these two different conditions represents the amount of progress needed to reach natural visibility conditions. In this example, the state has determined that the baseline for the 20% worst days for the Class I area is 13.35 dv and estimated that natural background is 6.68 dv, a difference of 6.67 dv.

- Calculate the annual average visibility improvement needed to reach natural conditions by 2064 by dividing the total amount of improvement needed by 60 years (the period between 2004 and 2064). In this example, this value is 0.11 dv/yr.

- Multiply the annual average visibility improvement needed by the number of years in the first planning period (the period from 2004 until 2018). In this example, this value is 1.54 dv. This is the uniform rate of progress that would be needed during the first planning period to attain natural visibility conditions by 2064.

The URP is not a presumptive target. When establishing RPGs, the state may determine RPGs at greater, lesser or equivalent visibility improvement than the URP. In cases where the RPG results in less improvement in 2018 than the URP, the state must demonstrate why the URP is not achievable, and why the RPGs are "reasonable".

For the 20% worst days, the URP is expressed in deciviews per year (i.e. slope of the glide path) is determined by the following equation: URP = [Baseline Condition - Natural Condition] / 60 years

The 2018 Progress Goal (i.e. the amount of reduction necessary for the 1st planning period) is determined by multiplying the URP by the number of years in the 1st planning period. 2018 Progress Goal = [Uniform ROP] x [14 years]

The 14 years comprising the 1st planning period includes the 4 years between the baseline and the SIP submittal date plus the standard 10-year planning period.

<u>Long-Term Strategy</u>

The Regional Haze Rule also requires states to submit a long-term strategy (LTS) that includes enforceable measures to achieve RPGs. The LTS must identify all anthropogenic sources inside the state

that affect Class I areas both inside and outside the state. The first long-term strategy will cover 10 to 15 years, with reassessment and revision of those goals and strategies in 2018 and every 10 years thereafter. At a minimum, the following factors must be considered in developing the long-term strategy:

- Measures to mitigate the impact of construction activities;
- Emission limitations and schedules for compliance to achieve the RPG;
- Source retirement and replacement schedules;
- Smoke management techniques for agricultural and forestry burning, including plans to reduce smoke impacts;
- Enforceability of emission limitations and control measures; and
- The anticipated net affect on visibility due to projected changes in point, area, and mobile source emissions over the period addressed of the long term strategy.

Best Available Retrofit Technology (BART)

Best Available Retrofit Technology (BART) requirements apply to certain older industrial facilities that began operating before national rules were adopted in 1977 to prevent new facilities from causing visibility impairment. BART applies to facilities built between 1962 and 1977, have potential emissions greater than 250 tons per year, and which fall into one of 26 specific source categories. These facilities must be evaluated to see how much they contribute to regional haze and if retrofitting with controls is feasible and cost effective.

The BART process consists of three-steps: (1) determining BART-eligibility; (2) determining is a source is "subject to BART" by conducting modeling of Class I visibility impacts; and (3) conducting an analysis of BART controls (retrofitting) for those sources subject to BART that contribute to regional haze.

In determining BART controls, the state must take into account several factors, including the existing control technology in place at the source, the costs of compliance, energy and non-air environmental impacts of compliance, remaining useful life of the source, and the degree of visibility improvement that is reasonably anticipated from the use of such technology.

(page intentionally blank)

CHAPTER 2: ARIZONA REGIONAL HAZE SIP DEVELOPMENT PROCESS

The Regional Haze Rule contains requirements for state, federal, and tribal consultation. The Arizona Regional Haze State Implementation Plan (SIP) was developed through a process of consultation with other states, Tribes, the Environmental Protection Agency (EPA), state and federal natural resource agencies, other stakeholders, and the public. This chapter contains a description of the requirements from the Regional Haze Rule. For additional details regarding individual consultation, see Chapter 11 (Long-Term Strategy).

2.1 Federal Land Manager Consultation

40 CFR 51.308(i)(4) requires SIP provisions for continuing consultation between the State and FLMs to address the implementation of the visibility protection program.

Comments received from the Federal Land Managers (FLMs) on the plan were addressed. The comments and responses are included in the appendices to this plan. Arizona will continue to coordinate and consult with the Federal Land Managers during the development of future progress reports and plan revisions, as well as during the implementation of programs having the potential to contribute to visibility impairment in the mandatory Class I areas.

Arizona will continue to coordinate and consult with the FLMs during the development of future progress reports and plan revision, as well as during the implementation of programs having the potential to contribute to visibility impairment in federal Class I areas. The FLMs will be consulted as follows:

1) Arizona will afford the FLM, at least 60 days prior to holding any public hearing on a SIP revision, an opportunity to discuss their assessment of visibility impairment in each federal Class I are; and to provide recommendations on the reasonable progress goals and on the development and implementation of the visibility control strategies. Arizona will include a summary of how it addressed the FLM comments in the revised SIP.
2) Arizona will provide the FLM an opportunity to review and comment on the five-year progress reports and other developing programs that may contribute to Class I visibility impairment.

2.2 State Consultation

Section 51.308(d)(3)(i) requires states to consult with other neighboring states to develop coordinated emission strategies. This requirement applies both where emissions from Arizona are reasonable anticipated to contribute to visibility impairment in Class I areas outside Arizona, and when emission from other states are reasonably anticipated to contribute to visibility impairment in Class I areas within Arizona.

Arizona consulted with other states by participation in the WRAP and inter-RPO processes that developed technical information necessary for development of coordinated strategies. Arizona also coordinated with WRAP and other RPOs to develop a weight of evidence analysis that was used to develop the States long-term strategy.

2.3 Tribal Consultation

Arizona consulted with Tribes by participation in the WRAP and inter-RPO processes that developed technical information necessary for development of coordinated strategies. The State of Arizona also contacted the National Tribal Environmental Council with notification of the proposed Regional haze SIP, public comment period, and public hearing to obtain input on the regional haze plan. Additional details on this consultation is provided in Appendix E.

CHAPTER 3: ARIZONA CLASS I AREAS

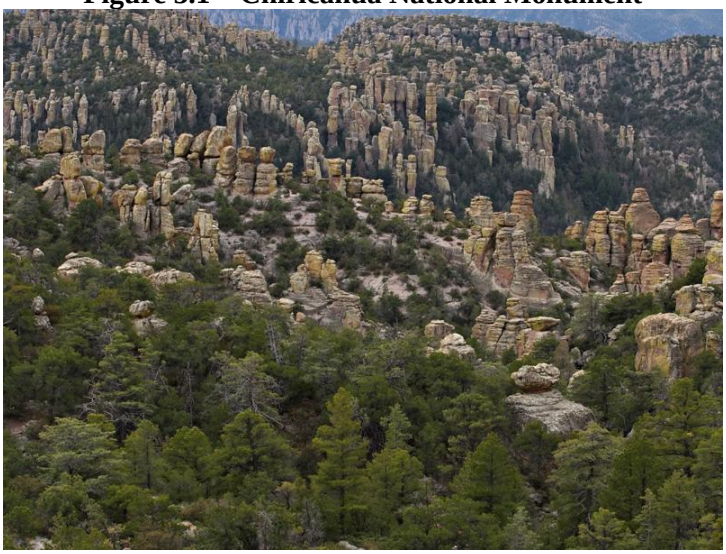
This chapter provides an overview of Arizona's Class I areas included in this document.

3.1 Chiricahua National Monument

Chiricahua National Monument is located approximately 120 miles southeast of Tucson, Arizona. Originally established in 1924, the monument now comprises 11,985 acres within the Chiricahua Mountains. Elevations range from 5,124 feet to 7,310 feet at the summit of Sugarloaf Mountain. The mountains consist largely of volcanic rock, which eroded over thousands of years to create dramatic pinnacles and spires.

Temperatures are generally mild with summer daytime highs in the upper 90s and nighttime lows in the 50s. Winter daytime highs range in the 50s to 60s and nighttime lows are typically in the upper- teens or low twenties but can dip into the subzero range. Precipitation is evenly distributed, half during the winter as snow, half in the summer as rain. Daily thunderstorms can occur during the monsoon thunderstorms generally occurring in July through September.

Figure 3.1 – Chiricahua National Monument



3.2 Chiricahua Wilderness Area

Located in the Chiricahua Mountains and adjacent to Chiricahua National Monument, the Chiricahua Wilderness was originally established in 1933 at 18,000 areas and officially became a Wilderness Area in 1964 with the Federal Wilderness Act. The 1984 Arizona Wilderness Act expanded the area to encompass 87,700 acres. The area consists of sharp ridges, deep canyons, and high peaks, with elevations ranging from 5200 feet to the highest elevation at 9,797 feet (Chiricahua Peak).

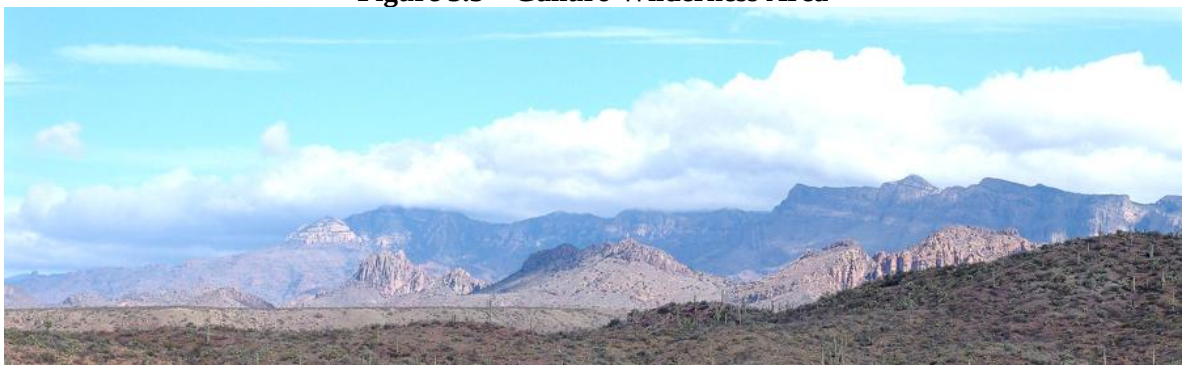
Figure 3.2 – Chiricahua Wilderness Area

3.3 Galiuro Wilderness Area

Located in southeastern Arizona, approximately 50 miles northeast of Tucson, the Galiuro Wilderness consists of 76,317 acres of grasslands, forests, and canyons. The wilderness ranges in elevation from 4000 feet to 7671 feet and is bisected by two canyons, the Redfield and the Rattlesnake. The vegetation in the wilderness varies from that found in semi-desert grasslands to higher elevation mixed conifer species.

The average temperature during winter months are in the low 20s (degrees Fahrenheit) to highs in the mid-forties. Summer months commonly average around 45 degrees for low temperatures and highs in the upper 90s. The summer monsoon thunderstorms can produce rapidly changing weather.

Figure 3.3 – Galiuro Wilderness Area



3.4 Grand Canyon National Park

The Grand Canyon National Park is on the southwestern Colorado Plateau. Over time, the Colorado River and its tributaries cut through the many layers of rock that make up the southwestern Colorado Plateau, forming a gorge one-mile deep and several miles wide. This cut into the earth begins at Lees Ferry, below Glen Canyon Dam, and extends 277 miles with a variation in width from 10-18 miles wide

to just hundreds of yards in Marble Canyon to the northeast. The western part of the canyon extends into the Mohave Desert, while the eastern part reaches into the Great Basin Desert.

The Park, after being designated a national monument in 1908, became a national park on February 26, 1919. The Park is contained within Mohave and Coconino Counties. The Grand Canyon was designated a World Heritage Site in 1979. The Grand Canyon is a spectacular example of weathering and erosion, featuring unmatched vistas and intriguing landforms comprised of irregular-shaped cliffs and valleys caused by differential erosion, buttes, mesas, and rock depositions forming talus cones and aprons. Because of these geological spectacles, the Grand Canyon ranks among the world's greatest attractions with on-going erosion revealing much about the earth's geological history. Every year millions of visitors from all over the world visit the Park.

Figure 3.4 – Grand Canyon National Park

3.5 Mazatzal Wilderness Area

The Mazatzal Wilderness was originally established in 1938 as a primitive area and has expanded to encompass over 252,500 acres within the Tonto and Coconino National Forests. Elevations range from 1,600 feet along the Verde River to 7,903 feet on Mazatzal Peak. The wilderness contains the northern portion of the Mazatzal Range with desert mountains and narrow canyons. Typical vegetative types include desert scrub and Lower Sonoran vegetation at the lower elevations with grassy chaparral as the elevation increases. The Verde River also flows through the Sonoran Desert located in the western part of the wilderness area.

At the lower elevations, summer temperatures can reach 110 degrees Fahrenheit while the spring and fall temperatures are milder. Winter temperatures are typically in the 70s with lows in the middle and low 40s.

Figure 3.5 – Mazatzal Wilderness Area

3.6 Mount Baldy Wilderness Area

Not to be confused with California's Mt. Baldy, located in the San Gabriel Mountains, Mount Baldy Wilderness, located in Apache County about 90 miles south of the Petrified Forest National Park. Mount Baldy Wilderness, 7,079 acres, is an ancient volcano and the second highest peak in Arizona. It is located in the White Mountains along the southern edge of the Colorado Plateau. The summit of Mount Baldy is on the White Mountain Apache Indian Reservation and is closed to all non-tribal members. This SIP is only for the portion of Mount Baldy under the jurisdiction of the State.

Four rivers have headwaters on the slopes of Mount Baldy: the Black, Blue, White, and Little Colorado rivers. Fishing and camping are major recreational activities where 25 lakes are scattered among the mountains. Livestock grazing is common on the meadows and pine forests of the White Mountains. The area has a wide range of weather, with snow at the higher elevations. The same conditions and restrictions that pertain to the Sycamore Canyon Wilderness Area also pertain to Mount Baldy Wilderness area – no motorized or mechanized vehicles, no bicycles, and no power equipment is allowed.

Figure 3.6 – Mount Baldy Wilderness Area

3.7 Petrified Forest National Park

Petrified Forest National Park is located in northeastern Arizona. The Park lies within both Navajo and Apache Counties, covering a total of 93,533 acres. It was designated a national monument in 1906 and a national park in 1962. The southern portion of Petrified Forest National Park contains one of the world's largest concentrations of petrified wood. The northern portion of the Park encompasses the badlands of the Chinle Formation that extends along the Little Colorado River valley to the west for about 125 miles. Known more commonly as "the Painted Desert" with its colored soils ranging from blues and reds to yellows and grays, this area includes at its southern tip, the Rainbow Forest

Figure 3.7 – Petrified Forest National Park

3.8 Pine Mountain Wilderness Area

The Pine Mountain Wilderness is located in central Arizona approximately 100 kilometers north of the Phoenix area. The Pine Mountain Wilderness is within both the Prescott and Tonto National Forests. Designated in 1972, it encompasses 20,061 acres with a high elevation approximately 6,814 feet and a low elevation of about 4,000 feet. The area runs along the high Verde Rim and contains ponderosa pine-Douglas Fir forests, desert mountains, dry mesas, and deep canyons. Pine Mountain is the highest point on the Verde River Rim, which slashes across this area from northeast to southwest. Steep and rocky southeastern slopes fall toward the Verde River, Arizona's only Wild & Scenic River Area. On the rim is an "island" of tall ponderosa pine and Douglas fir surrounded by mountains and hot dry mesas covered in pinion and juniper, cut by rugged canyons.

Figure 3.8 – Pine Mountain Wilderness Area

3.9 Saguaro National Park

Saguaro National Park was originally established in 1933 as a national monument as was officially changed to a national park in 1994. Saguaro National Park encompasses 91,440 acres and has two districts: the Rincon Mountain District (east of Tucson) and the Tucson Mountain District (west of Tucson). Park elevations range from 2,180 feet to 8,666 feet at the peak of Mica Mountain. Vegetative communities in the two districts consist of desert scrub, desert grassland, oak woodland, pine-oak woodland, pine forest, and mixed-conifer forest.

Temperatures in the park range from the mid-30s to mid-60s during winter months and average in the mid-60s to the high 90s during the summer. Average rainfall is between 10 and 12 inches per year.

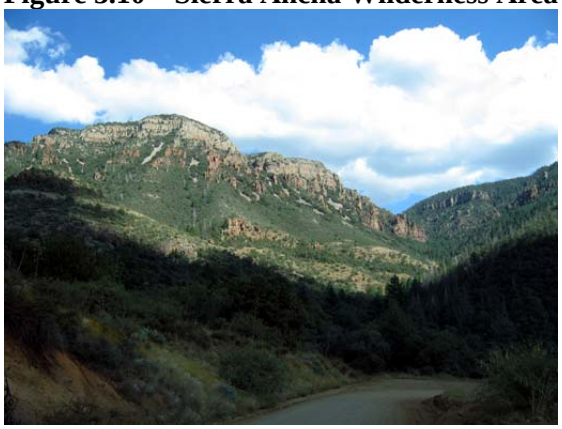
Figure 3.9 – Saguaro National Park

3.10 Sierra Ancha Wilderness Area

The Sierra Ancha Wilderness is located in central Arizona on the Tonto National Forest approximately 20 to 30 miles north of the Globe-Miami area. Originally designated as a "Primitive Area" in 1933, the Wilderness Act of 1964 expanded the area to encompass 20,850 acres. Elevations ranging from 4,000 feet to 7,400 feet, which includes different landscapes from desert scrub to box canyons and mountains. The types of vegetation found in the wilderness area vary from semi-arid brush and grassland to mixed-conifer and ponderosa pine.

Sierra Ancha receives an average of 26 inches of precipitation annually, higher elevations receive snowfall during winter months and the low elevations receive rain during the spring and late summer months. Maximum temperatures also vary with elevation, the low-elevation desert areas are typically in the mid-80s to low 90 degrees Fahrenheit in the summer and winter temperatures are commonly 20 to 30 degrees Fahrenheit. The higher elevations experience cooler temperatures ranging between 50 to 70 degrees and the spring/fall/winter temperatures range between 30 degrees Fahrenheit to the upper 40s.

Figure 3.10 – Sierra Ancha Wilderness Area



3.11 Superstition Wilderness Area

The Superstition Wilderness is located east of the Phoenix Metropolitan area. The wilderness was first designated in 1939, and expanded in 1984 to 160,200 acres. Elevations range from 2,000 feet to 6,265 feet. The topography varies between low hills and steep, rugged terrain. Vegetative types within the wilderness include Sonoran desert scrub, semi-desert grassland, and chaparral. There a few pockets of ponderosa pine at higher elevations.

The climate during summer months is harsh with high temperatures in mid-100s. Low temperatures average in the mid-80s. The spring, fall, and winter climate is much more pleasant, with average temperature ranging from the low to mid-40s to the high 60s and low 70s. The wilderness averages between 10 and 12 inches of rain per year, mostly occurring during the monsoon thunderstorms. Snow can occur in the high elevations during the winter.

Figure 3.11 – Superstition Wilderness Area – Flat Iron Peak

3.12 Sycamore Canyon Wilderness Area

Approximately 40 miles southwest of Flagstaff, Arizona is the Class I Area known as Sycamore Canyon Wilderness. Designated in 1935 as a Primitive Area, Congress formally established the area as a federally protected area in 1972. It became a Wilderness Area through the 1977 Arizona Wilderness Act.

The area, split between Coconino and Yavapai Counties, contains 55,937 acres, beginning with pine and fir forests on the Colorado Plateau through part of the Mogollon Rim, ending at the desert mouth of the Verde Valley. Sycamore Canyon Wilderness, containing beautiful red rock, buttes, and sheer cliffs, is only 15 miles west of Oak Creek Canyon and Sedona area, one of Arizona's most popular tourist destinations. Motorized or mechanized vehicles are not allowed in the area.

Figure 3.12 – Sycamore Canyon Wilderness

CHAPTER 4: REGIONAL HAZE MONITORING NETWORK

4.1 Overview of the IMPROVE Monitoring Network

In the mid-1980s, the Interagency Monitoring of Protected Visual Environments (IMPROVE) was established to measure visibility impairment in mandatory CIAs throughout the United States. The monitoring sites are operated and maintained through a formal cooperative relationship between the EPA, National Park Service, U.S. Fish and Wildlife Service, Bureau of Land Management, and U.S. Forest Service. In 1991, several additional organizations joined the effort: State and Territorial Air Pollution Program Administrators and the Association of Local Air Pollution Control Officials, Western State Air Resources Council, Mid-Atlantic Regional Air Management Associations, and Northeast States for Coordinated Air Use Management.

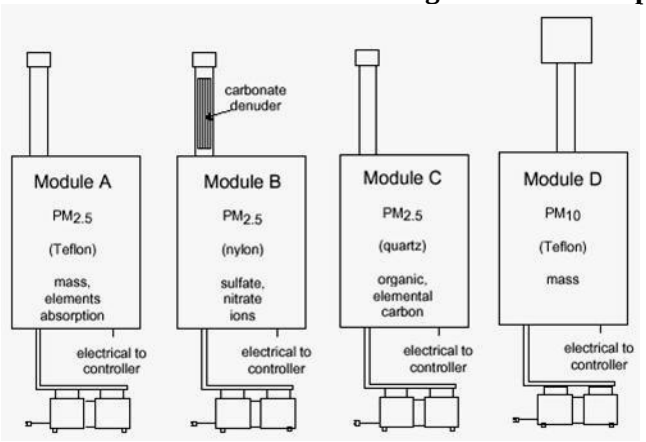
The objectives of the IMPROVE program include establishing current visibility and aerosol conditions in mandatory Class I Federal Areas (CIAs), identifying the chemical species and emission sources responsible for existing human-made visibility impairment, documenting long-term trends for assessing progress towards the national visibility goals, and support the requirements of the Regional Haze Rule by providing regional haze monitoring representing all visibility protected CIAs where practical.

The data collected at the IMPROVE monitoring sites are used by land managers, industry planners, scientists, public interest groups, and air quality regulators to better understand and protect the visual air quality resource in CIAs. Most importantly, the IMPROVE Program scientifically documents for American citizen, the visual air quality of their wilderness areas and national parks.

Figure 4.1 shows a typical IMPROVE site, and Figure 4.2 shows the four separate modules used for sampling the different pollutant species.

Figure 4.1 – Typical IMPROVE Monitor

Figure 4.2 – Four Modules used for Regional Haze Sampling



The data collected at the IMPROVE monitoring sites are used by land managers, air quality regulators, industry planners, scientists, and public interest groups to understand, analyze, and protect the visual air quality resource in Class I areas. Most importantly, the IMPROVE Program scientifically documents the visual air quality of their wilderness areas and national parks.

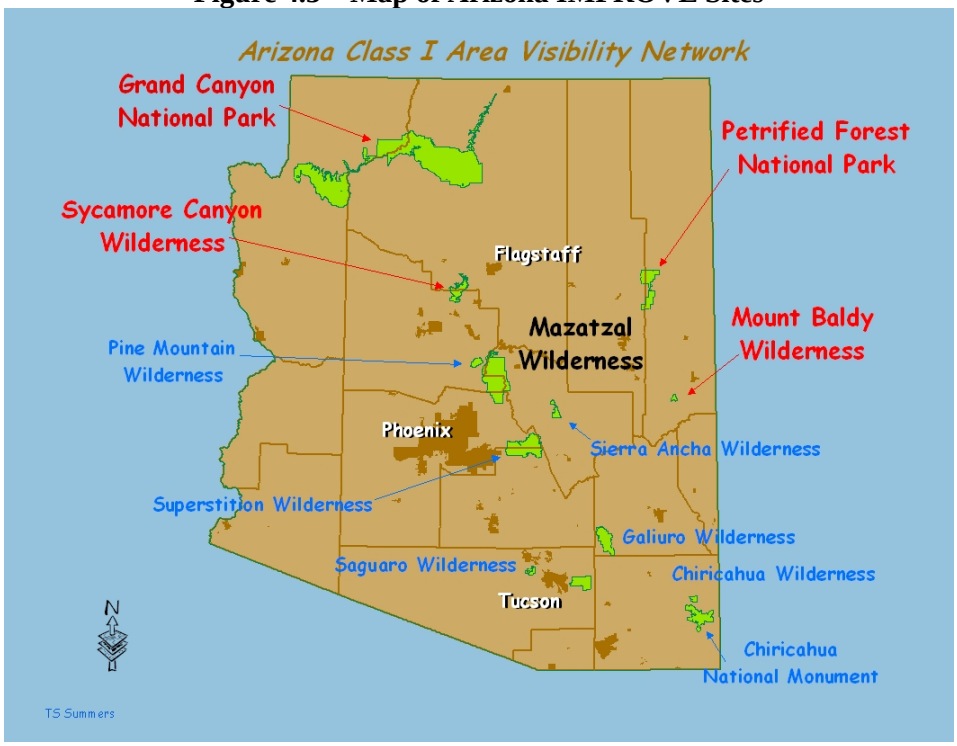
4.2 Arizona IMPROVE Monitoring Network

In Arizona, there are ten IMPROVE monitors, listed in Table 4.1, that collect data for regional haze monitoring. Figure O shows the locations of the IMPROVE monitors in Arizona.

Table 4.1 – Arizona IMPROVE Monitors

Site Name	Site Code	Class I Area	Sponsor	Elevation MSL	Start Date
Chiricahua NM	CHIR1	Chiricahua NM, Chiricahua WA, Galiuro WA	USFS	1554	3/1998
Hance Camp at Grand Canyon	GRCA2	Grand Canyon NP	NPS	2267	9/1997
Ike's Backbone	IKBA1	Mazatzal WA, Pine Mountain WA	USFS	1297	12/2000
Mount Baldy	BALD1	Mt. Baldy WA	USFS	2508	2/2000
Petrified Forest NP	PEFO1	Petrified Forest NP	NPS	1766	3/1988
Saguaro NP – East Unit	SAGU1	Saguaro NP	NPS	941	6/1988
Saguaro NP – West Unit	SAWE1	Saguaro NP	NPS	714	4/2001
Sierra Ancha	SIAN1	Sierra Ancha WA	USFS	1600	2/2000
Sycamore Canyon	SYCA1	Sycamore Canyon WA	USFS	2046	9/1991
Tonto NM	TONT1	Superstition WA	USFS	775	4/1988

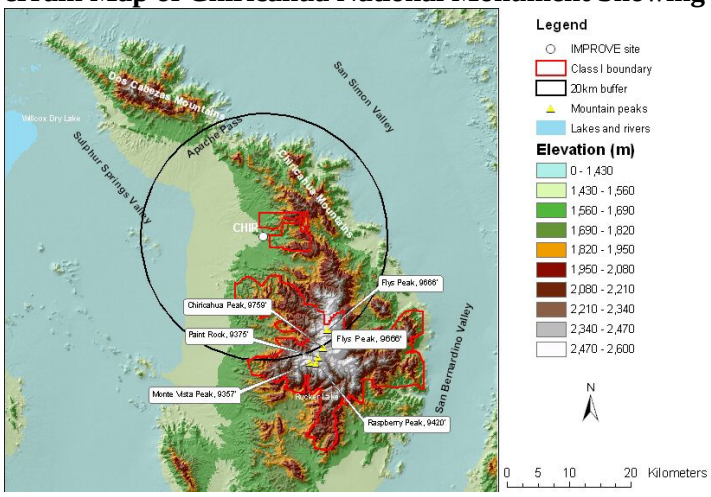
Figure 4.3 – Map of Arizona IMPROVE Sites



4.2.1 Chiricahua NM (CHIR1)

The IMPROVE monitoring site representing Chiricahua National Monument, Chiricahua Wilderness, and Galiuro Wilderness is Chiricahua NM (CHIR1), which is located outside of the western boundary of Chiricahua National Monument at an elevation of 5,150 feet.

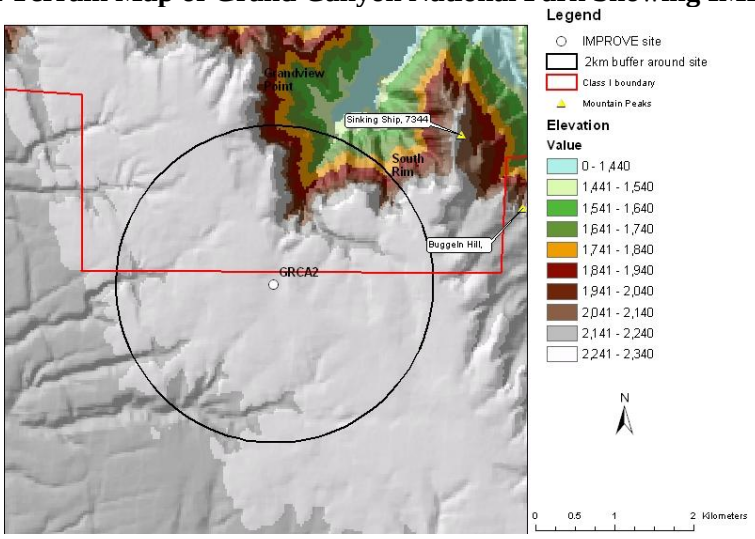
Figure 4.4 – 20 km Terrain Map of Chiricahua National Monument Showing IMPROVE Location



4.2.2 Hance Camp at Grand Canyon (GRCA2)

The IMPROVE monitoring site representing Grand Canyon National Park is Hance Camp at Grand Canyon (GRCA2), which is located at a regionally exposed location on the south rim, elevation 2,267 m (7,346 ft). Terrain in the vicinity of GRCA2 is forested rolling hills to the south, and drops into the Grand Canyon to the north.

Figure 4.5 – 2 km Terrain Map of Grand Canyon National Park Showing IMPROVE Location



4.2.3 Ike's Backbone (IKBA1)

Ike's Backbone (IKBA1) is the IMPROVE monitor that is representative for Pine Mountain Wilderness and Mazatzal Wilderness. Ike's Backbone is a promontory above the Verde River that extends into the Wilderness at its northwestern extreme. From IKBA1 the Wilderness vista is to the southeast, across the Verde towards the higher terrain. At an elevation of 4,274 feet, the monitor is midway in the range of elevations found over the area. From IKBA1 the Pine Mountain Wilderness is to the southwest across the Verde River valley.

Figure 4.6 – 20 km Terrain Map of Mazatzal Wilderness

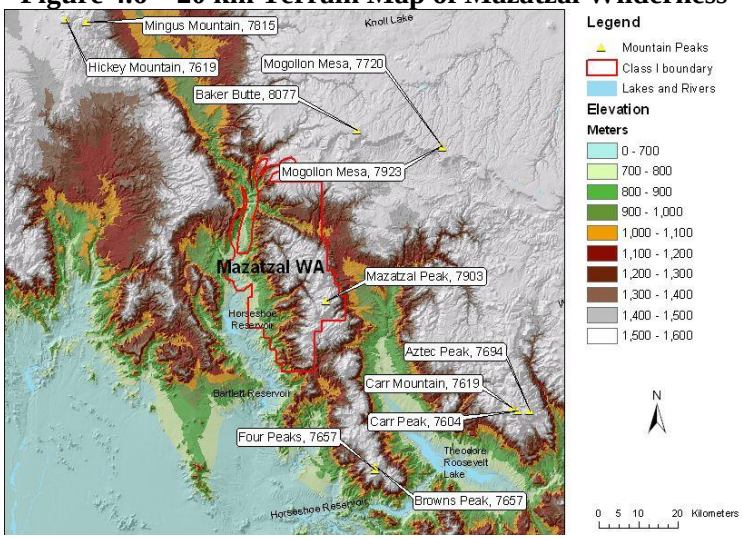
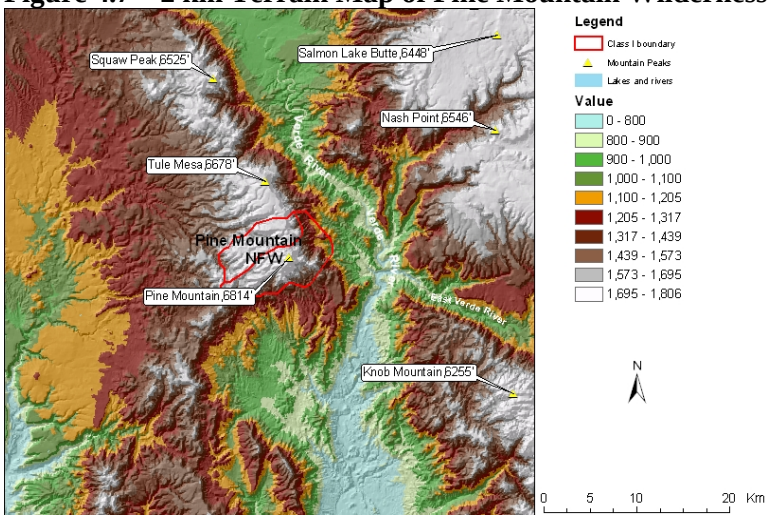


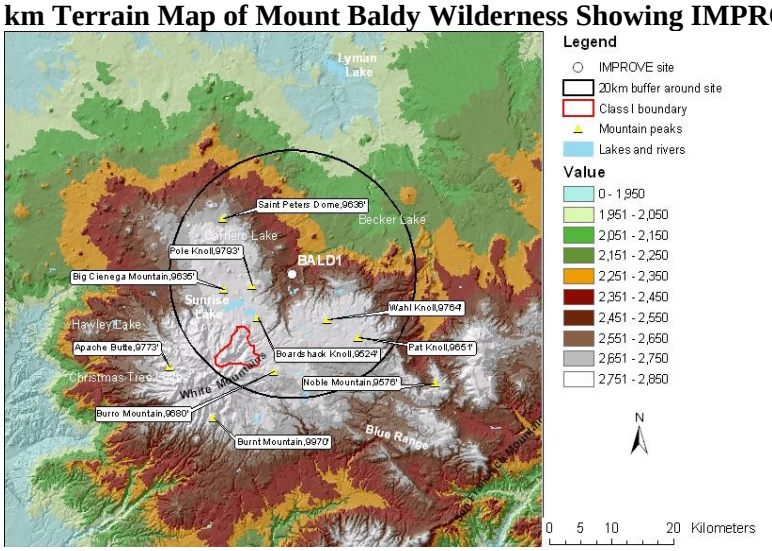
Figure 4.7 – 2 km Terrain Map of Pine Mountain Wilderness



4.2.4 Mount Baldy (BALD1)

The IMPROVE monitoring site representing the Mount Baldy Wilderness Area is BALD1, located outside of the Wilderness Boundary about 6.214 miles to the northeast, elevation 8,243 feet. The Mount Baldy Wilderness Area is within the Fort Apache Indian Reservation in east-central Arizona. It comprises the northeast slopes and drainages of Baldy Peak, an extinct volcano with peak elevation 3,477 ft (11,403 ft), and includes the headwaters of the West and East Forks of the Little Colorado River. Mount Baldy is the highest peak in a large region of eastern Arizona/western New Mexico. Most of the forest covering the mountain is mixed conifers with ponderosa pine in the lower elevations and fir and spruce higher up.

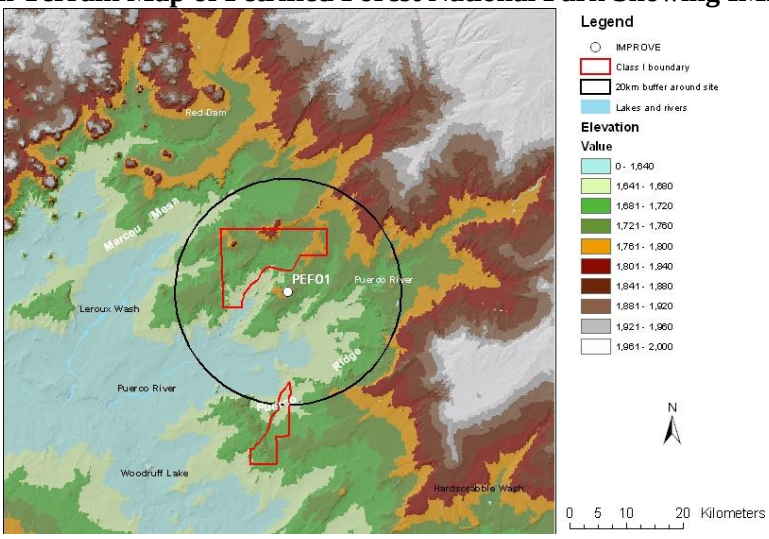
Figure 4.8 – 20 km Terrain Map of Mount Baldy Wilderness Showing IMPROVE Location



4.2.5 Petrified Forest NP (PEFO1)

The IMPROVE monitoring site representing Petrified Forest National Park is PEFO1, which is located in a well-exposed location near the crest of a ridge, an extension from higher terrain to the northeast into lower terrain towards the Little Colorado to the southwest. It is located between two separated parcels that comprise the National Park, one about 3 miles across a low-lying area to the north and west, and the other about 10 miles across a similar low-lying area to the south. Elevation at the monitoring site is 5,796 feet. Elevations in the two National Park sections are similar range from 5,400 to 5,750 feet. Terrain is generally badland hills, flat-topped mesas and buttes, with sparse ground cover.

Figure 4.9 – 20 km Terrain Map of Petrified Forest National Park Showing IMPROVE Location

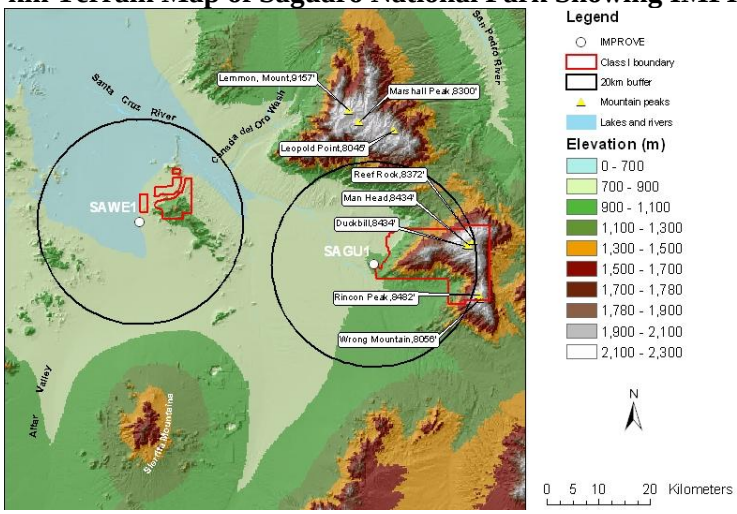


4.2.6 Saguaro NM (SAGU1) and West Unit (SAWE1)

The IMPROVE monitoring site for the east unit (Rincon Mountain District) is Saguaro NM (SAGU1). The site is at an elevation of 3,060 ft near the base of the mountains on the west side and very close to eastern Tucson city limits. Unlike the west unit (Tucson District), the east unit is likely to be influenced by Tucson urban emissions as there are no terrain obstructions between.

The IMPROVE site representing the West Unit (Tucson Mountain District) of Saguaro National Park is SAWE1, located at an elevation 2,355 feet on the west slope. The Tucson Mountain District, including SAWE1, is isolated from the Tucson urban area by the Tucson Mountains that present a barrier between them.

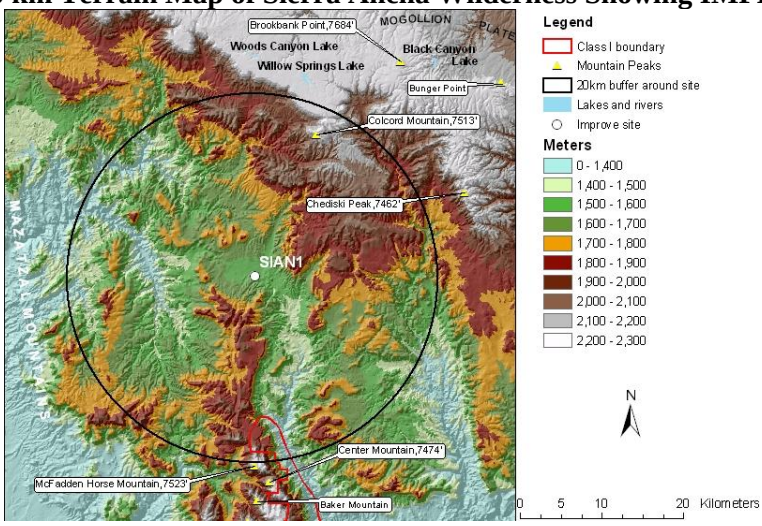
Figure 4.10 – 20 km Terrain Map of Saguaro National Park Showing IMPROVE Locations



4.2.7 Sierra Ancha (SIAN1)

The IMPROVE monitoring site representing the Sierra Ancha Wilderness Area is SIAN1, located outside of the Wilderness Boundary about 20 km to the north near the town of Young, Arizona. It is at an elevation of 1,595 m, midway within the range of elevations of the Sierra Ancha Wilderness, and is midway between the Wilderness Area and the Mogollon Rim to the north.

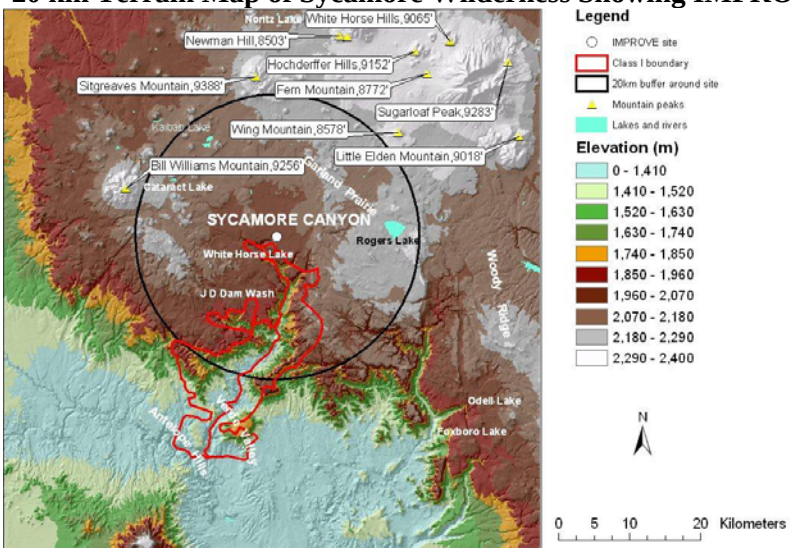
Figure 4.11 – 20 km Terrain Map of Sierra Ancha Wilderness Showing IMPROVE Location



4.2.8 Sycamore Canyon (SYCA1)

The IMPROVE monitoring site representing the Sycamore Wilderness Area is SYCA1, which is located on the large open plateau terrain near the rim of the canyon, approximately 1.864 miles northeast of the canyon's most northerly extent. Elevation at the monitoring site is 6,691 ft, while elevations at the canyon bottom range from about 5906 feet at the north end to 3543 feet where it joins with the Verde River, about 25 miles south of the monitoring site. Terrain near the monitoring site is forested rolling land, part of the Kaibab National Forest. Within the canyon, terrain is steep and populated with shrubs and cacti.

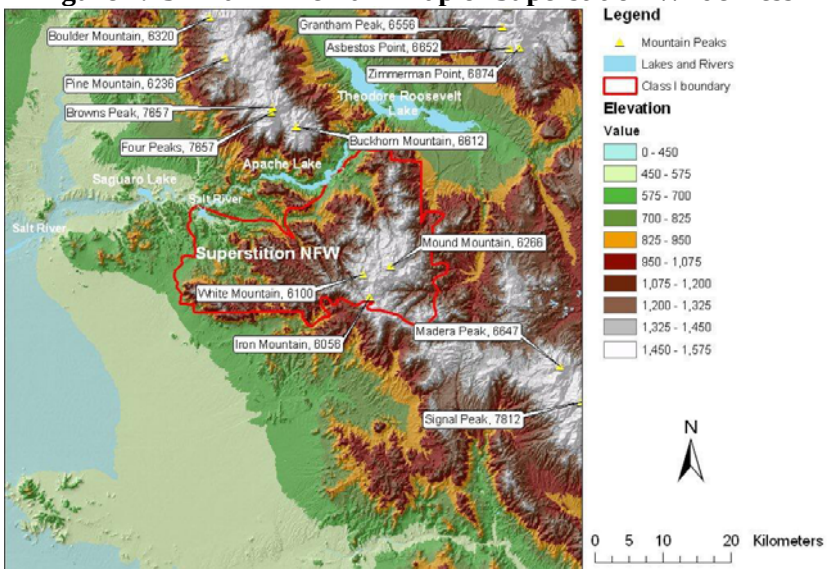
Figure 4.12 – 20 km Terrain Map of Sycamore Wilderness Showing IMPROVE Location



4.2.9 Tonto NM (TONT1)

The IMPROVE monitoring site representing the Superstition Wilderness Area is TONT1, Tonto National Monument, at an elevation of 2,578 feet. It is about 5 km north of the northwestern Wilderness boundary.

Figure 4.13 – 20 km Terrain Map of Superstition Wilderness



4.3 Arizona Regional Haze Monitoring Commitments

In 1996, ADEQ's monitoring plan for the Arizona Class I areas adding optical and meteorological monitoring equipment to existing IMPROVE sites to supplement data collected by the IMPROVE aerosol monitors with continuous measurements to better characterize the air quality in these areas. ADEQ also established protocol sites (completely supported by ADEQ following IMPROVE monitoring requirements) to supplement network coverage. Part of the motivation for installing integrating

nephelometers at IMPROVE sites was a desire to use short term (five minutes) visibility estimates to model the visual experience of a visitor to a Class I area. A second motivation for installing nephelometers at IMPROVE sites was to provide input to mathematical algorithms that create values that can be compared with the IMPROVE measurements to test the performance of the IMPROVE algorithm. Both the original and the revised IMPROVE algorithms tend to over-estimate the lowest extinction values typical of the Arizona IMPROVE sites.

ADEQ's current monitoring plan identifies the IMPROVE sites as the visibility network for monitoring regional haze. The IMPROVE sites contained in the visibility network are those described in Section 4.2 of this chapter. ADEQ will continue to use the federally operated and funded IMPROVE sites for monitoring visibility conditions at the Class I areas and will encourage the continued funding and maintenance of IMPROVE.

ADEQ is discontinuing operation of the nephelometers at nine Class I visibility sites in 2010 due to budget constraints. The nephelometers to be closed are:

- Chiricahua Entrance Station
- Greer Water Treatment Plant
- Ike's Backbone
- Organ Pipe National Monument
- Petrified Forest National Park - South
- Pleasant Valley Ranger Station
- Queen Valley
- Saguaro National Park West
- Sycamore Canyon

The monitors listed are not required by the IMPROVE program, the CFR, or by the Regional Haze Rule SIP, and they have been funded solely by ADEQ. A wealth of data has been collected at each site and will be analyzed and summarized to characterize optical air quality for each Class I area represented. These results will be made available on ADEQ's website and the VIEWS website during the summer of 2010. It is important to note that only the ADEQ nephelometers will close and the IMPROVE aerosol monitors will continue to operate.

(page intentionally blank)

CHAPTER 5: TECHNICAL INFORMATION AND DATA

This chapter describes the information relied upon in developing this plan. It describes the Western Regional Air Partnership (WRAP), committees and workgroups of the WRAP, and work products developed by WRAP that were used to develop this plan.

5.1 WRAP and Technical Support

The WRAP is a voluntary organization of western states, Tribes and federal agencies. It was formed in 1997 as the successor to the Grand Canyon Visibility Transport Commission (GCVTC). It is a regional planning organization that provides assistance to western states to aid in the preparation of regional haze plans. The WRAP also implements regional planning processes to improve visibility in all Western Class I areas by providing the technical and policy tools needed by states and Tribes to implement the federal regional haze rule. The WRAP is administered jointly by the Western Governors' Association (WGA) and the National Tribal Environmental Council (NTEC).

The states involved with WRAP are Alaska, Arizona, California, Colorado, Idaho, Montana, New Mexico, North Dakota, Oregon, South Dakota, Utah, Washington, and Wyoming. Tribal board members include Campo Band of Kumeyaay Indians, Confederated Salish and Kootenai Tribes, Cortina Indian Rancheria, Hopi Tribe, Hualapai Nation of the Grand Canyon, Native Village of Shungnak, Nez Perce Tribe, Northern Cheyenne Tribe, Pueblo of Acoma, Pueblo of San Felipe, and Shoshone-Bannock Tribes of Fort Hall. Representatives of other tribes participate on WRAP forums and committees. Participation is encouraged throughout the western states and Tribes. Federal participants are the Department of the Interior (National Park Service and Fish & Wildlife Service,) the Department of Agriculture (Forest Service), and the Environmental Protection Agency (EPA).

5.1.1 WRAP Committees and Workgroups

1. Initiatives Oversight Committee

The Initiatives Oversight Committee (IOC) is responsible for establishing and overseeing the work of forums that develop policies and programs to improve and protect our air quality. IOC forums are:

The Air Pollution Prevention Forum
The Air Pollution Prevention Forum is tasked with developing energy conservation initiatives and programs to expand the use of renewable energy sources. They are working to find, and encourage use of, energy sources that minimize air pollution.

The Economic Analysis Forum
This Forum assists with studies to evaluate the economic effects of air quality programs being developed by the WRAP to diminish haze throughout the West.

The Forum on Emissions In/Near Class 1 Areas
This Forum is looking at pollution sources in and near federally mandated Class 1 areas to determine their impact on visibility in those areas. The group also will address mitigation and outreach options.

The Mobile Sources Forum
This Forum addresses the impact of motor vehicles and other mobile sources of pollution. For example, the Forum developed a plan presented to the WRAP that suggested a revision of U.S. Environmental Protection Agency rules regarding the production of low-sulfur fuel by small refineries. The Forum also recommended reforms for off-road emissions and diesel fuel.

2. Technical Oversight Committee

The Technical Oversight Committee's (TOC's) tasks are to identify and manage technical issues and to establish and oversee the work of forums and work groups that are developing and analyzing, scientific information related to air quality planning in the West. TOC forums and work groups include:

The Air Quality Modeling Forum
This Forum identifies, evaluates the performance of, and applies mathematical air quality models, which can be used to quantify the benefits of various air quality programs for reducing haze in the western United States.

The Ambient Monitoring and Reporting Forum
This Forum oversees the collection, use, and reporting of ambient air quality and meteorological monitoring data as needed to further the WRAP's overall goals.

The Emissions Forum
This Forum is developing the first comprehensive inventory of haze-causing air emissions in the West, including a comprehensive emissions tracking and forecasting system. The forum also monitors trends in actual emissions and forecasts emissions reductions anticipated from current regulations and alternative control strategies.

Attribution of Haze Work Group
This Work Group is preparing guidance for states and tribes regarding both the types of pollution emitters and the regions in which pollutants contribute to visibility impairment in national parks and other Class 1 areas. Three state and three tribal representatives form the work group along with all members of the Technical Oversight Committee and one representative each from the Initiatives Oversight Committee, the technical and joint forums and the Tribal Data Development Work Group.

The Tribal Data Development Work Group
This Work Group is identifying gaps in air quality data for tribal lands and working with tribes to collect that data. While some tribes have adequate staff and equipment for such an undertaking, many lack the manpower and technical resources to accomplish the work on their own. This Work Group is providing help by both enhancing the tribes' ability to collect the necessary data and establishing an organized way to standardize and catalogue the information for subsequent analysis.

3. WRAP Working Committees and Forums

Implementation Work Group

The purpose of this work group is to bring together state and tribal staff involved in the development of regional haze plans, to meet the requirements of the Regional Haze Rule. This work group discusses the major strategies associated with state and tribal regional haze plans, issues associated with plan development and rule interpretation, and coordination and consultation between states, tribes, EPA, and the FLMs on these topics. State representatives on this work group are the primary regional haze plan writers.

Joint Technical and Policy Forums

Joint Forums address both technical issues and policy. Both the TOC and the IOC have oversight.

The Dust Emissions Joint Forum

This Dust Emissions Joint Forum (DEJF) seeks to improve the methods for estimating dust emissions and their inputs into air quality models. The Forum also is examining the extent of dust impacts and strategies to reduce dust emissions.

The Fire Emissions Joint Forum (FEJF)

The Grand Canyon Commission confirmed that forest fires contribute significantly to visibility problems and that the use of prescribed fire is expected to increase as a forest management tool. The FEJF is developing measures to reduce the effects of emissions from prescribed fires and is examining emissions from all kinds of fire, whether ignited naturally or by humans. The Forum is considering public health and nuisance effects as well as visibility impacts. It will develop a tracking system for fire emissions and management techniques to minimize emissions. This Forum is working to coordinate with and gain the full cooperation of federal, tribal, state, and local agencies as well as private landowners, forest managers, and the agriculture community.

The Stationary Sources Joint Forum

The Stationary Sources Joint Forum (SSJF), formerly the Market Trading Forum, developed the details of an emissions trading program to achieve cost-effective reductions from industrial sources of sulfur dioxide. The Forum first set emission milestones for sulfur dioxide between now and 2018 and then designed a trading program to be triggered if these emission targets are exceeded. The Forum is now examining other industrial source emissions, such as oxides of nitrogen and particulate matter, and is assisting WRAP members in compliance with the stationary source provisions of the regional haze rule.

5.1.2 WRAP Technical Support System

The primary purpose of the Technical Support System (TSS) is to provide key summary analytical results and methods documentation for the required technical elements of the Regional Haze Rule, to support the preparation, completion, evaluation, and implementation of the regional haze implementation plans to improve visibility in Class I areas. The TSS provides technical results prepared using a regional approach, to include summaries and analysis of the comprehensive datasets used to identify the sources and regions contributing to regional haze in the Western Regional Air Partnership (WRAP) region.

The secondary purpose of the TSS is to be the one-stop-shop for access, visualization, analysis, and retrieval of the technical data and regional analytical results prepared by WRAP Forums and Workgroups in support of regional haze planning in the West. The TSS specifically summarizes results and consolidates information about air quality monitoring, meteorological and receptor modeling data analyses, emissions inventories and models, and gridded air quality/visibility regional modeling simulations. These copious and diverse data are integrated for application to air quality planning purposes by prioritizing and refining key information and results into explanatory tools. Additional information on the TSS is provided in Appendix C.

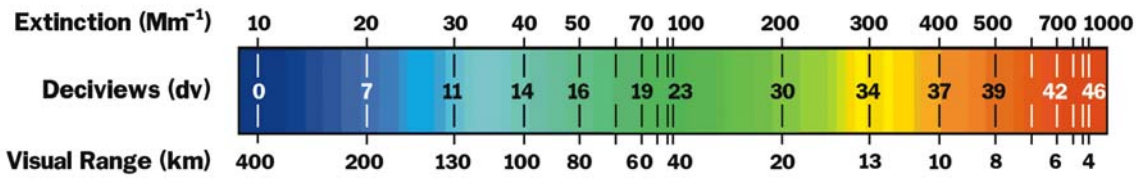
(page intentionally blank)

CHAPTER 6: ARIZONA CLASS ONE AREA BASELINE, NATURAL CONDITIONS, AND UNIFORM RATE OF PROGRESS

6.1 The Deciview

Each IMPROVE monitor collects particulate concentration data which are converted into reconstructed light extinction through a complex calculation using the IMPROVE equation (see Technical Support Documents for any Class I area). Reconstructed light extinction (denoted as b_{ext}) is expressed in units of inverse megameters (1/Mm or Mm^{-1}). The Regional Haze Rule requires the tracking of visibility conditions in terms of the Haze Index (HI) metric expressed in the deciview (dv) unit [40 CFR 51.308(d)(2)]. Generally, a one deciview change in the haze index is likely humanly perceptible under ideal conditions regardless of background visibility conditions.

The relationship between extinction (Mm^{-1}), haze index (dv) and visual range (km) are indicated by the following scale.



6.2 Baseline and Current Visibility Conditions

EPA requires the calculation of baseline conditions [40 CFR 51.308(d)(2)(i) and (ii)]. The baseline condition for each Arizona Class I area is defined as the five year average (annual values for 2000-2004) of IMPROVE monitoring data (expressed in deciviews) for the most impaired (20% worst) days and the least impaired (20% best) days. For this regional haze SIP submittal, the baseline conditions are the reference point against which visibility improvement is tracked. For subsequent regional haze SIP updates (in the year 2018 and every 10 years thereafter), baseline conditions are used to calculate progress from the beginning of the regional haze program.

Current conditions for the best and worst days are calculated from a multiyear average, based on the most recent five-year of monitored data available [40 CFR 51.308(f)(1)]. This value will be revised at the time of each periodic SIP revision and will be used to illustrate the following: 1) the amount of progress made since the last SIP revision, and 2) the amount of progress made from the baseline period of the program.

Arizona has established baseline visibility for the best and worst visibility days for each Class I area using on-site data from the IMPROVE monitoring sites. A five-year average (2000-2004) was calculated for each value (both best and worst). The calculations were made in accordance with 40 CFR 51.308(d)(2) and EPA's *Guidance for Tracking Progress Under the Regional Haze Rule* (EPA-454/B-03-004, September 2003). The IMPROVE II algorithm as described in the TSD has been utilized for the calculation of Uniform Rate of Progress (URP) glide slopes for all Class I areas. Table 6.1 shows the baseline conditions for each IMPROVE monitor site in Arizona.

Table 6.1 – Baseline Conditions for 20% Worst Days

Mandatory Federal Class I Area	IMPROVE Monitor	Baseline Conditions for 20% Worst Visibility Days (dv)
Mount Baldy Wilderness	BALD1	11.85
Chiricahua National Monument, Chiricahua Wilderness, Galiuro Wilderness	CHIR1	13.43
Grand Canyon National Park	GRCA2	11.66
Mazatzal Wilderness, Pine Mountain Wilderness	IKBA1	13.35
Petrified Forest National Park	PEFO1	13.21
Saguaro National Park – West Unit	SAWE1	14.83
Saguaro National Park – East Unit	SAGU1	16.22
Sierra Ancha Wilderness	SIAN1	13.67
Sycamore Canyon Wilderness	SYCA1	15.25
Superstition Wilderness	TONT1	14.16

6.3 Monitoring Data

Visibility impairing pollutants both scatter and absorb light in the atmosphere, thereby affecting the clarity of objects viewed at a distance by the human eye. Each haze pollutant has a different light extinction capability. In addition, relative humidity changes the effective light extinction of both nitrates and sulfates. Since haze pollutants can be present in varying amounts at different locations throughout the year, aerosol measurements of each visibility impairing pollutant are made every three days at the IMPROVE monitors located in or near each Class I area.

In addition to extinction, the Regional Haze Rule requires another metric for analyzing visibility impairment, known as the "Haze Index", which is based on the smallest unit of uniform visibility changes that can be perceived by the human eye. The unit of measure of the deciview (denoted dv).

More detailed information on the methodology for reconstructing light extinction along with converting between the haze index and reconstructed light extinction can be found in the Technical Support Documents for any of Arizona's eight Class I areas.

The haze pollutants reported by the IMPROVE monitoring program are sulfates, nitrates, organic carbon, elemental carbon, fine soil, and coarse mass. Summary data are provided for the worst and best days for baseline conditions from the all IMPROVE monitors for the six haze pollutants, See Section 6.5, Table 6.3.

6.4 Natural Visibility Conditions

The natural condition for each Class I area represents the visibility goal expressed in deciviews for the 20% worst visibility days and the 20% best visibility days that would exist if there were no naturally or anthropogenic impairment. The 20% worst days natural conditions correspond to the visibility goals for each Class I area to be reached by 2064 [40 CFR 51.308(d)(iii)].

Table 6.2 provides the 2064 natural conditions goal in deciviews for each Arizona Class I area. The natural conditions estimates were calculated consistent with EPA's *Guidance for Estimating Natural Visibility Conditions Under the Regional Haze Rule* (EPA-454/B-03-005, September 2003). The natural conditions goal can be adjusted as new visibility information becomes available. The Natural Haze Level II Committee methodology was utilized as described in the General TSD.

Table 6.2 – 2064 Natural Conditions Goal for 20% Worst Days

Mandatory Federal Class I Area	IMPROVE Monitor	2064 Natural Conditions for 20% Worst Visibility Days (dv)
Mount Baldy Wilderness	BALD1	6.24
Chiricahua National Monument, Chiricahua Wilderness, Galiuro Wilderness	CHIR1	7.2
Grand Canyon National Park	GRCA2	7.04
Mazatzal Wilderness, Pine Mountain Wilderness	IKBA1	6.68
Petrified Forest National Park	PEFO1	6.49
Saguaro National Park – West Unit	SAWE1	6.24
Saguaro National Park – East Unit	SAGU1	6.46
Sierra Ancha Wilderness	SIAN1	6.59
Sycamore Canyon Wilderness	SYCA1	6.65
Superstition Wilderness	TONT1	6.54

6.5 Uniform Progress

For the 20% worst days, uniform progress for each Class I area is the calculation of a uniform rate of progress (URP) goal per year to achieve natural conditions in 60 years [40 CFR 51.308(d)(1)(i)(B)]. In this SIP submittal, the first benchmark is the 2018 deciview level based on the URP applied to the first fourteen years of the program. This is also shown in Figure 6.3 in the column "2018 URP Goal".

For the 20% worst days, the uniform rate of progress (URP) in deciviews per year (i.e. slope of the glide path) is determined by the following equation:

URP = [Baseline Condition – Natural Condition]/60 years

Multiplying the URP by the number of years in the first planning period calculates the uniform progress needed by 2018 in order to be on the glidepath towards achieving the 2064 natural conditions goal.

2018 UPG = [URP] x [14 years]

The first planning period spans 14 years, which includes the four years between the end of the baseline period and the SIP submittal plus the standard 10 year planning period for the subsequent SIP revisions. The calculations are consistent with EPA's *Guidance for Setting Reasonable Progress Goals Under the Regional Haze Rule* (June 1, 2007). For the 20% best visibility days at each Class I area, the state must ensure no degradation in visibility for the least impaired days over the same period.

Table 6.3 shows the 2018 URP for the 20% worst days and the baseline that must not be exceeded over the years in order to maintain the best days. As with natural conditions, the URP can be adjusted as new visibility information becomes available.

Table 6.3 – Summary of Best and Worst Visibility Days for Arizona Class I Areas

Arizona Class I Area	20% Worst Days Visibility			20% Best Days Visibility		
	Worst Days Baseline (dv)	2018 URP (dv)	2018 Projected Visibility (dv)	Best Days Baseline (dv)	2018 Projected Visibility (dv)	2018 Projection less than Baseline?
Chiricahua NM, Chiricahua W, Galiuro W	13.43	11.98	13.35	4.91	4.94	No
Grand Canyon NP	11.66	10.58	11.14	2.16	2.12	Yes
Mazatzal W, Pine Mountain W	13.35	11.79	12.76	5.40	5.17	Yes
Mount Baldy W	11.85	10.54	11.52	2.98	2.86	Yes
Petrified NP	13.21	11.64	12.85	5.02	4.73	Yes
Saguaro NP – West Unit	16.22	13.90	15.99	8.58	8.34	Yes
Saguaro NP – East Unit	14.83	12.88	14.82	6.94	7.04	No
Sierra Ancha W	13.67	12.02	13.17	6.16	5.88	Yes
Superstition W	14.16	12.38	13.89	6.46	6.22	Yes
Sycamore Canyon W	15.25	13.25	15	5.58	5.49	Yes

CHAPTER 7: VISIBILITY IMPAIRMENT AT ARIZONA CLASS I AREAS

This chapter provides a summary of visibility impairment at the Class I areas covered in this plan. Data was gathered from the IMPROVE monitoring sites for each Class I area. Each section includes a summary of the pollutants causing visibility impairment and a summary of the visibility improvement needed from baseline (2000-2004) to the 2018 URP goal, and to the 2064 natural condition goal.

The visibility impairing pollutants described in this section include: ammonium nitrate, ammonium sulfate, elemental carbon, organic mass carbon, coarse mass, fine soil, and sea salt. Table 7.1 lists the pollutants, their abbreviations, and associated colors.

Table 7.1 – IMPROVE Monitor Aerosol Composition

Color	Pollutant	IMPROVE Abbreviation
	Ammonium Nitrate	ammno3f_bext
	Ammonium Sulfate	ammso4f_bext
	EC (Elemental Carbon)	ecf_bext
	OMC (Organic Mass Carbon)	omcf_bext
	CM (Coarse Mass)	cm_bext
	Soil (Fine Soil)	soilf_bext
	Sea Salt	seasalt_bext

Figures 7.1 and 7.2 – Reconstructed Aerosol Components for 20% Worst Days (2000-2004)

Figure 7.1 - Average Extinction for 20% Worst Days During Baseline Period (2000-2004)

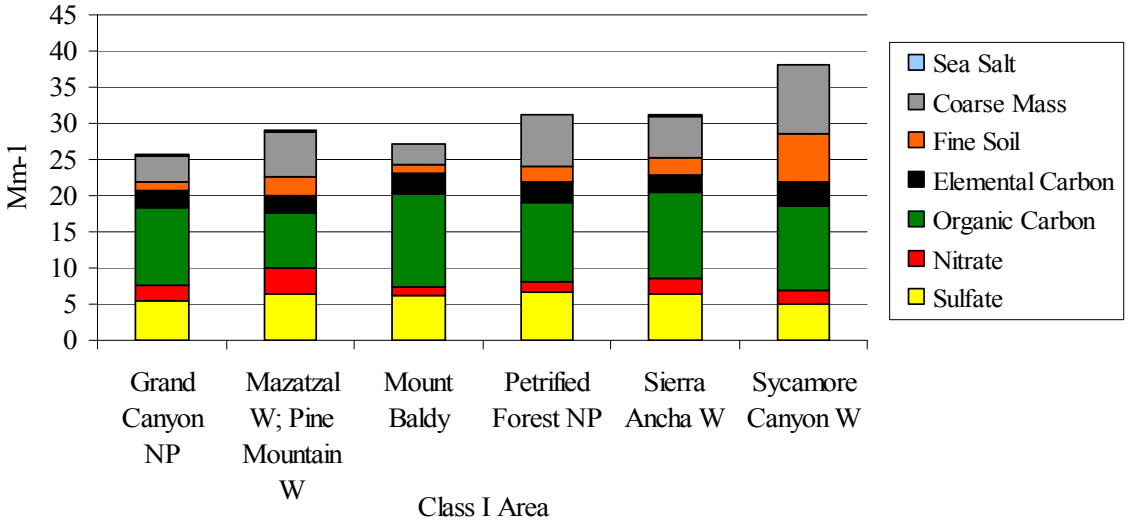
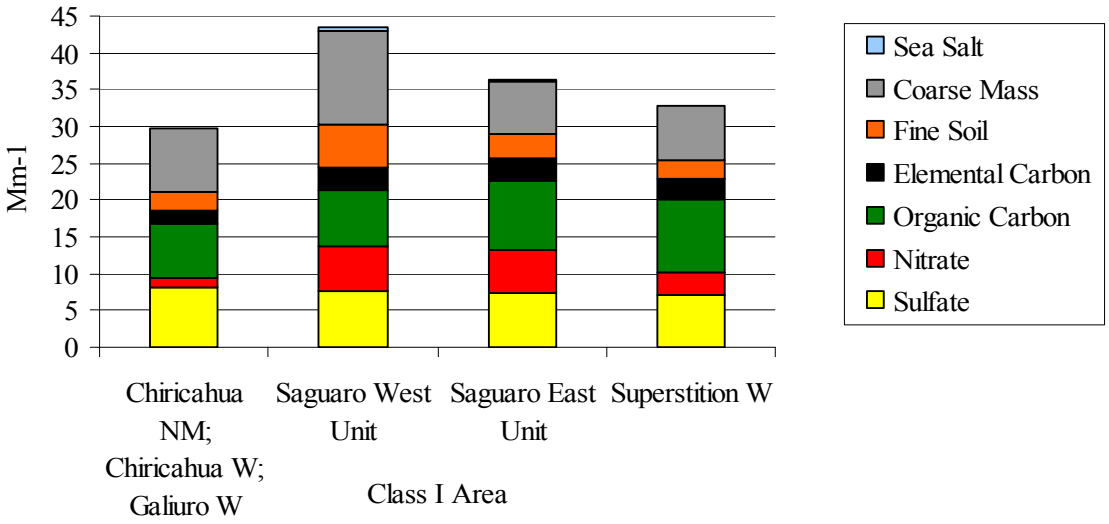


Figure 7.2 - Average Extinction for 20% Worst Days During Baseline Period (2000-2004)



Figures 7.3 and 7.4 – Reconstructed Aerosol Components for 20% Best Days (2000-2004)

Figure 7.3 - Average Extinction on 20% Best Days During Baseline Period (2000-2004)

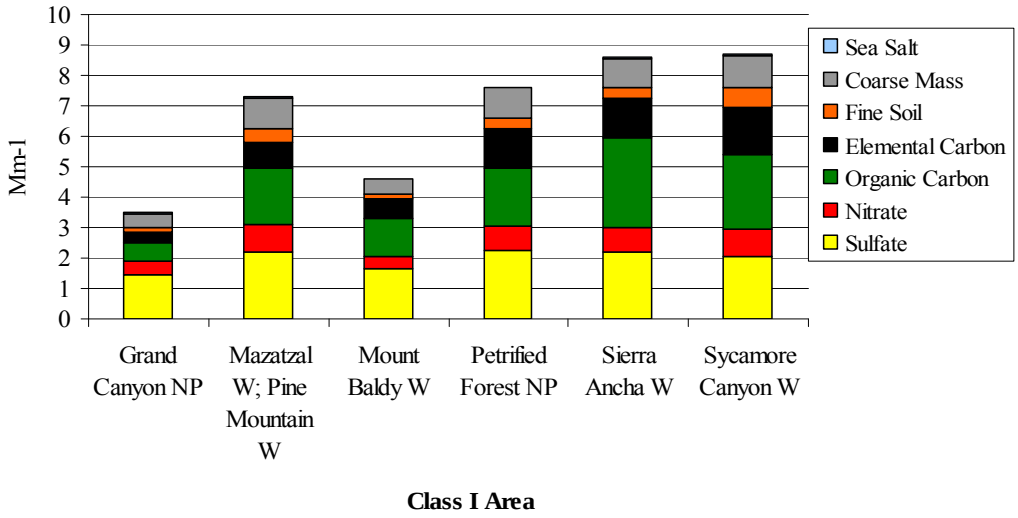
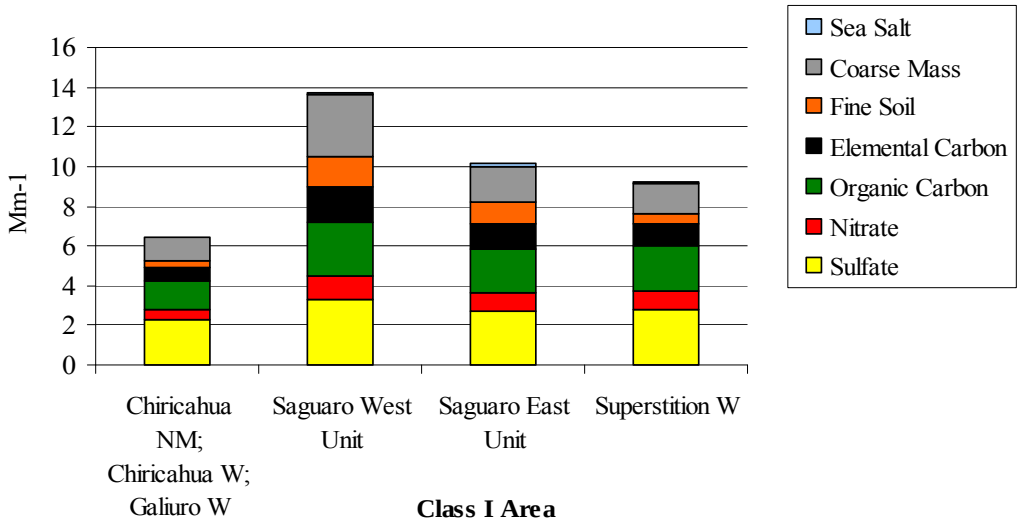


Figure 7.4 - Average Extinction on 20% Best Days During Baseline Period (2000-2004)



7.1 Chiricahua National Monument, Chiricahua Wilderness, and Galiuro Wilderness

The pollutants affecting visibility on the worst days at Chiricahua National Monument, Chiricahua Wilderness, and Galiuro Wilderness (as represented by IKBA1 IMPROVE monitor) are primarily coarse mass, sulfate, and organic carbon. Best days are dominated by sulfates, followed by organic carbon then coarse mass. The average contributions are shown in Figure 7.5 for baseline conditions.

Figure 7.5 – Average Species Contribution to 20% Best and Worst Days Baseline (CHIR1)

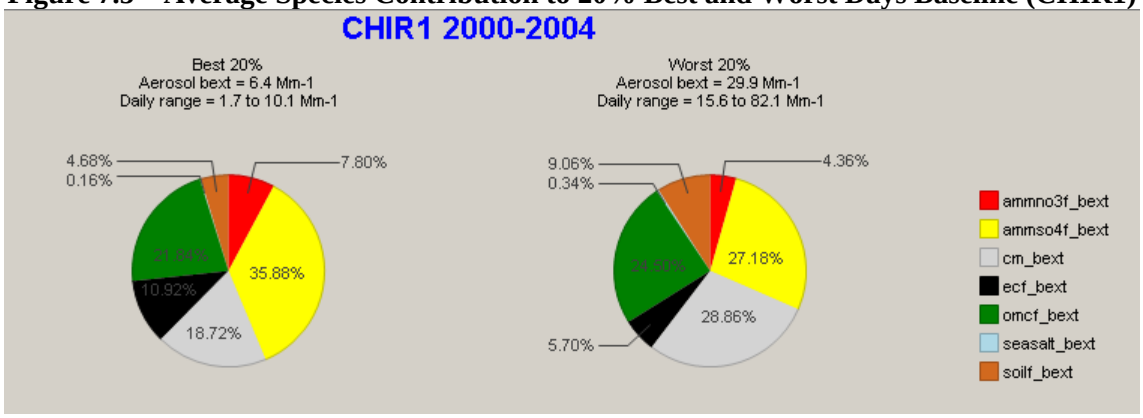


Figure 7.6 shows the light extinction for all haze-impairing pollutants over the baseline period. Extinction due to sulfate varies seasonally, increasing during the summer months. Spikes in organic carbon occurred during June 2002 and July 2003. Sources of coarse mass vary throughout the year while nitrate remains fairly constant.

Figure 7.6 – Monthly Average Species Variation for All Sampled Days over Baseline (CHIR1)

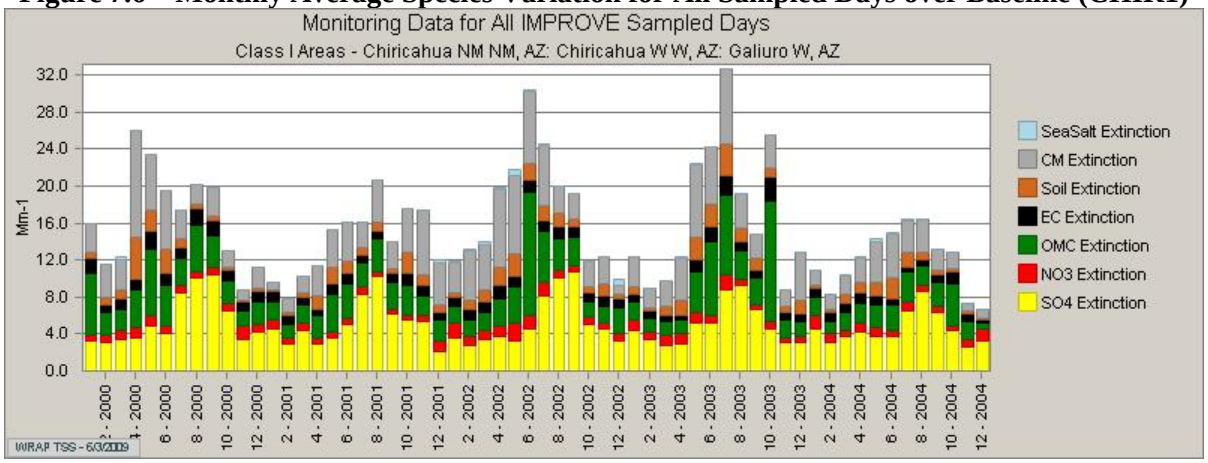
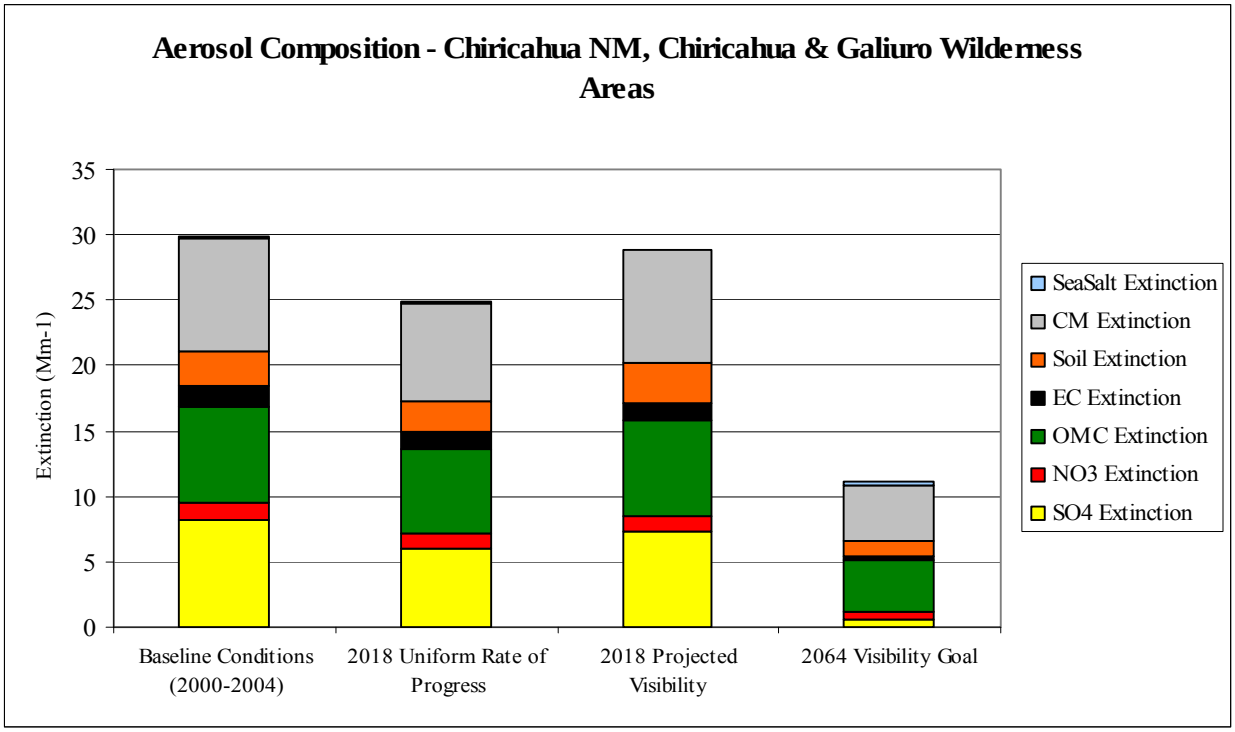


Figure 7.7 shows the light extinction for the baseline, the URP, the 2018 projected visibility, and natural conditions for all aerosol pollutants. The projected visibility condition, based on modeling, does not meet the 2018 URP.

Figure 7.7 – Baseline Worst Day Aerosol Composition Compared to 2018 URP, 2018 Projected Visibility and 2064 Natural Conditions Goal (CHIR1)



7.2 Grand Canyon National Park

The pollutants affecting visibility on the worst days at Grand Canyon National Park are primarily organic carbon, sulfate, and coarse mass. Best days are dominated by sulfates, followed by organic carbon then coarse mass. The average contributions are shown in Figure 7.8 for baseline conditions on both best and worst days.

Figure 7.8 - Average Species Contribution to 20% Best and Worst Days Baseline (GRCA2)

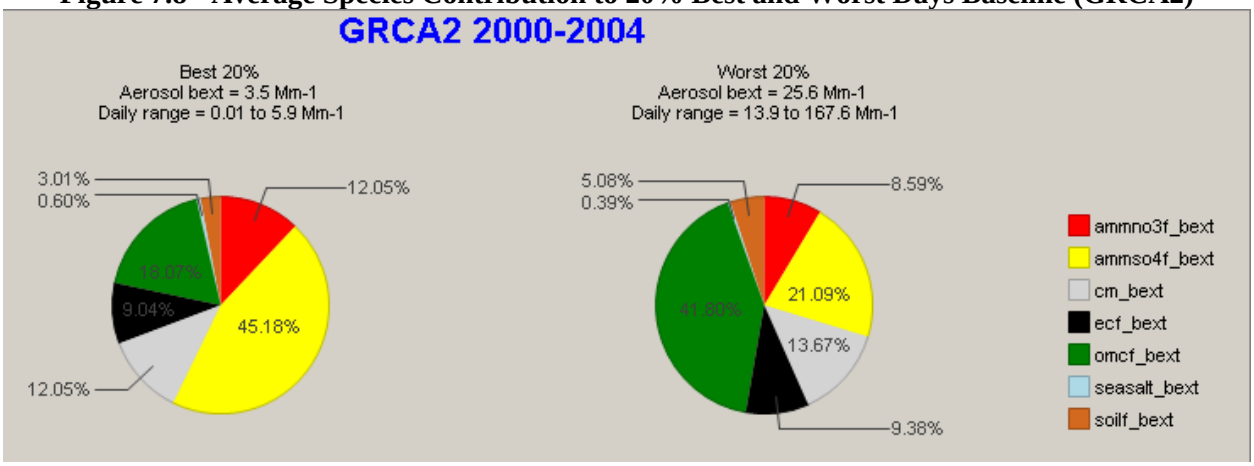


Figure 7.9 shows the light extinction for all haze-impairing pollutants over the baseline period for all IMPROVE sampled days. Extinction due to sulfate varies seasonally, increasing during the summer months. Spikes in organic carbon occurred during June 2002 and during June and July, 2003. Sources of coarse mass appear to increase during the summer months.

Figure 7.9 – Monthly Average Species Variation for All Sampled Days during the Baseline Period (GRCA2)

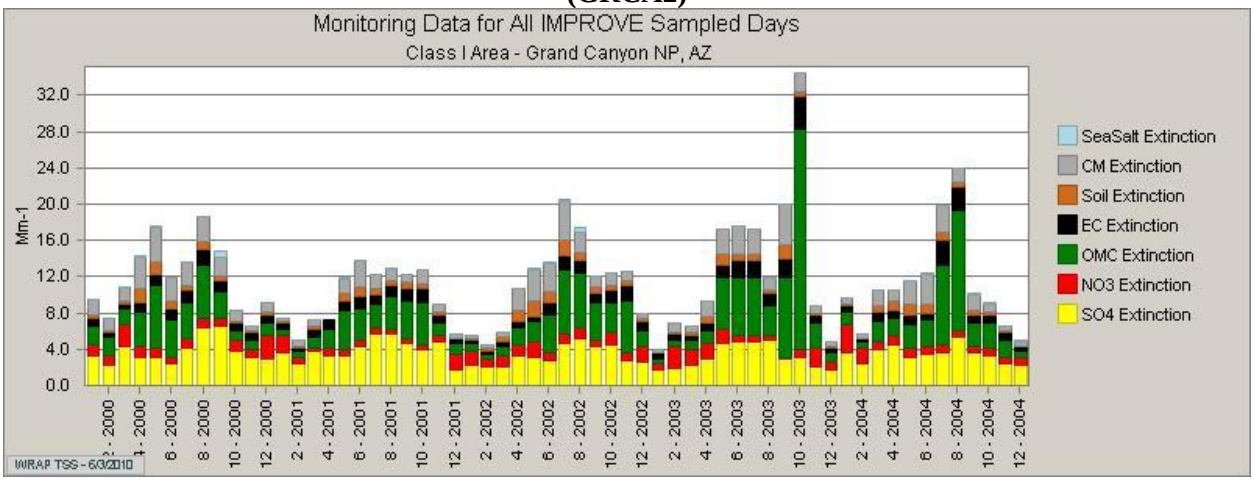
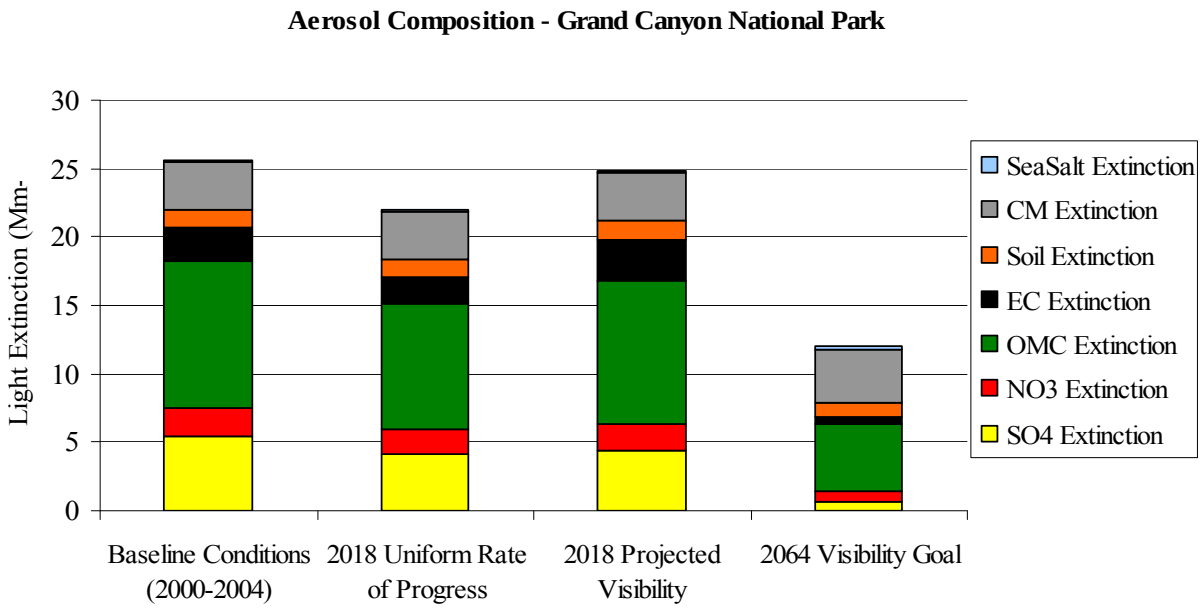


Figure 7.10 shows the light extinction for the baseline, the URP, the 2018 projected visibility, and natural conditions for all aerosol pollutants. The projected visibility condition, based on modeling, does not meet the 2018 URP.

Figure 7.10 – Baseline Worst Day Aerosol Composition Compared to 2018 URP, 2018 Projected Visibility and 2064 Natural Conditions Goal (GRCA2)



7.3 Mazatzal Wilderness and Pine Mountain Wilderness

Figure 7.11 shows that over the baseline period for best and worst days, the primary contributors to impairment are sulfate, organic carbon, and coarse mass. The visibility on best days has more impairment due to sulfate, whereas on worst days, organic carbon is the primary pollutant.

Figure 7.11 – Average Species Contribution to 20% Best and Worst Days Baseline (IKBA1)

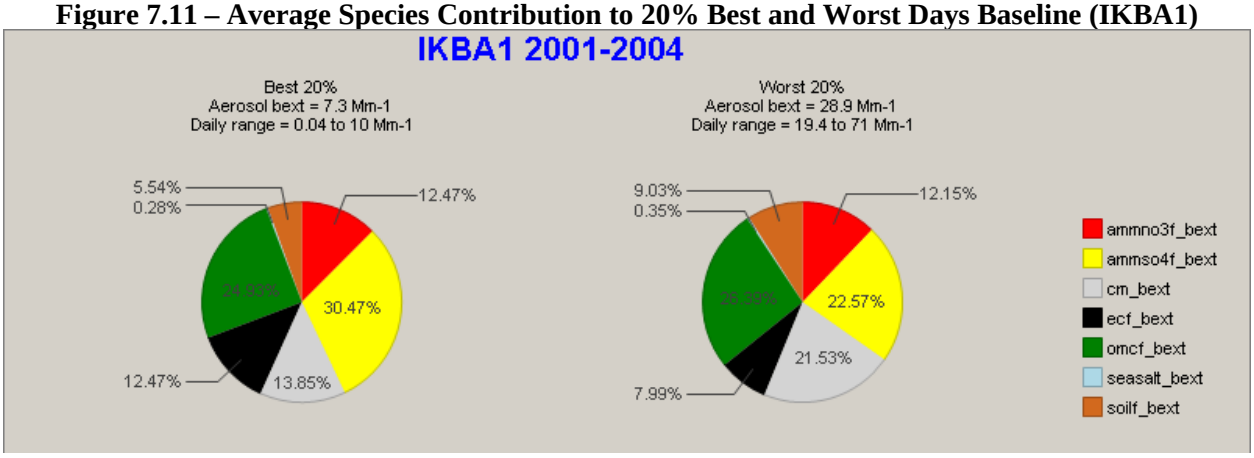


Figure 7.12 shows the species variation for all IMPROVE sampled days over the baseline period. Light extinction due to sulfate and organic carbon varies seasonally, increasing during the summer. There are spikes in organic carbon extinction in October 2003 and July 2004. Nitrate extinction appears to increase during winter months.

Figure 7.12: Monthly Average Species Variation for All Sampled Days during the Baseline Period (IKBA1)

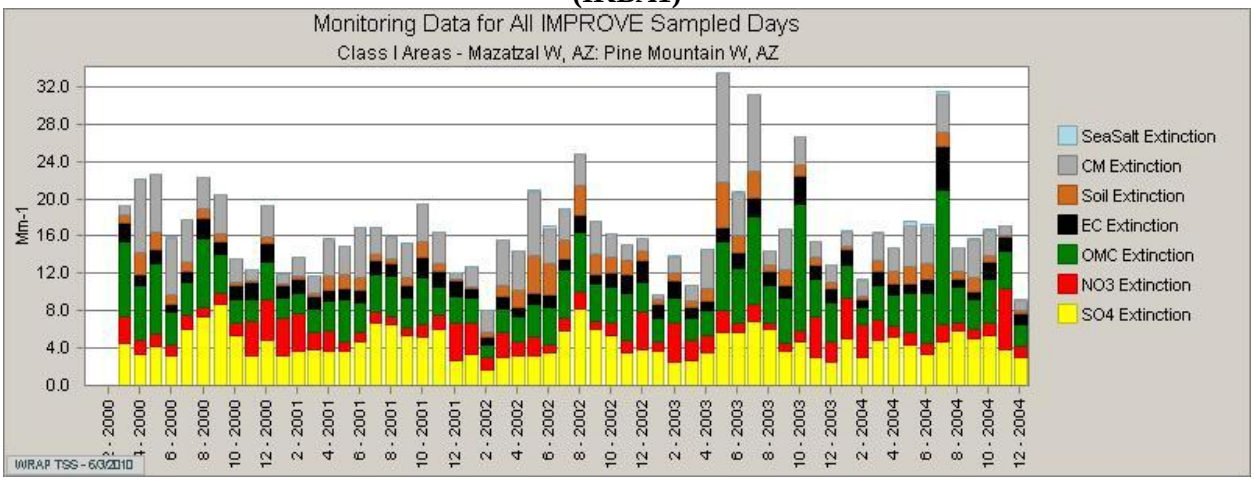
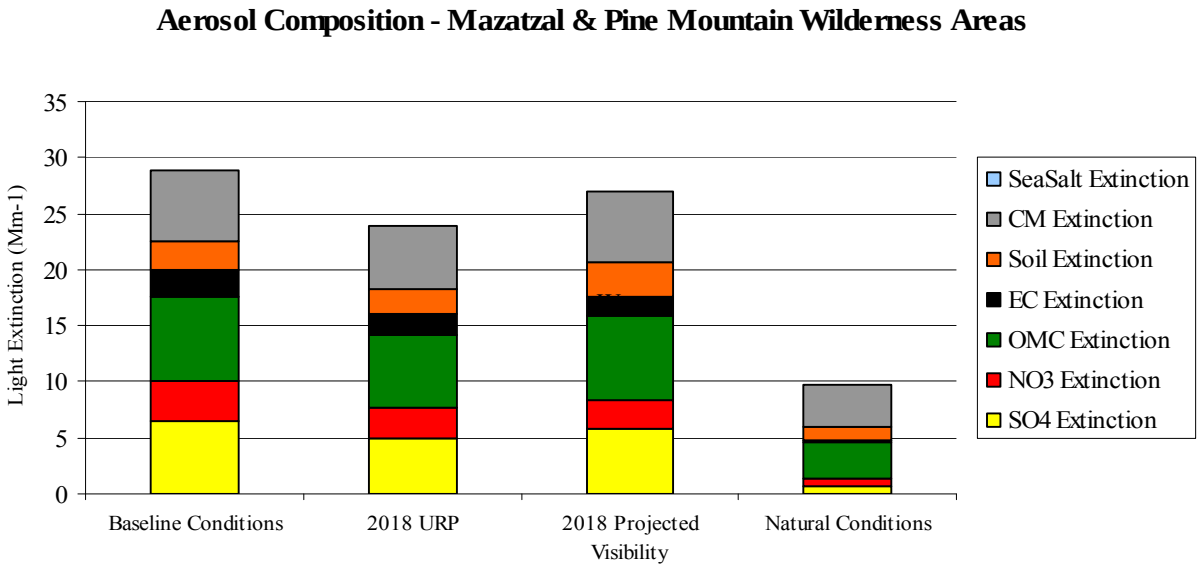


Figure 7.13 shows the light extinction for the baseline, the URP, the 2018 projected visibility, and natural conditions for all aerosol pollutants. The projected visibility condition, based on modeling, does not meet the 2018 URP.

Figure 7.13: Baseline Worst Day Aerosol Composition Compared to 2018 URP, 2018 Projected Visibility and 2064 Natural Conditions Goal (IKBA1)



7.4 Mount Baldy Wilderness

Figure 7.14 shows that over the baseline period for best and worst days, the primary contributors to impairment are sulfate, organic carbon, and coarse mass. On worst days, the primary pollutant is organic carbon, contributing to approximately 44 percent of visibility impairment. The visibility on best days has more impairment due to sulfate.

Figure 7.14: Average Species Contribution to 20% Best and Worst Days Baseline (BALD1)

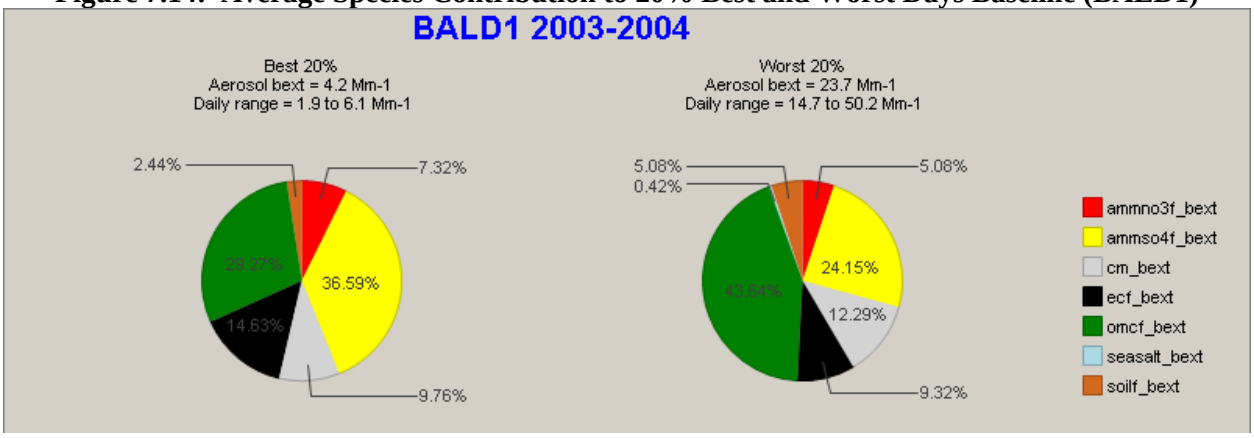


Figure 7.15 (a) shows the species variation for all IMPROVE sampled days over the baseline period. Light extinction due to sulfate and organic carbon varies seasonally, increasing during the summer and early fall. There are spikes in organic carbon extinction in June and July 2002 that may be due to fire occurrences. The Rodeo-Chediski Fire burned in north-eastern Arizona starting on June 18, 2002, ending July 16, 2002, which consumed a total of 468,838 acres. Figure 7.15 (b) shows the daily time series for the 20% worst visibility days for BALD1 and the spike in OC on June 25, June 28, and July 1, 2002. Table 7.2 shows the monitor data for BALD1 during June and July 2002. Extinction due to nitrate appears to increase during winter months.

Figure 7.15 (a) - Monthly Average Species Variation for All Sampled Days during the Baseline Period (BALD1)

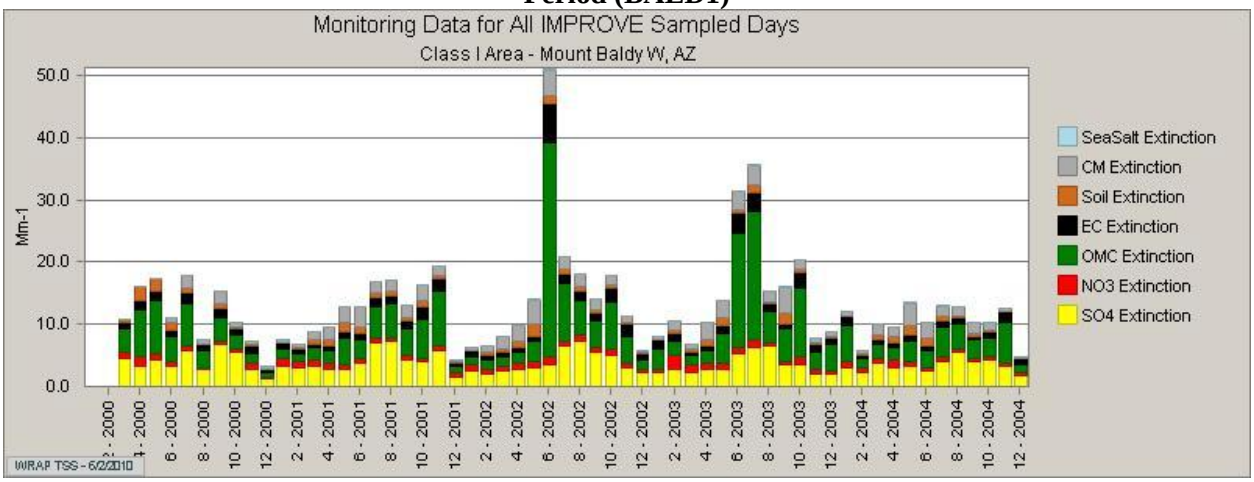


Figure 7.15 (b) – Daily Monitoring Data for 20% Worst Visibility Days during the Baseline Period

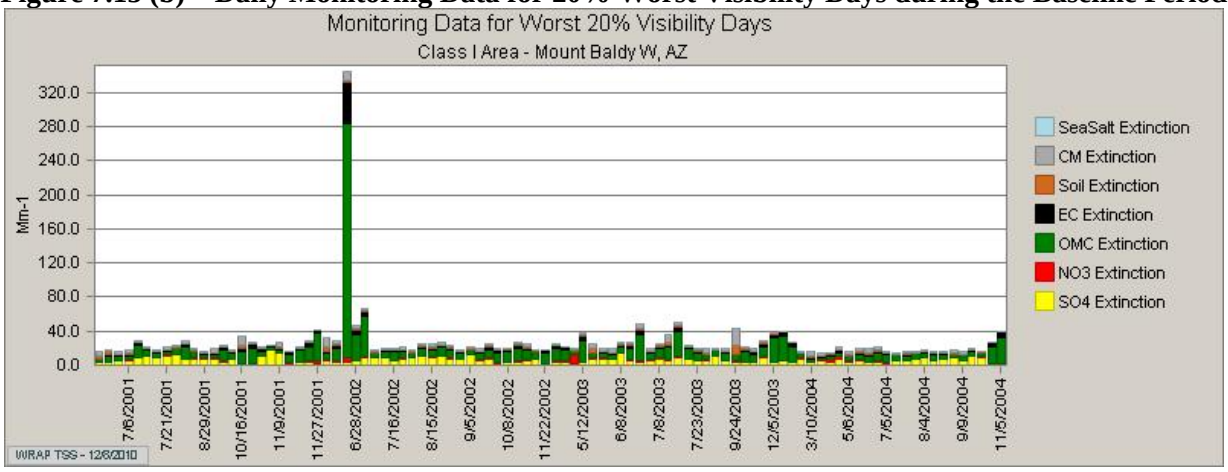
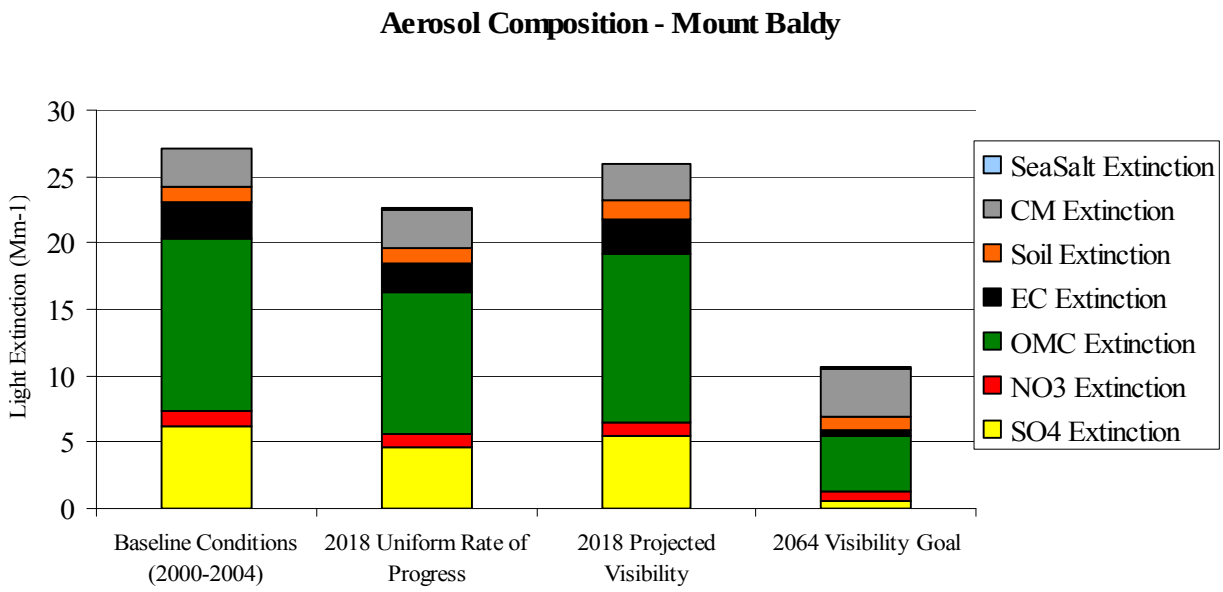


Table 7.2 – Daily Monitoring Data for June and July 2002 at BALD1							
Date	**SO4 Extinction**	**NO3 Extinction**	**OMC Extinction**	**EC Extinction**	**Soil Extinction**	**CM Extinction**	**Sea Salt Extinction**
6/1/2002	4.21	1.03	15.3	2.45	1.85	4.13	0
6/4/2002	3.46	1.18	3.74	0.88	1.24	4.04	0
6/7/2002	3.83	0.77	5.83	0.93	1.38	3.84	0
6/10/2002	3.3	0.82	3.02	0.47	1.79	4.13	0
6/13/2002	2.73	0.32	5.46	1.21	1.04	1.52	0
6/16/2002	3.32	0.86	3.45	0.89	0.98	2.12	0.43
6/19/2002	2.3	0.51	1.88	0.6	1.17	2.61	0
6/22/2002	2.84	0.54	1.96	0.31	0.93	3.77	0
6/25/2002	3.65	5.13	275.23	48.17	1.75	10.2	0.09
6/28/2002	4.62	1.34	30.53	5.68	1.34	3.84	0
7/1/2002	8.55	2.54	45.84	6.57	0.99	2.7	0
7/4/2002	4.57	0.64	6.01	1.14	0.89	2.01	0
7/7/2002	8.67	1.03	4.78	0.77	0.89	2.08	0
7/10/2002	6.72	0.5	6.04	0.8	0.74	1.98	0
7/13/2002	8.13	0.68	7.66	0.71	0.84	1.53	0
7/16/2002	5.44	0.57	10.29	1.5	0.78	1.47	0
7/19/2002	4.81	0.5	4.23	1.04	0.59	1.56	0
7/22/2002	5.51	0.63	3.88	0.61	0.9	2.37	0
7/25/2002	4.98	0.57	5.04	1.25	0.76	1.87	0
7/28/2002	5.5	0.69	2.01	0.63	0.62	1.69	0
7/31/2002	7.6	1.62	6.5	1.53	1.11	2.45	0

Figure 7.16 shows the light extinction for the baseline, the URP, the 2018 projected visibility, and natural conditions for all aerosol pollutants. The projected visibility condition, based on modeling, does not meet the 2018 URP.

Figure 7.16 – Baseline Worst Day Aerosol Composition Compared to 2018 URP, 2018 Projected Visibility and 2064 Natural Conditions Goal (BALD1)



7.5 Petrified Forest National Park

The pollutants affecting visibility on the worst days at the Petrified Forest National Park are primarily organic carbon, sulfate, and coarse mass. Best days are dominated by sulfates, followed by organic carbon then elemental carbon. The average contributions are shown in Figure 7.17 for baseline conditions.

Figure 7.17 – Average Species Contribution to 20% Best and Worst Days Baseline (PEFO1)

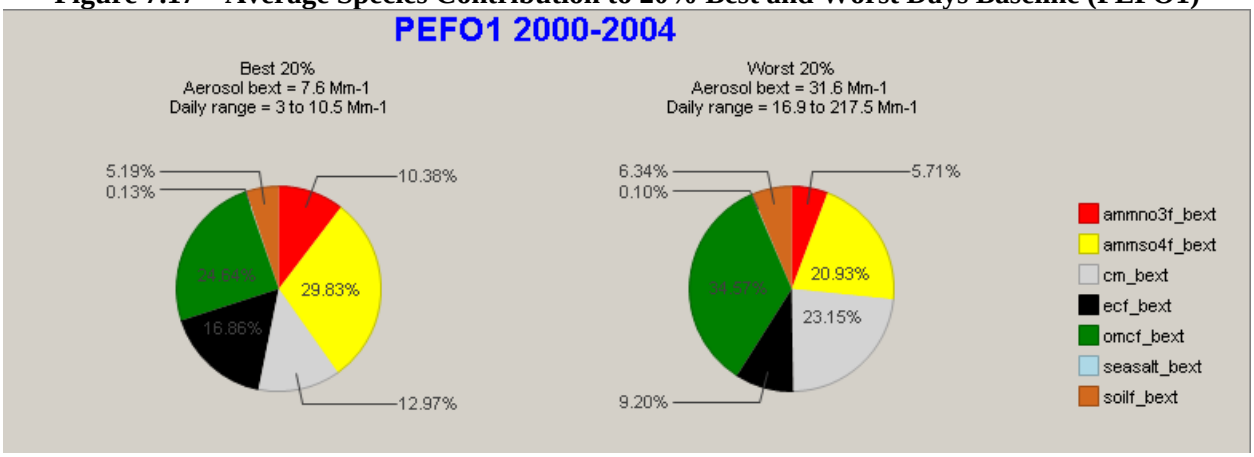


Figure 7.18 (a) shows the monthly average for light extinction for all haze-impairing pollutants over the baseline period at PEFO1. Extinction due to sulfate varies seasonally, increasing during the summer and early fall. Nitrate shows slight elevation in winter months. Extinction from due to organic and elemental carbon is constant except for spikes in June 2002 and July 2004, which may be related to fire occurrences. The Rodeo-Chediski Fire burned in north-eastern Arizona starting on June 18, 2002, ending July 16, 2002, which consumed a total of 468,838 acres. Petrified Forest NP is located approximately 70 miles northeast of the location of the Rodeo-Chediski fire. Figure 7.18 (b) shows the daily time series for all IMPROVE sampled days at PEFO1. Table 7.3 lists the daily extinction for June 2003 and July 2004. There were OC spikes July 1 and July 5, 2004, which coincide the Jacket Wildfire that burned 13 miles southeast of Winona, Arizona. The fire location was approximately 80 miles northwest of the park. Coarse mass and fine soil is elevated in late spring and early summer.

Figure 7.18(a) – Monthly Average Species Variation for All Sampled Days during the Baseline Period (PEFO1)

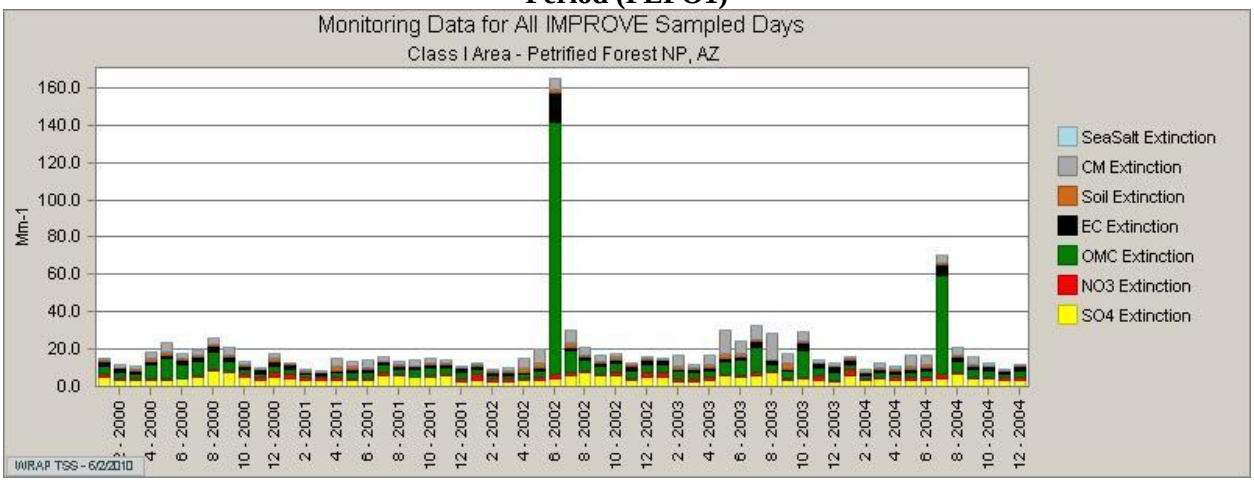


Figure 7.18 (b) – Daily Monitoring Data for All IMPROVE Sampled Days during the Baseline

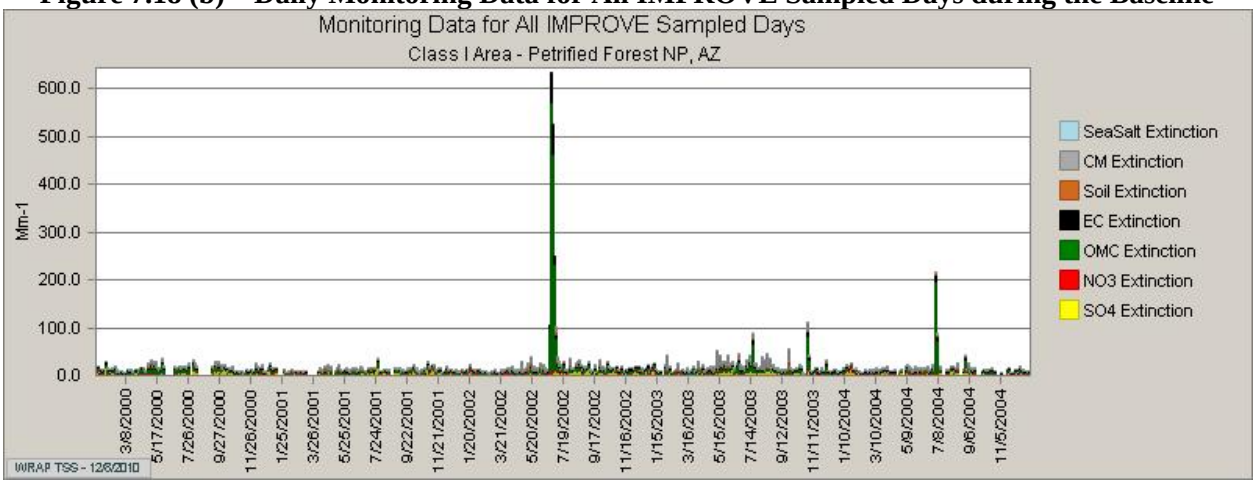
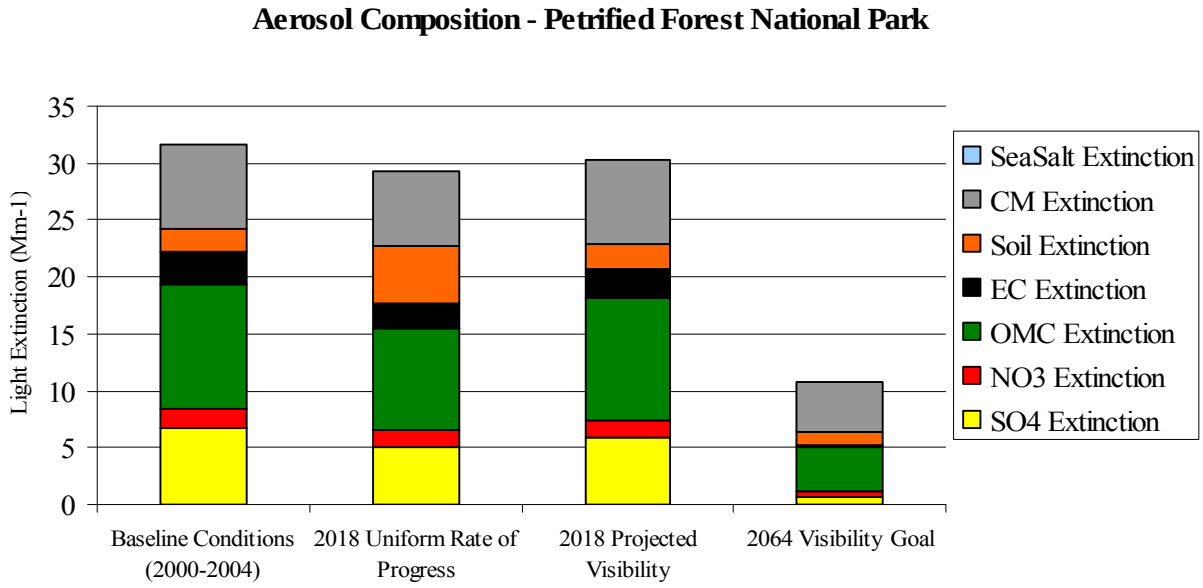


Table 7.3 - Daily Monitoring Data for June 2002 and July 2004 at PEFO1							
June 2002							
Date	SO4 Extinction	NO3 Extinction	OMC Extinction	EC Extinction	Soil Extinction	CM Extinction	Sea Salt Extinction
6/1/2002	5.88	1.3	7.87	2.59	2.5	5.95	0
6/4/2002	3.45	0.75	2.88	0.77	1.78	6.22	0
6/7/2002	4.28	1.28	5.55	2.56	1.42	7.56	0
6/10/2002	2.68	0.97	2.14	0.94	2.16	6	0
6/13/2002	2.24	0.68	1.59	1.7	1.68	4.88	0
6/16/2002	4.2	1.25	2.6	1.58	1.18	3.86	0
6/19/2002	3.42	2.61	91.34	6.97			
6/22/2002	3.82	7.44	559.18	63.15			
6/25/2002	4.57	5.7	452.89	62.54			
6/28/2002	7.27	4	220.58	16.99			
7/1/2002	9.53	3.74	66.81	5.74	5.67	11.2	0
7/4/2002	7.39	1.49	12.39	3.58	3.17	11.51	0
7/7/2002	8.08	2.01	6.72	1.93	1.52	9.29	0.01
7/10/2002	4.46	0.59	2.54	1	3.93	2	0.03
7/13/2002	7.02	0.8	4.74	2.15	1.54	6.15	0
7/16/2002	4.86	1.27	17.97	2.49	1.85	0.09	0
7/19/2002	4.43	0.73	3.89	2.4	0.8		0
7/22/2002	5.19	0.91	1.71	1.24	1.04		0
7/25/2002	4.58	0.5	1.94	1.84	0.7	2.46	0
7/28/2002	4.82	1.61	0.75	0.87	1.25	3.84	0
7/31/2002	5.33	2.43	7.12	1.86	4.78	15.02	0.02
July 2004							
7/2/2004	3.39	7.71	186.85	12.92	1.26	5.08	0.26
7/5/2004	4.43	3.76	65.27	9.14	1.12	3.16	0.25
7/8/2004							
7/11/2004	6.35	0.63	4.7	2.23	0.8	3.75	0
7/14/2004							
7/17/2004							
7/20/2004							
7/23/2004	4.28	0.66	3.1	2.12	0.7	3.02	0.07
7/26/2004							
7/29/2004	3.61	0.62	3.25	2.06	0.89	3.06	0.01

Figure 7.19 shows the light extinction for the baseline, the URP, the 2018 projected visibility, and natural conditions for all aerosol pollutants. The projected visibility condition, based on modeling, does not meet the 2018 URP.

Figure 7.19 - Baseline Worst Day Aerosol Composition Compared to 2018 URP, 2018 Projected Visibility and 2064 Natural Conditions Goal (PEFO1)



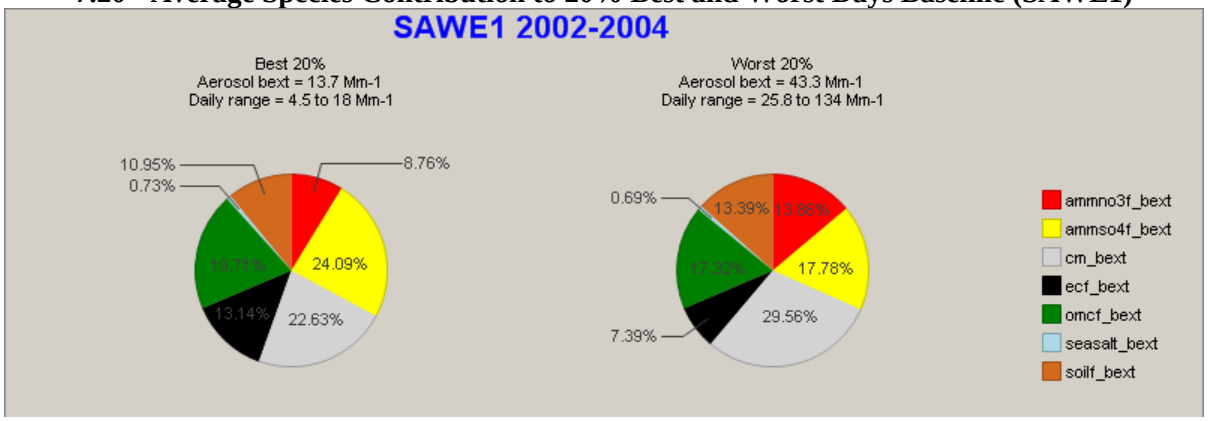
7.6 Saguaro National Park

Saguaro National Park consists of two units, the Tucson Mountain District (West Unit) and the Rincon Mountain District (East Unit) and are located by Tucson, Arizona. The West Unit is west of Tucson and the East Unit is located east of Tucson. The locations of the two monitors relative to the City of Tucson result in different aerosol compositions of pollutant species as they impact visibility.

7.6.1 West Unit

Figure 7.20 shows that over the baseline period for best and worst days, the primary contributors to impairment at the West Unit are sulfate, organic carbon, and coarse mass. On worst days, nitrates and coarse mass contribute the most to visibility impairment. Sulfate and coarse mass contribute to nearly half of the visibility impairment on best days. The impact of coarse mass may be due to the location of the West Unit of Saguaro National Park. The West Unit does not have any major cities or towns to the north, west, or south. Given the location and meteorology for the area, conditions are amenable to natural occurring pollutants such as coarse mass, fine soil, and organic carbon.

7.20 - Average Species Contribution to 20% Best and Worst Days Baseline (SAWE1)



The average species variation for all sampled day over the baseline period is shown in Figure 7.21. Sulfates increase during the summer months, while nitrates increase during the winter. There are a couple of spikes in light extinction due to nitrates during December 2001 and December 2002. Organic carbon and coarse mass show a slight increase in light extinction during the summer. Elemental carbon shows a different pattern, increasing in the late fall and early winter. Extinction due to fine soil was relatively consistent, except for an increase during the summers of 2002 and 2003.

Figure 7.21 - Monthly Average Species Variation for All Sampled Days during the Baseline Period (SAWE1)

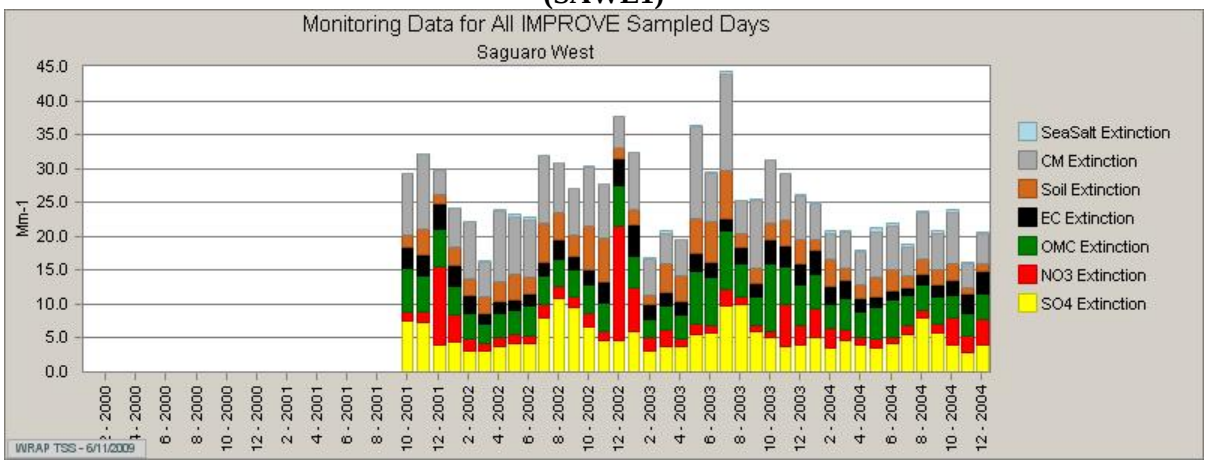
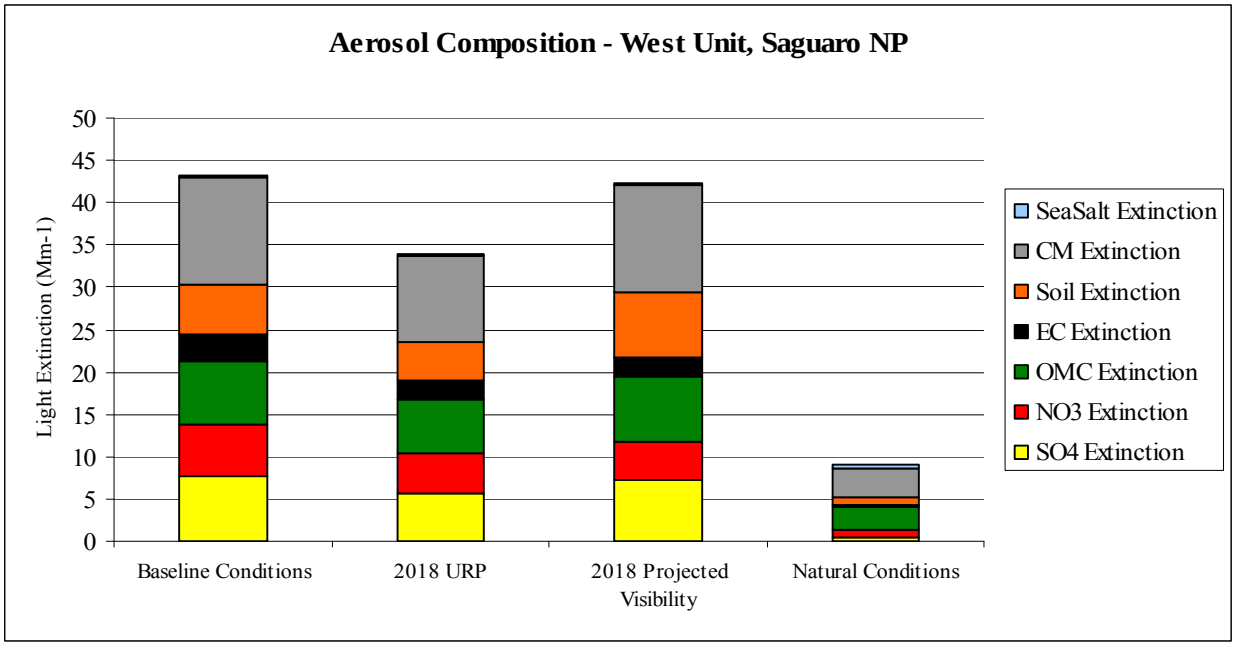


Figure 7.22 shows the light extinction for the baseline, the URP, the 2018 projected visibility, and natural conditions for all aerosol pollutants. The projected visibility condition, based on modeling, does not meet the 2018 URP.

Figure 7.22 – Baseline Worst Day Aerosol Composition Compared to 2018 URP, 2018 Projected Visibility and 2064 Natural Conditions Goal (SAWE1)



7.6.2 East Unit

Figure 7.23 shows the average contribution on 20% best and worst days for all visibility impairing pollutants. On best and worst days, the primary contributors are organic carbon, sulfate, and coarse mass. In addition, on worst days, nitrates have about a 16% contribution to extinction.

7.23 – Average Species Contribution to 20% Best and Worst Days Baseline (SAGU1)

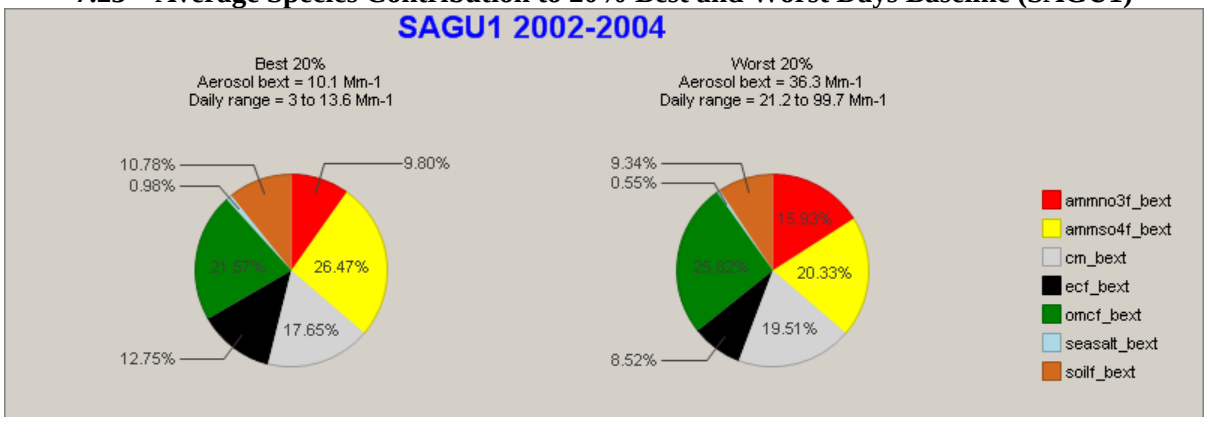


Figure 7.24 shows the monthly average for all sampled days during the baseline period. Data shows that nitrates increase during the winter, with notable spikes in December 2001, December 2003, and to a lesser degree November 2003. Sulfate increases during the summer as well as fine soil, which increase in the late spring, early summer. Fine soil shows a similar pattern with increases in the late spring and early summer months. Both organic carbon and elemental carbon are relatively consistent throughout the year. Organic carbon, however, had spikes in May, June, and October 2003. The spikes in OC in June 26, 2003 may coincide with two fires that occurred during June and July 2003. The wildfire Helen's II, burned

between June 17, 2003 and June 30, 2003 in Saguaro National Park northeast of Tucson, Arizona. The Aspen Wildfire burned in the Santa Catalina Mountains northeast of Tucson from June 17, 2003 to July 18, 2003. Coarse mass shows spikes in May and July 2003, but remained relatively consistent throughout the year.

Figure 7.24 – Monthly Average and Daily Species Variation for All Sampled Days during the Baseline Period (SAGU1)

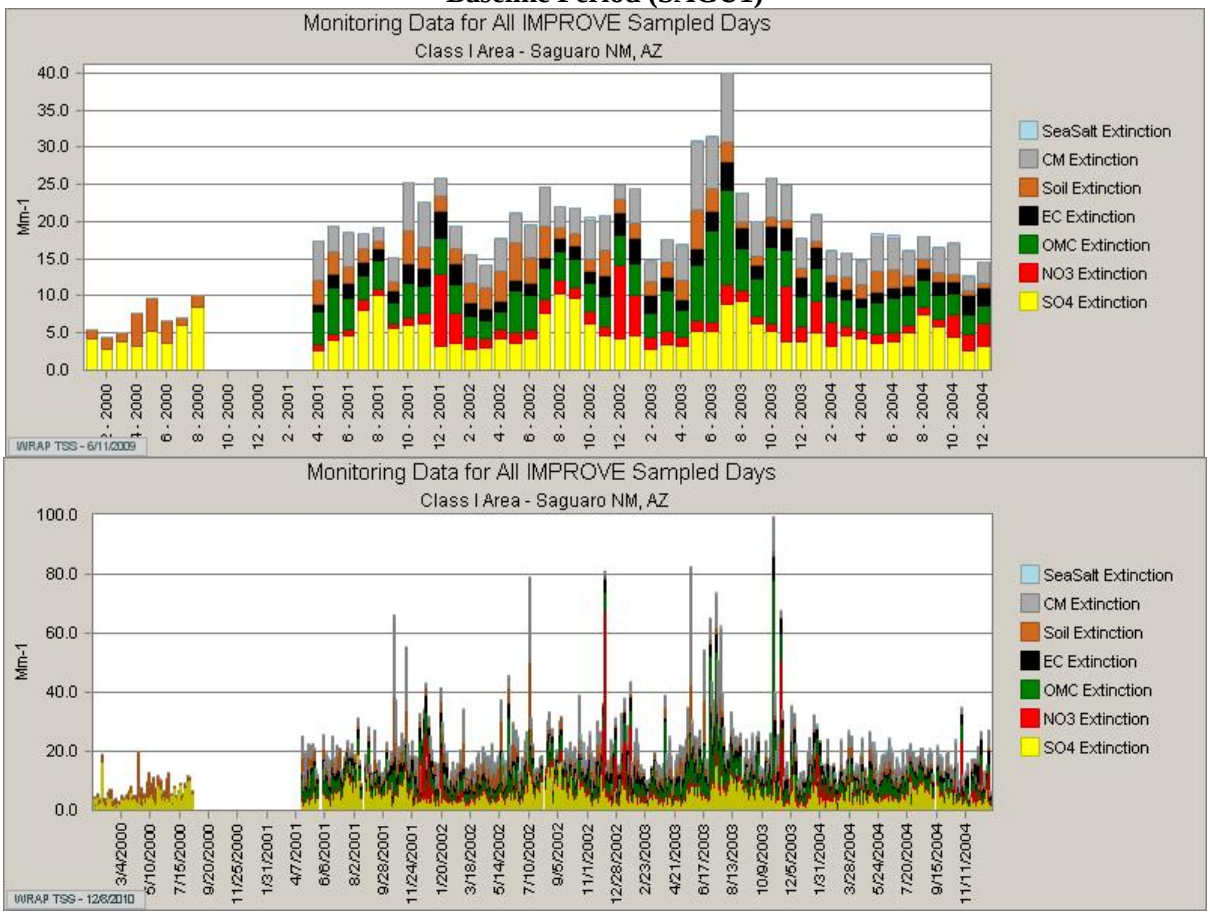
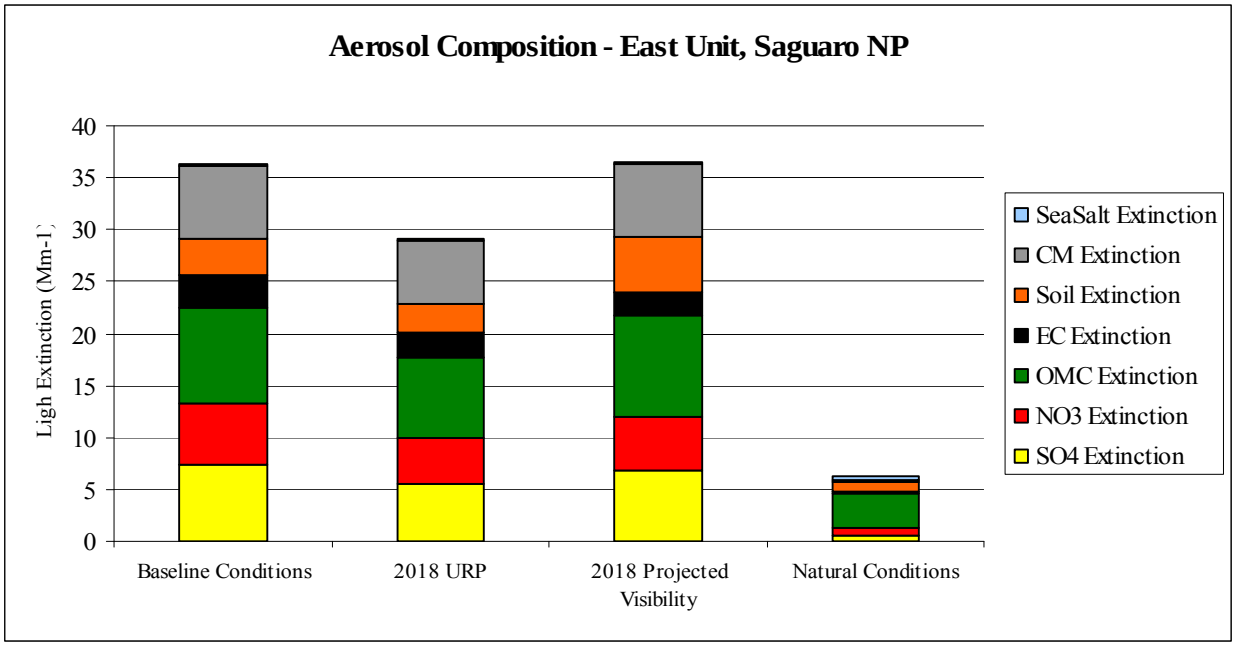


Table 7.4 - Daily Monitoring Data for June 2002 and July 2004 at PEFO1							
Date	**SO4 Extinction**	**NO3 Extinction**	**OMC Extinction**	**EC Extinction**	**Soil Extinction**	**CM Extinction**	**Sea Salt Extinction**
6/2/2003	8.16	1.28	6.01	1.97	2.19	4.85	0
6/5/2003	4.63	0.7	4.61	2.67	2.34	3.33	0
6/8/2003	8.18	1.16	8.89	2.96	1	4.92	0
6/11/2003	5.34	0.84	4.48	2.14	2.13		0.13
6/14/2003	3.7	0.84	8.52	3.13	1.06		0
6/17/2003	5.13	1.65	15.32	1.1	14.47	16.45	0.11
6/20/2003	4.03	0.92	4.99	1.66	2.97	2.8	0.14
6/23/2003	3.31	0.63	4.12	1.29	0.82	6.98	0.43
6/26/2003	3.73	1.38	47.33	4.16	1.59	6.8	0.33
6/29/2003	7.22	1.76	18.93	5.49	1.93	8.5	0

Table 7.4 - Daily Monitoring Data for June 2002 and July 2004 at PEFO1							
Date	SO4 Extinction	NO3 Extinction	OMC Extinction	EC Extinction	Soil Extinction	CM Extinction	Sea Salt Extinction
7/2/2003	9.01	3.01	7.16	3.55	2.23	9.52	0
7/5/2003	7.5	2.06	12.58	6.37	1.66	7.17	0
7/8/2003	14.8	4.72	34.23	6.28	2.21	10.85	0.79
7/11/2003	15.41	4.39	9.75	3.37	3.29	14.57	0
7/14/2003	7.35	1.63	11.36	3.34	2.09	10.19	0
7/17/2003	5.32	2.66	18.08	1.67	10.51	23.54	1.04
7/20/2003	11.83	2.5	13.79	3.67	2.19	6.21	0
7/23/2003	7.05	1.51	9.2	4.22	1.36	4.89	0
7/26/2003	5.96	1.64	5.72	2.52	0.84	2.72	0
7/29/2003	4.9	1.12	6.06	2.47	0.72	2.52	0

Figure 7.25 shows the light extinction for the baseline, the URP, the 2018 projected visibility, and natural conditions for all aerosol pollutants. The projected visibility condition, based on modeling, does not meet the 2018 URP.

Figure 7.25 – Baseline Worst Day Aerosol Composition Compared to 2018 URP, 2018 Projected Visibility and 2064 Natural Conditions Goal (SAGU1)



7.7 Sierra Ancha Wilderness

For the 20% best and worst days over the baseline period the primary contributors are organic carbon, sulfate, and coarse mass. Figure 7.26 shows that worst days are dominated by organic carbon, with a similar percentage from sulfate and coarse mass. The percentage contribution changes slightly on best days where the light extinction due to organic carbon and coarse mass are reduced, but sulfate and elemental carbon have a higher percentage.

7.26 – Average Species Contribution to 20% Best and Worst Days Baseline (SIAN1)

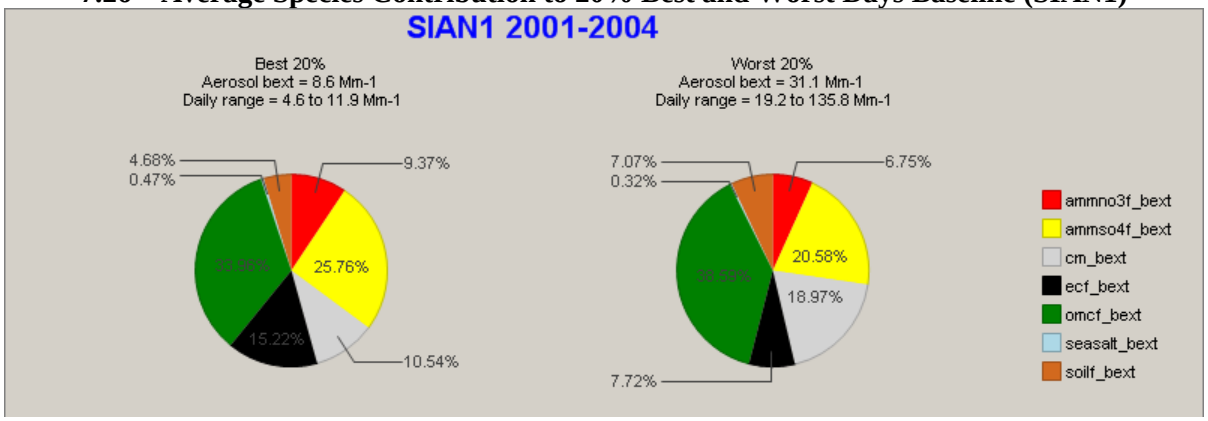


Figure 7.27 shows that sulfate and organic carbon increase during the summer. There are spikes in extinction for organic carbon in June and July 2003, and July 2004. The OC spike that occurred July 8, 2004 may be correlated with Willow wildfire that burned near Payson, Arizona. The monitor is located about 18 to 20 miles to the southeast of Payson. Fine soil and coarse mass increased in the late spring and early summer with spikes in coarse mass occurring in April 2000, May 2002, and May 2003. Extinction due to nitrates increased during the winter.

Figure 7.27 – Monthly & Daily Average Species Variation for All Sampled Days during the Baseline Period (SIAN1)

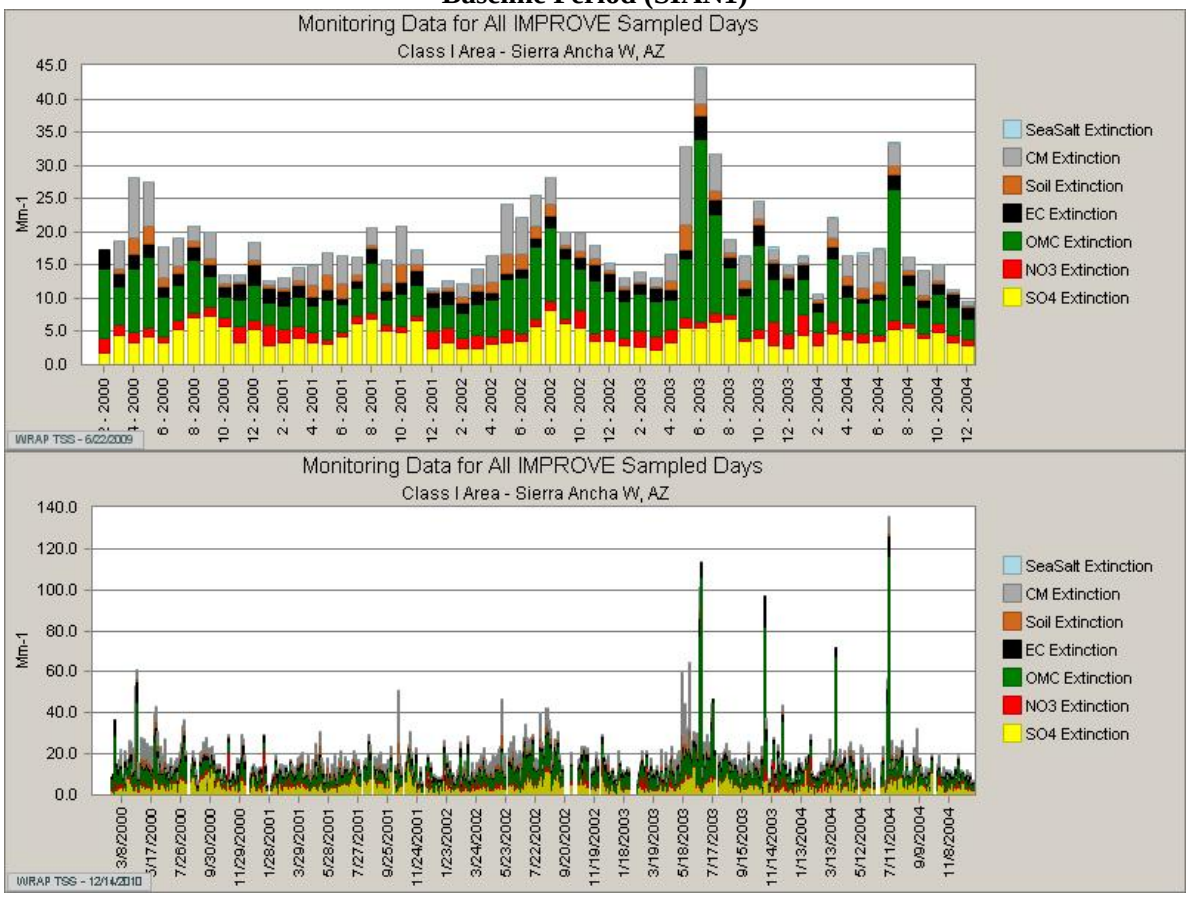
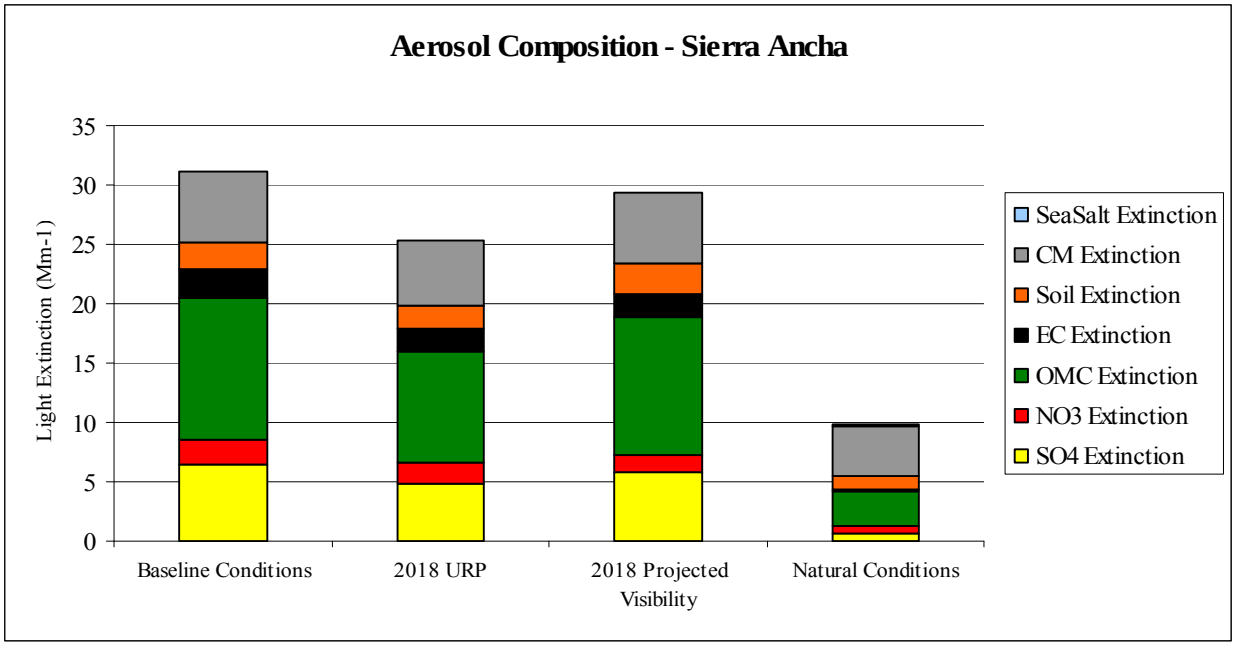


Figure 7.28 shows the light extinction for the baseline, the URP, the 2018 projected visibility, and natural conditions for all aerosol pollutants. The projected visibility condition, based on modeling, does not meet the 2018 URP.

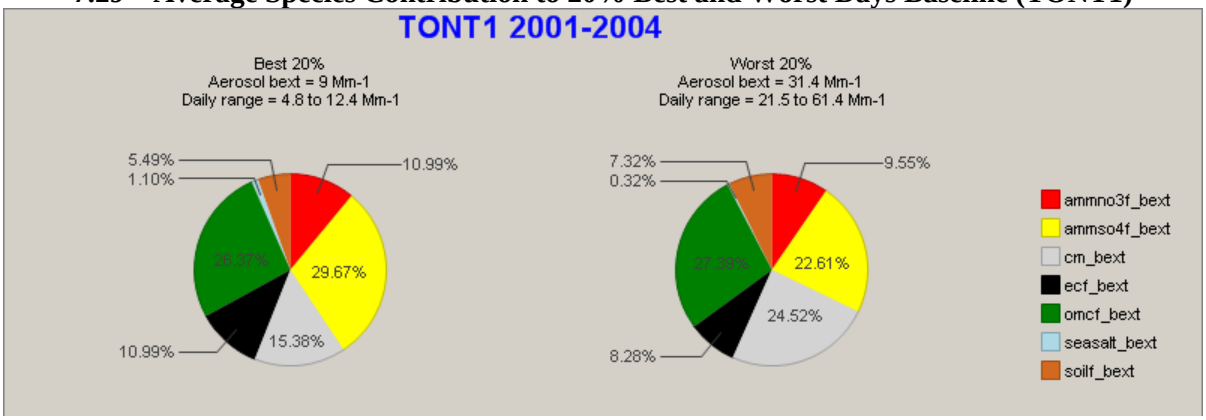
Figure 7.28 – Baseline Worst Day Aerosol Composition Compared to 2018 URP, 2018 Projected Visibility and 2064 Natural Conditions Goal (SIAN1)



7.8 Superstition Wilderness

Figure 7.29 shows that almost one-half of the light extinction at Superstition Wilderness is due to sulfates and coarse mass on worst days. Organic carbon is the highest contributor on worst days with slightly over 27% percent. Best days on dominated by sulfate, organic carbon, and coarse mass.

7.29 – Average Species Contribution to 20% Best and Worst Days Baseline (TONT1)



For all IMPROVE sampled days sulfate, organic carbon, and coarse mass increase during the summer. Organic carbon showed a spike in July 2002 (Figure 7.30). Fine soil increased in late spring, early

summer then showed decreased during the summer. Nitrate increases during the winter. Extinction due to elemental carbon is relatively consistent throughout the year; however, there are slight increases during the winter.

Figure 7.30 – Monthly & Daily Average Species Variation for All Sampled Days during the Baseline Period (TONT1)

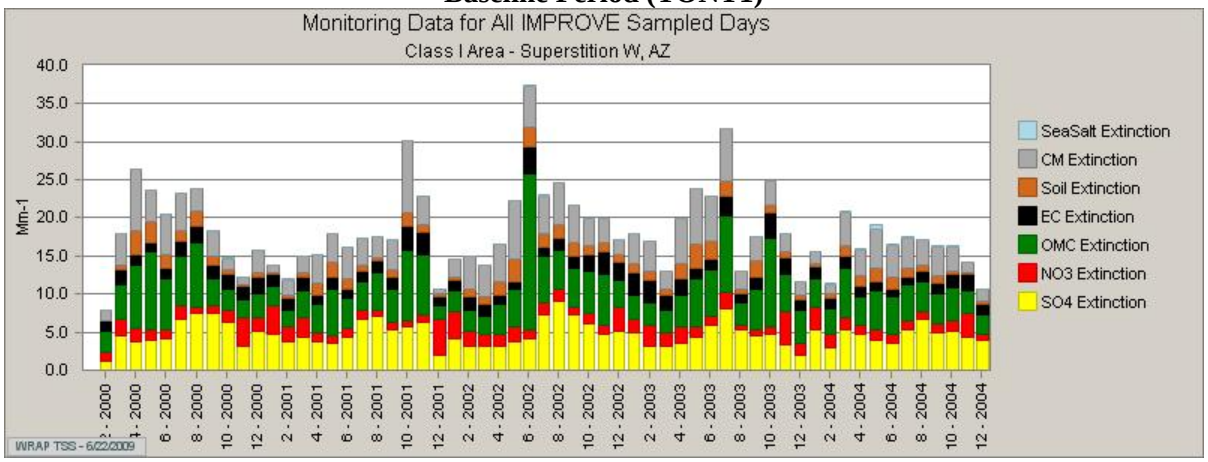
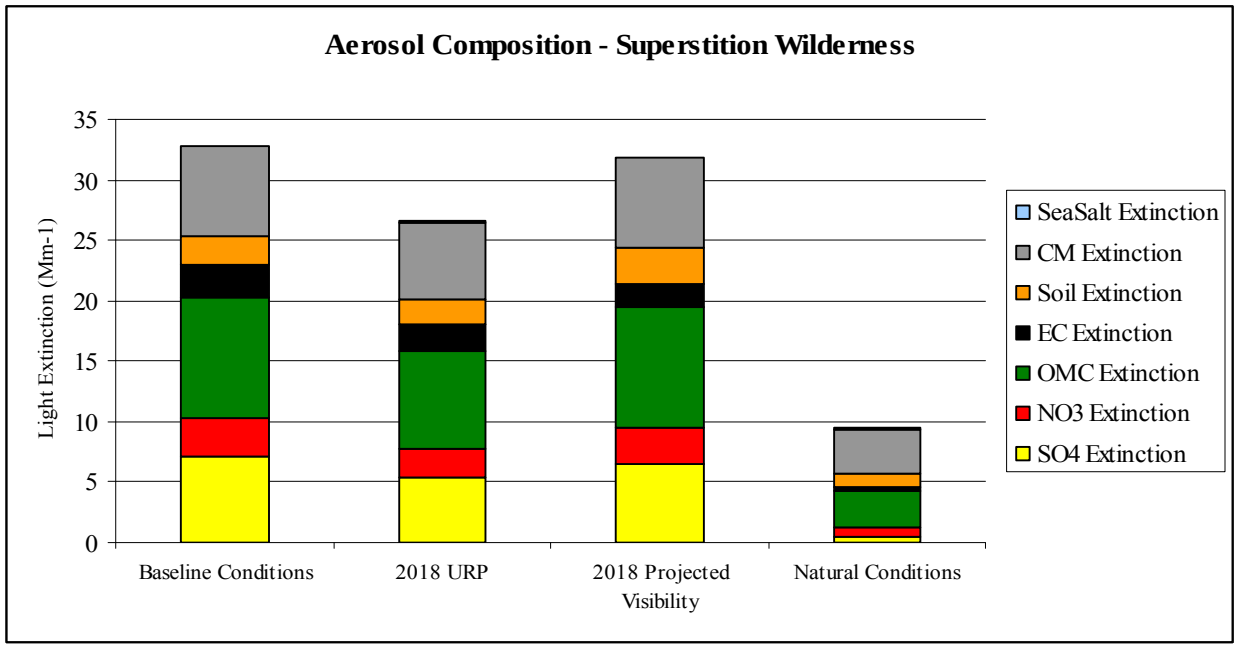


Figure 7.31 shows the light extinction for the baseline, the URP, the 2018 projected visibility, and natural conditions for all aerosol pollutants. The projected visibility condition, based on modeling, does not meet the 2018 URP.

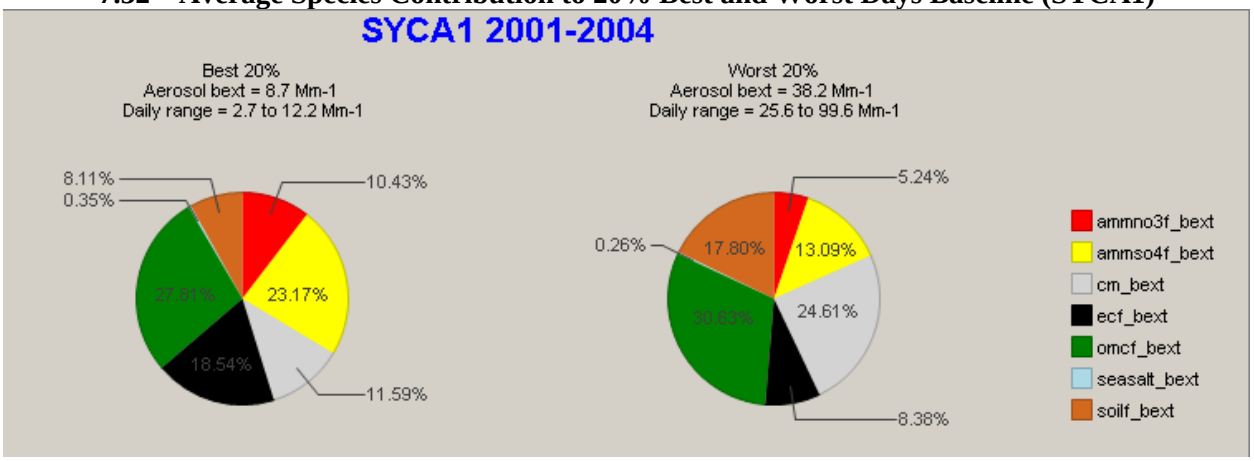
Figure 7.31 – Baseline Worst Day Aerosol Composition Compared to 2018 URP, 2018 Projected Visibility and 2064 Natural Conditions Goal (TONT1)



7.9 Sycamore Canyon Wilderness

Approximately 30 percent, of light extinction on worst days at Sycamore Canyon Wilderness is due to organic carbon (Figure 7.32). Coarse mass and fine soil are responsible (collectively) for about 42 percent of extinction on worst days. Best days are dominated by sulfate and organic carbons.

7.32 – Average Species Contribution to 20% Best and Worst Days Baseline (SYCA1)



For all IMPROVE sampled days (Figure 7.33), sulfate, organic carbon, elemental carbon, coarse mass, and fine soil all increase during summer and early fall. A very high spike of organic carbon occurred in August 2002. Nitrates commonly increase slightly during winter months.

Figure 7.33 – Monthly Average Species Variation for All Sampled Days during the Baseline Period (SYCA1)

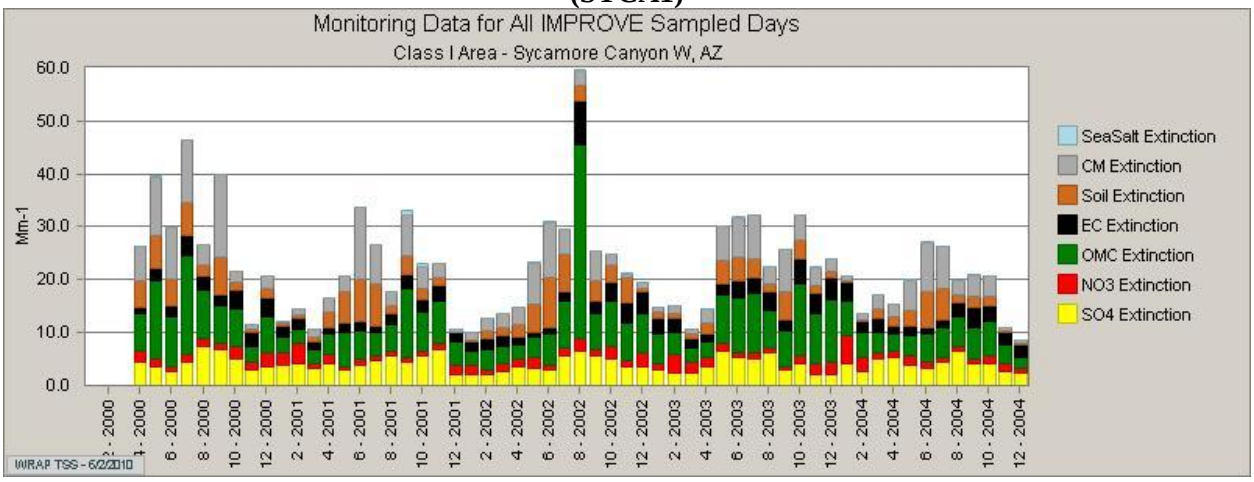
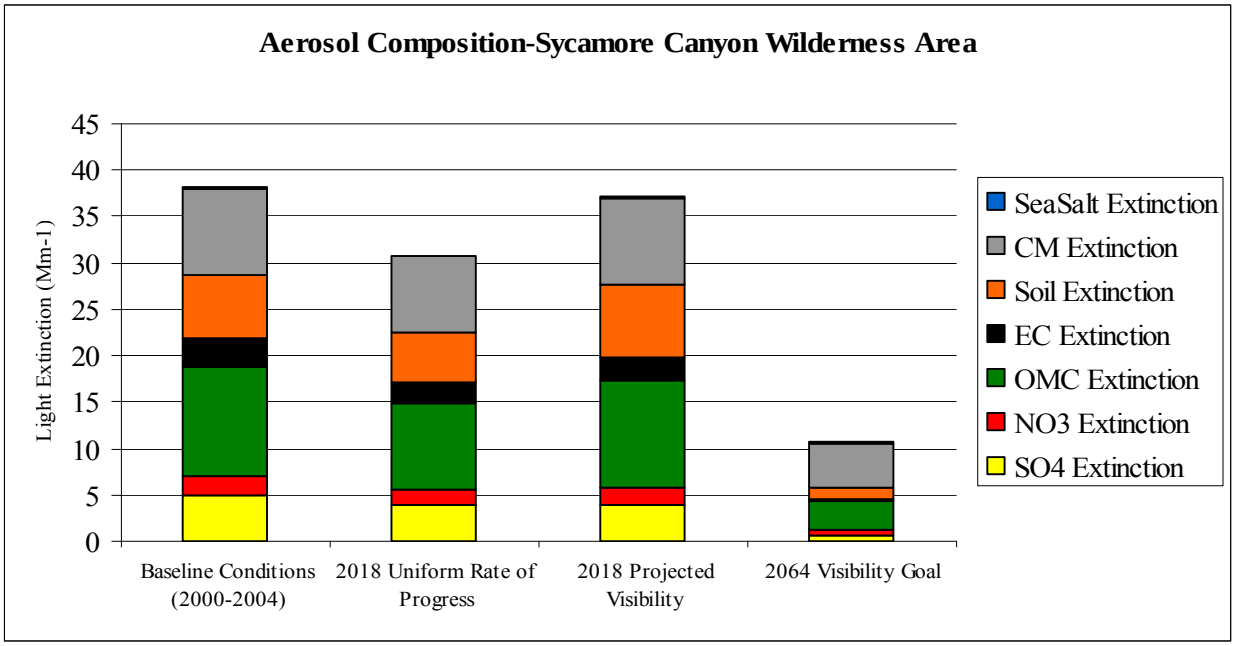


Figure 7.34 shows the light extinction for the baseline, the URP, the 2018 projected visibility, and natural conditions for all aerosol pollutants. The projected visibility condition, based on modeling, does not meet the 2018 URP.

Figure 7.34 – Baseline Worst Day Aerosol Composition Compared to 2018 URP, 2018 Projected Visibility and 2064 Natural Conditions Goal (SYCA1)



CHAPTER 8: SOURCES OF VISIBILITY IMPAIRMENT

8.1 Anthropogenic Sources

Anthropogenic (human caused) sources of visibility impairment include anything directly attributable to human caused activities that produce emissions of visibility impairing pollutants. Some examples include transportation, agricultural activities, mining operations, and fuel combustion. Anthropogenic visibility conditions are not constant; they vary with changing human activities throughout the years. For purposes of this SIP anthropogenic emissions include those emissions originating within the boundaries of the U.S. but also include international anthropogenic emissions that originate outside of U.S. boundaries and are transported into the country. These include, but are not necessarily limited to, emissions from Canada, Mexico, and maritime shipping emissions from Pacific offshore sources.

Although anthropogenic sources contribute to visibility impairment, international emissions cannot be regulated, controlled, or prevented by the states and are therefore beyond the scope of this planning document. Any reductions in international emission would likely fall under the purview of the U.S. EPA.

8.2 Natural Sources

Natural sources of visibility impairment include anything not directly attributed to human-caused emissions of visibility impairing pollutants. Natural events (e.g. windblown dust, wildfire, volcanic activity, biogenic emissions) also introduce pollutants that contribute to haze in the atmosphere. Natural visibility conditions are not constant; they vary with changing natural processes throughout the year. Specific natural events can lead to high short-term concentrations of visibility impairing particulate matter and its precursors. For purposes of this planning document, natural visibility conditions are represented by a long-term average of conditions expected to occur in the absence of emissions normally attributed to human activities. Natural visibility conditions reflect contemporary vegetated landscape, land-use patterns, and meteorological/climatic conditions. The 2064 visibility goal is the natural visibility conditions for the 20% worst natural conditions days.

Natural sources contribute to visibility impairment but natural emissions cannot be realistically controlled or prevented by the states and therefore are beyond the scope of this planning document. Current methods of analysis of IMPROVE data do not provide a distinction between natural and anthropogenic emissions.

8.3 Overview of Emission Inventory System – WRAP Technical Support System

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 for western states. The TSS provides state, county, and grid cell level emissions information for typical criteria pollutants such as SO_2, 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 Regional Modeling Center website at the following link: http://pah.cert.ucr.edu/aqm/308/

In addition to the emission information on the WRAP TSS, each Class I area Technical Support Document (TSD) includes regional emissions maps. During the WRAP process western states and EPA agreed that the tremendous amount of data collected, analyzed, and maintained by the WRAP would be impracticable and nearly infeasible to include in individual TSDs for individual states. For purposes of administrative efficiency, WRAP data and analyses that the member states are utilizing to develop their Regional Haze SIPs will be available through the WRAP and the TSS website. All of the information on the TSS is scheduled for update in 2008 and 2009 and will be used by Arizona for future SIP revisions.

8.4 Arizona Emissions Data

CFR 40.51.308(d)(4)(v) requires a statewide emission inventory of pollutants that are reasonably anticipated to cause or contribute to visibility impairment in any mandatory Class I area. The pollutants inventoried by the WRAP that Arizona will use include sulfur dioxide (SO_2), volatile organic compounds (VOC), primary organic aerosol (POA), elemental carbon (EC), fine particulate matter (Soil-$PM_{2.5}$), coarse particulate matter ($PM_{2.5}$ to PM_{10}), and ammonia (NH_3). An inventory was developed for the baseline year 2002 and projections of future emissions have been made for 2018. Colorado will provide updates to WRAP on this inventory on a periodic basis. A summary of the inventory results follows; the complete emission inventory is included in the TSD.

Emission inventories are developed for all of the species or pollutants known to directly or indirectly impact visibility. Inventories are used air quality models to predict concentrations of pollutants at future dates. WRAP developed emission inventories with input and data provided by Western states and stakeholders. A description of the development and content of the emission inventories can be found on the WRAP TSS website at the following link: http://vista.cira.colostate.edu/TSS/Results/Emissions.aspx

Dispersion modeling predicts daily atmospheric concentrations of pollutants for the baseline year and these modeled results are compared to monitored data taken from the IMPROVE network. A second inventory is created to predict emission in 2018 based on expected controls, growth, or other factors. Additional inventories are created for future years to simulate the impact of different control strategies. 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 EPA national emission database. Arizona 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, and EPA mobile source emissions model is used to develop emission projections. Arizona vehicle registration, vehicle miles traveled information and other vehicle data are used to tailor the mobile source data to best represent statewide and area specific emission. Population, employment, and household data are used in other parts of the emission 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 EPA emission factors based on data from tests of similar types of emission sources. In essence all sources go through the same 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. By multiplying the emission rate times the hours of operation in a day, a daily emission rate can be calculated.

The following tables represent Arizona emissions.

8.4.1 SO_2 Emissions

The following table shows Arizona's SO_2 emissions for baseline and future years.

Table 8.1 – Arizona SO_2 Emission Inventory (2002 & 2018)

Arizona Planning and Baseline Emission Inventories			
Statewide SO_2			
Source Category	**Plan02d (tpy)**	**PRP18b(tpy)**	**Net Change**
Point	94,716	67,429	-28.81
Anthropogenic Fire	190	181	-4.64
Natural Fire	4,369	4,369	0.00%
Area	2,677	3,408	27.32%
WRAP Area O&G	0	0	0.0%
On-Road Mobile	2,715	762	-71.92%
Off-Road Mobile	4,223	546	-87.07%
Total	108,890	76,697	-29.56%

Sulfur 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. Emissions of SO_2 are primarily from coal combustion at electrical generation facilities but smaller amounts come from natural gas combustion, mobile sources and even wood combustion. There are no significant biogenic SO_2 emissions in Arizona. A 29 percent statewide reduction in SO_2 emissions are expected by 2018 due to planned controls on existing sources, especially on-the-books rules for mobile sources.

8.4.2 NO_X Emissions

The following table shows Arizona's NO_X emissions for baseline and future years.

Table 8.2 – Arizona NO_X Emission Inventory (2002 & 2018)

Arizona Planning and Baseline Emission Inventories			
Statewide NOx			
Source Category	**Plan02d (tpy)**	**PRP18b (tpy)**	**Net Change**
Point	69,968	68,748	-1.74%
Anthropogenic Fire	725	676	-6.76%
Natural Fire	16,493	16,494	0.01%
Biogenic	27,664	27,664	0.00%
Area	9,049	12,783	41.27%
WRAP Area O&G	17	15	-11.27%
On-Road Mobile	178,009	53,508	-69.94%
Off-Road Mobile	66,414	43,249	-34.88%
Total	368,339	223,138	-39.42%

Nitrogen oxides (NO_X) are 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 nitrogen dioxide and in much smaller amounts other odd oxides of nitrogen. Nitrogen oxides, like sulfur dioxide, react in the atmosphere to form nitrate particles. 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. Emissions of NO_X in Arizona are expected to decline approximately 40 percent by 2018, primarily due to significant improvements in mobile sources and mobile source regulations.

8.4.3 Organic Carbon Emissions

The following table shows Arizona's organic carbon emissions (primary organic aerosol) for baseline and future years.

Table 8.3 – Arizona Primary Organic Aerosol (POA) Emission Inventory (2002 & 2018)

Arizona Planning and Baseline Emission Inventories			
Statewide Organic Carbon (POA)			
Source Category	**Plan02d (tpy)**	**PRP18b (tpy)**	**Net Change**
Point	276	176	-36.29%
Anthropogenic Fire	816	719	-11.85%
Natural Fire	47,810	47,813	0.01%
Area	4,728	6,682	41.34%
WRAP Area Oil & Gas	0	0	0.0%
On-Road Mobile	1,583	1,786	12.85%
Off-Road Mobile	2,006	1,645	-18.02%
Road Dust	231	331	43.40%
Fugitive Dust	305	483	58.60%
Total	57,754	59,635	3.26%

Organic carbon (OC) is primarily the end product of combustion of organic material. Most of these emissions are from natural (nonanthropogenic) wildfire, which can fluctuate greatly from year to year. Another source is anthropogenic fire (human-caused), which includes forestry prescribed burning, agricultural field burning, and outdoor residential burning. Area sources are estimated to increase by 41 percent by 2018. Overall, OC emissions are estimated to increase by 3% by 2018.

8.4.4 Elemental Carbon Emissions

The following table shows Arizona's elemental carbon emissions for baseline and future years.

Table 8.4 – Arizona Elemental Carbon (EC) Emission Inventory (2002 & 2018)

Arizona Planning and Baseline Emission Inventories			
Statewide Elemental Carbon			
Source Category	**Plan02d (tpy)**	**PRP18b (tpy)**	**Net Change**
Point	26	30	18.49%
Anthropogenic Fire	149	140	-6.18%
Natural Fire	9,570	9,570	0.0%
Area	449	612	36.43%
WRAP Area Oil & Gas	0	0	0.0%
On-Road Mobile	1,761	532	-69.77%
Off-Road Mobile	2,752	1,387	-49.59%
Road Dust	19	27	43.58%
Fugitive Dust	21	33	58.60%
Total	14,745	12,332	-16.37%

Elemental carbon (EC) is the carbon black, or soot, which is a byproduct of incomplete combustion. It is similar to OC, but represents more combustion of fuel producing carbon particulate matter as the end product. Like OC, the primary source is natural fire, and to a lesser degree, anthropogenic fire. Other emissions of note are area and mobile sources. Area EC emissions are estimated to increase by about 36 percent, while mobile is estimated to decrease significantly by 2018, which likely due to the implementation of new federal mobile source regulations.

8.4.5 PM Fine Emissions

The following table shows Arizona's emissions of fine PM for baseline and future years.

Table 8.5 – Arizona Soil (PM Fine/$PM_{2.5}$) Emission Inventory (2002 & 2018)

Arizona Planning and Baseline Emission Inventories			
Statewide PM Fine			
Source Category	**Plan02d (tpy)**	**PRP18b (tpy)**	**Net Change**
Point	632	1,215	92.17%
Anthropogenic Fire	100	68	-31.89%
Natural Fire	3,845	3,847	0.04%
Area	4,223	6,433	52.34%
WRAP Area Oil & Gas	0	0	0.00%
On-Road Mobile	0	0	0.00%
Off-Road Mobile	0	0	0.0%
Road Dust	2,809	4,013	42.90%
Fugitive Dust	7,263	10,909	50.19%
WB Dust	6,422	6,422	0.00%
Total	25,294	32,907	30.10%

Fine particulate matter (PM fine or fine PM) in the emissions inventory includes soil materials and other non-carbon, non-sulfate and non-nitrate particulate matter less than 2.5 microns in size. The primary sources are area sources (woodstoves), and a variety of sources of dust (agriculture, mining, construction, and unpaved and paved roads.) Similar to OC and EC, natural fire is a significant source of PM fine. Overall, PM fine shows an increase of 30 percent by 2018.

8.4.6 Coarse Mass Emissions

The following table shows Arizona's emissions of coarse PM for baseline and future years.

Table 8.6 – Arizona Coarse Mass (PM Coarse) Emission Inventory (2002 & 2018)

Arizona Planning and Baseline Emission Inventories			
Statewide Coarse PM			
Source Category	**Plan02d (tpy)**	**PRP18b (tpy)**	**Net Change**
Point	8,473	8,650	2.09%
Anthropogenic Fire	17	9	-47.98%
Natural Fire	10,107	10,108	0.00%
Area	1,384	1,766	27.57%
WRAP Area Oil & Gas	0	0	0.00%
On-Road Mobile	1,004	1,258	25.25%
Off-Road Mobile	0	0	0.00%
Road Dust	24,381	34,799	42.73%
Fugitive Dust	54,934	91,967	67.41%
WB Dust	57,796	57,796	0.00%
Total	158,099	206,353	30.52%

Coarse particulate matter (PM coarse or coarse PM) is particulate matter larger than PM fine, generally between 2.5-10 microns in size. Emission sources are similar to PM fine, but involve activities like rock crushing and processing, material transfer, open pit mining and unpaved road emissions. Windblown dust is the dominant source of PM coarse emissions. Coarse mass particles travel shorter distances in the atmosphere than other smaller particles, but can remain in the atmosphere long enough to contribute to regional haze. Emissions of PM coarse are increasing in the fugitive dust category, which is likely due to emissions from construction activities and emissions from paved and unpaved roads that tied to population growth and vehicle miles traveled. Overall, PM coarse emissions are estimated to increase by 30 percent in 2018.

8.4.7 Ammonia Emissions

The following table shows Arizona's emissions of ammonia (NH_3) for baseline and future years.

Table 8.7 – Arizona Ammonia (NH_3) Emission Inventory (2002 & 2018)

Arizona Planning and Baseline Emission Inventories			
Statewide Ammonia			
Source Category	**Plan02d (tpy)**	**PRP18b (tpy)**	**Net Change**
Point	531	729	37.42%
Anthropogenic Fire	97	73	-24.60%
Natural Fire	3,781	3,782	0.02%
Area	32,713	36,248	10.81%
WRAP Area Oil & Gas	0	0	0.00%
On-Road Mobile	5,035	7,606	51.08%
Off-Road Mobile	48	64	33.18%
Total	42,203	48,502	14.92%

Emission estimates for NH_3 have a high degree of uncertainty, based on a high variability in emission factors, wide range of activities, and lack of a uniform emission methodology. However, NH_3 emissions are important because they react with SO_2 and NO_X to form ammonium sulfate and ammonium nitrate particles, which are very effective in impairing visibility. Most NH_3 emissions are from areas sources, such as agricultural related activities, livestock operations, or farming fertilizer applications, which are expected to increase by 2018. Total NH_3 emissions in Arizona are projected to increase by about 15 percent. However, improvements in developing ammonia inventories will be needed in the near future to develop more effective regional haze strategies.

8.4.8 Volatile Organic Compound (VOC) Emissions

The following table shows Arizona's VOC emissions for baseline and future years.

Table 8.8 – Arizona VOC Emission Inventory (2002 & 2018)

Arizona Planning and Baseline Emission Inventories			
Statewide VOC			
Source Category	**Plan02d (tpy)**	**PRP18b (tpy)**	**Net Change**
Point	5,464	9,401	72.04%
Anthropogenic Fire	855	745	-12.92%
Natural Fire	36,377	36,381	0.01%
Biogenic	1,576,698	1,576,698	0.00%
Area	102,918	170,902	66.06%
WRAP Area Oil & Gas	46	49	5.44%
On-Road Mobile	110,424	52,872	-52.12%
Off-Road Mobile	56,901	36,033	-36.67%
Total	1,889,682	1,883,080	-0.35%

The dominant source of VOC emissions is biogenic emissions. These are natural emissions primarily from forests, but also agricultural crops and urban vegetation. Biogenic emissions are the largest single source of VOCs in the country. Sources such as automobiles, industrial and commercial facilities, solvent use, and refueling automobiles contribute to VOC loading in the atmosphere. From a regional haze

perspective, there is less concern with VOCs emitted directly to the atmosphere and more with the secondary organic aerosol that VOCs form after condensation and oxidation. VOCs also play a role n the photochemical production of ozone in the troposphere. VOCs react with NO_X to produce nitrated organic particles that affect 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. Note that reductions in VOC emissions from mobile sources are offset by increases in VOCs from area and point sources, which are likely due to population growth. Overall, total VOC emissions are estimated to remain the same in 2018.

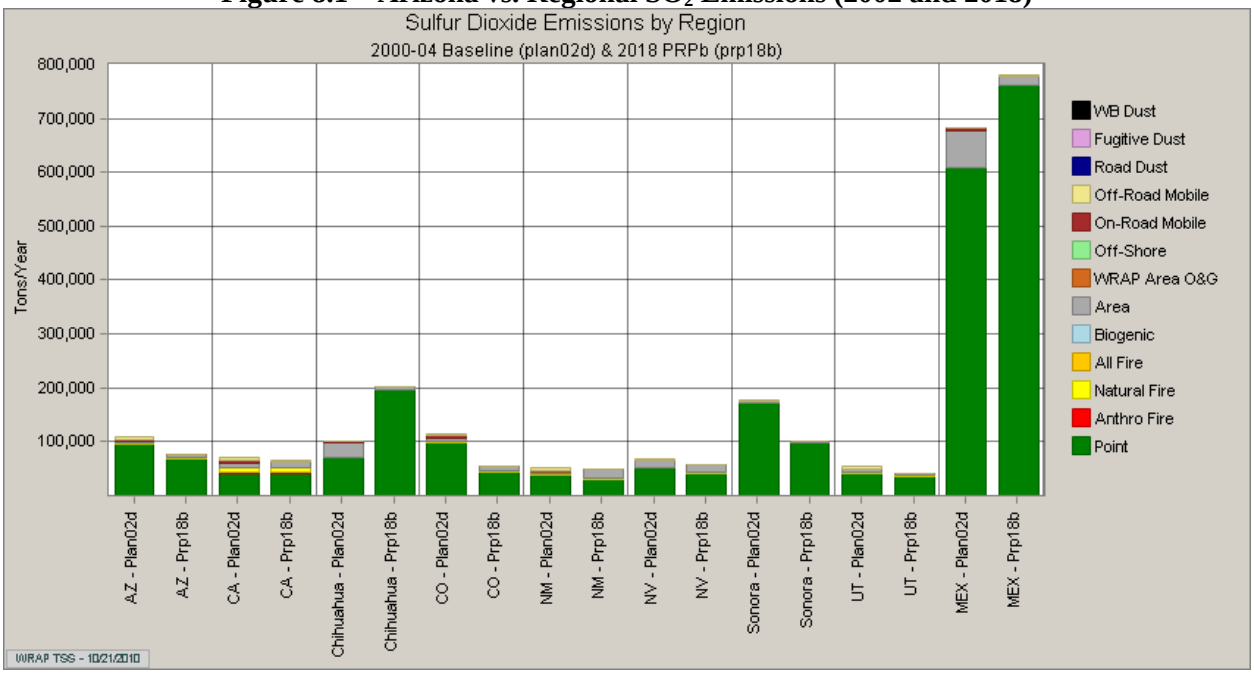
8.5 Regional Emissions

To better understand the relative contribution of in-state versus out-of-state emissions to regional haze, a comparison of Arizona emissions to regional emissions is provided in the following section. Section 8.5.1 is a comparison of Arizona to the neighboring states of California, Nevada, Utah, Colorado, and New Mexico.

8.5.1 SO_2 Emissions

As shown in Figure 8.1, SO_2 emissions are primarily from point sources, followed by area sources and natural fire. Projected levels for 2018 show an overall reduction in SO_2 emissions from Arizona. Compared to neighboring states, total SO_2 emissions from Arizona are slightly higher than neighboring states. Emissions of SO_2 from the Mexican State of Chihuahua are project to increase by approximately 150,000 tons per year (tpy) in 2018. Emissions from Chihuahua are projected to exceed those from Arizona.

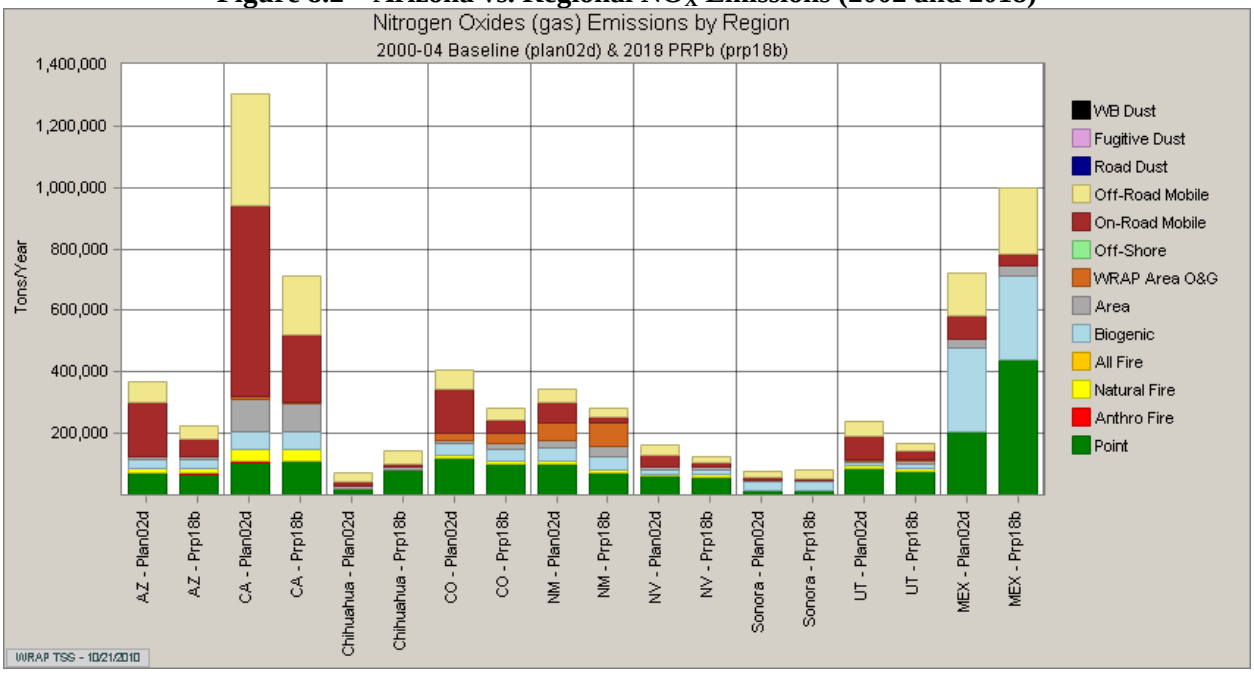
Figure 8.1 – Arizona vs. Regional SO_2 Emissions (2002 and 2018)



8.5.2 NO_X Emissions

As indicated in Figure 8.2, NO_X emissions are primarily from mobile sources, which show about a significant reduction by 2018. Compared to neighboring states, California NO_X emissions are considerably greater than Arizona and the other states.

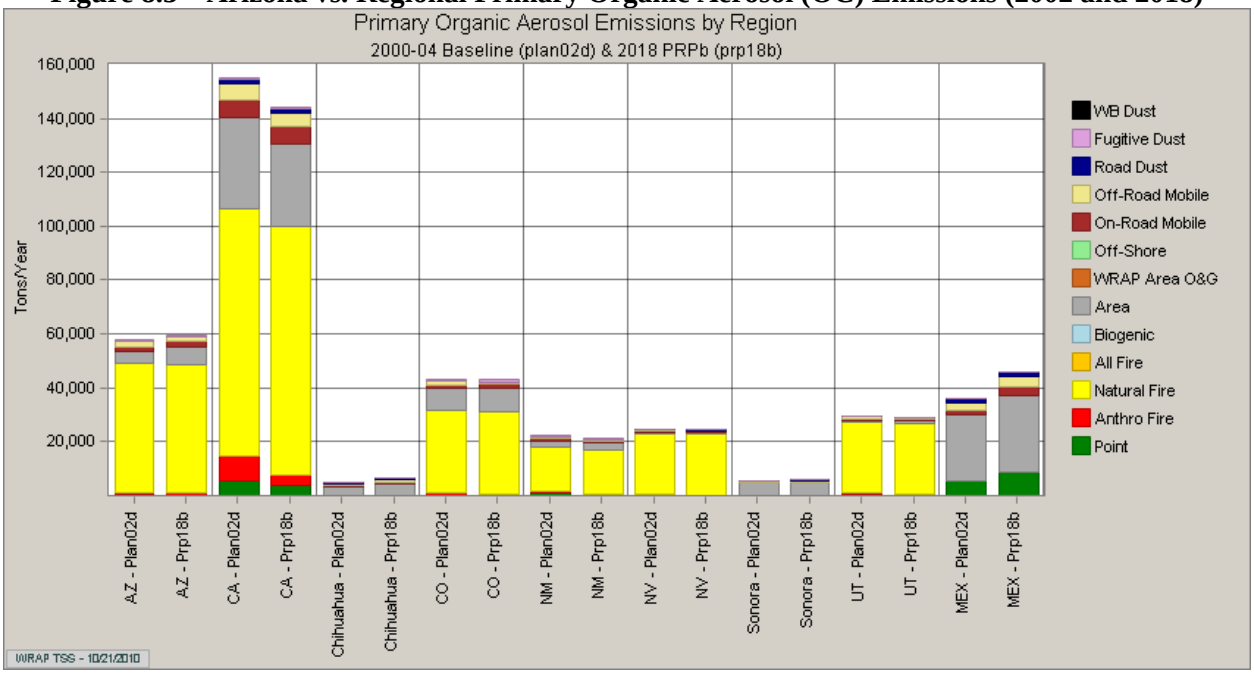
Figure 8.2 – Arizona vs. Regional NO_X Emissions (2002 and 2018)



8.5.3 OC Emissions

Figure 8.3 shows that Arizona OC emissions are primarily associated with sources of natural fire. These emissions are about 50 percent lower than California's fire emissions, but are higher than neighboring states.

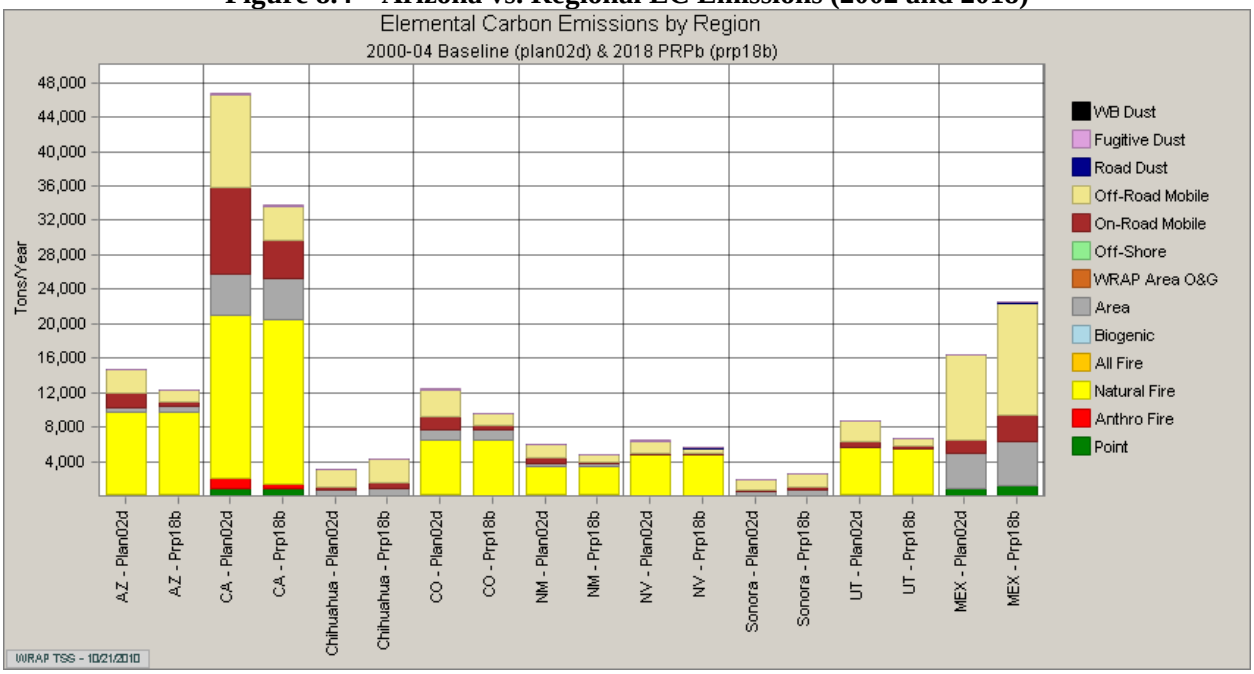
Figure 8.3 – Arizona vs. Regional Primary Organic Aerosol (OC) Emissions (2002 and 2018)



8.5.4 EC Emissions

As indicated in Figure 8.4, Arizona EC emissions are primarily from sources of natural fire, similar to OC.

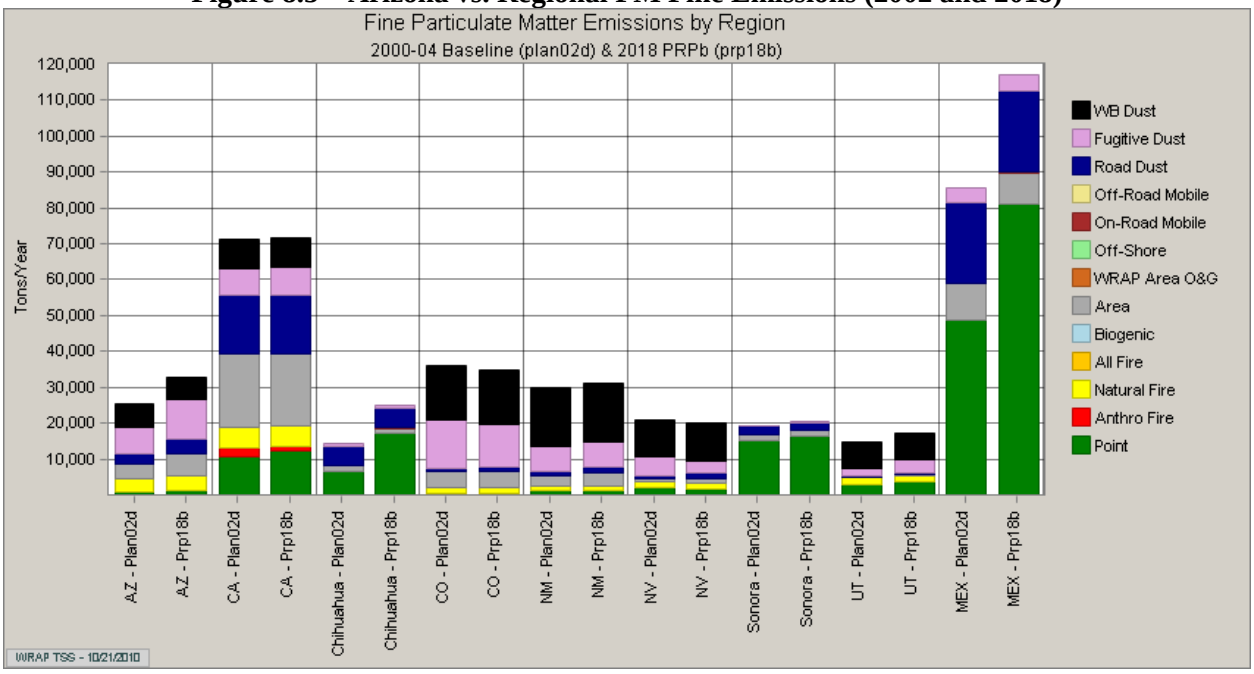
Figure 8.4 – Arizona vs. Regional EC Emissions (2002 and 2018)



8.5.5 PM Fine Emissions

As shown in Figure 8.5, PM fine emissions from Arizona are mostly dust and area sources. California's total emissions of PM fine are significantly higher than the other states. Arizona's total emissions of PM fine are less than those from Colorado and are approximately the same as those from New Mexico.

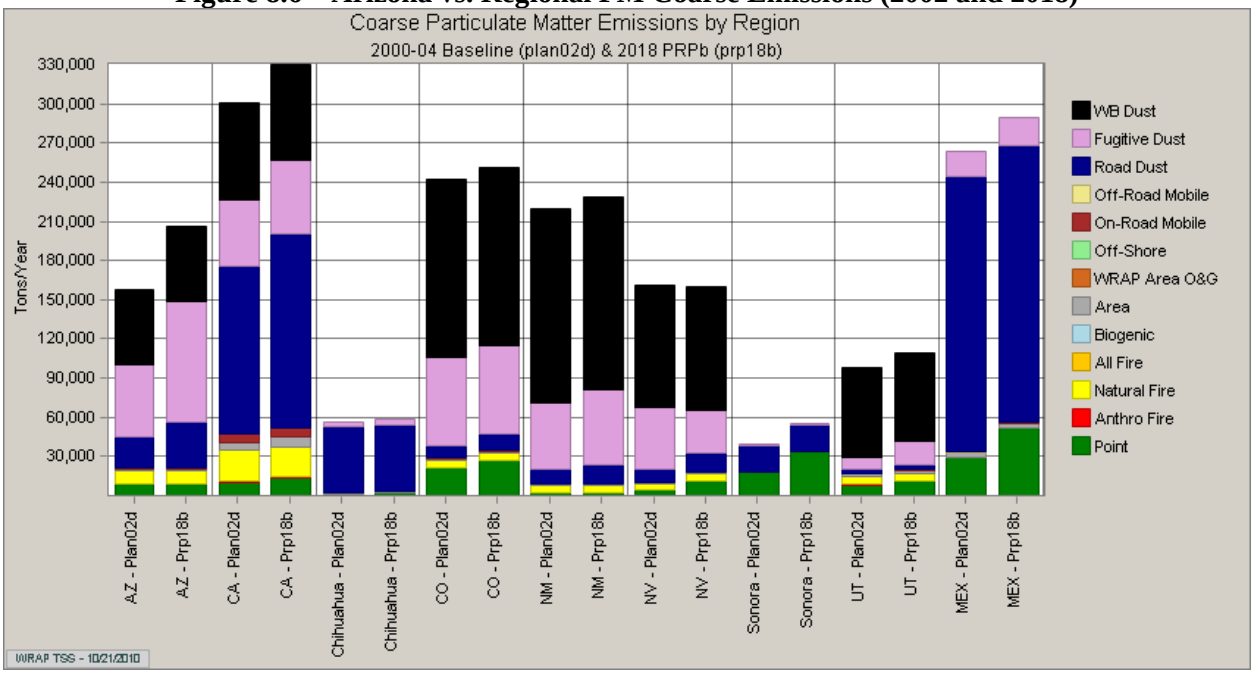
Figure 8.5 – Arizona vs. Regional PM Fine Emissions (2002 and 2018)



8.5.6 PM Coarse Emissions

As indicated in Figure 8.6, Arizona PM coarse emissions are almost exclusively dust related (windblown, fugitive, and road dust). Similar to PM fine, California's emissions for this pollutant are higher than the other states. Emissions of PM coarse from Arizona are less that the neighboring states of Colorado and New Mexico. However, PM coarse emissions are expected to increase in 2018.

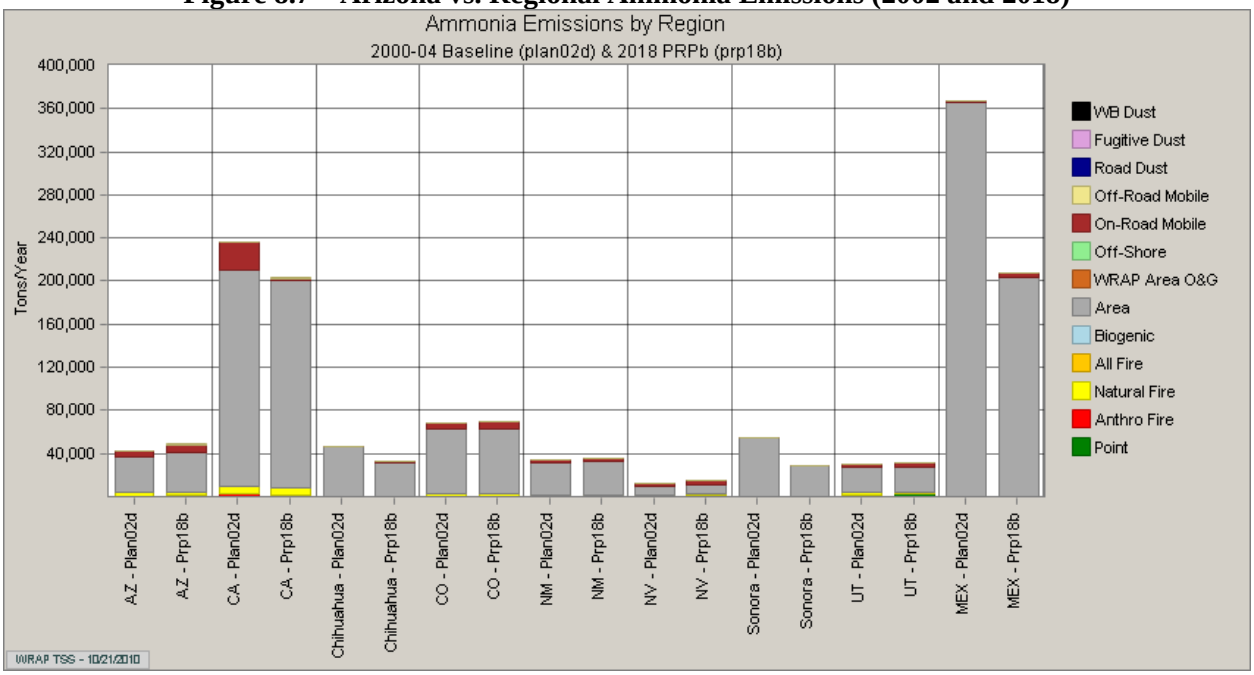
Figure 8.6 – Arizona vs. Regional PM Coarse Emissions (2002 and 2018)



8.5.7 Ammonia Emissions

As indicated in Figure 8.7, ammonia emissions are almost exclusively from area sources. California ammonia emissions dominate the regional total. Arizona ammonia emissions are less than those from Colorado but higher than the other states in this regional comparison.

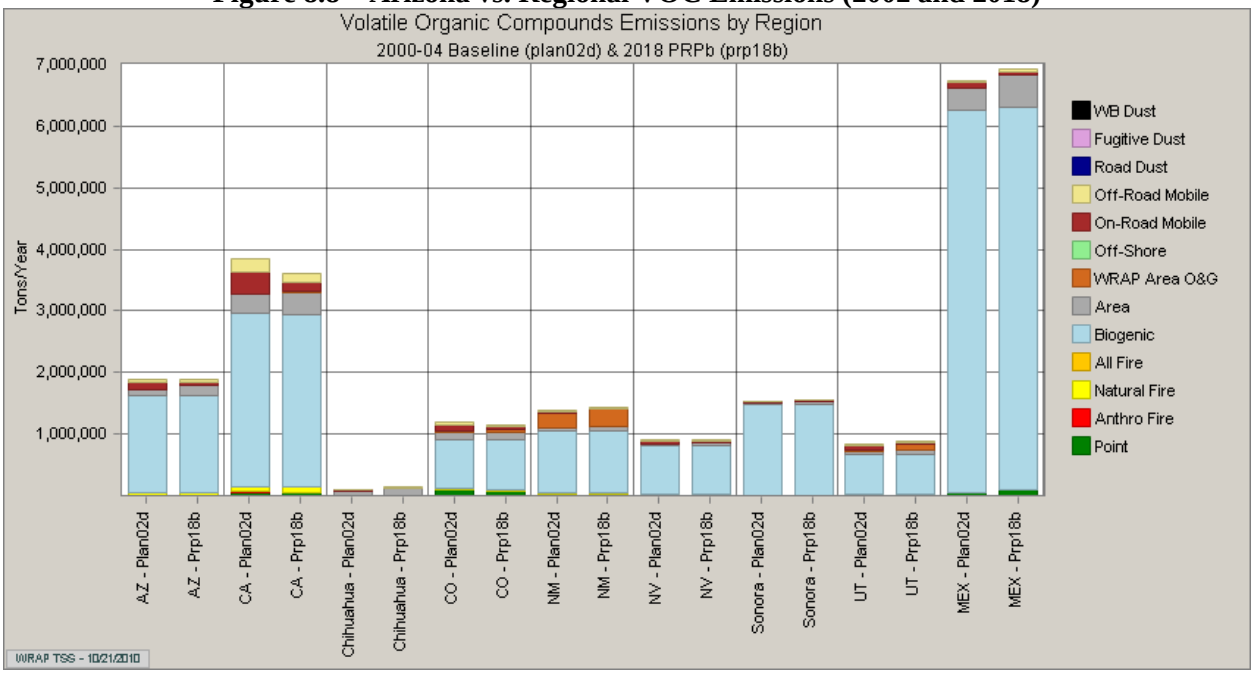
Figure 8.7 – Arizona vs. Regional Ammonia Emissions (2002 and 2018)



8.5.8 VOC Emissions

As indicated in Figure 8.8, VOC emissions are largely from biogenic sources. California's total VOC emissions are about twice that of Arizona.

Figure 8.8 – Arizona vs. Regional VOC Emissions (2002 and 2018)



(page intentionally blank)

Chapter 9: Visibility Modeling and Source Apportionment

9.1 Modeling Overview

9.1.1 Community Multi Scale Air Quality (CMAQ) Model

The Regional Modeling Center (RMC) Air Quality Modeling Group is responsible for regional haze modeling for the WRAP. The RMC is located at the University of California – Riverside in the College of Engineering Center for Environmental Research and Technology.

The RMC modeling analysis is based on a model domain comprising the continental U.S. using the Community Multi-Scale Air Quality (CMAQ) model. The EPA developed the CMAQ modeling system in the late 1990s. 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 an Eulerian Model; it is a grid-based model is which the frame of reference is a fixed, three-dimensional (3-D) grid with uniformly sized horizontal grid cells and variable vertical layer thicknesses. 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.

The RMC developed air quality modeling inputs including annual meteorology and emissions inventories for a 2002 actual emissions base case (Base02), a planning case to represent the 2001 – 2004 baseline period (Plan02), and a 2018 base case (Base 18) of projected emissions using factors known at the end of 2005. All emission inventories were developed during the Sparse Matrix operator Kernel Emission (SMOKE) modeling system. These inventories were revised during the development process. The development of these emission scenarios is documented under the emissions inventory sections of the TSS. A final report was prepared for the WRAP that discusses the 2002 performance evaluation, http://pah.cert.ucr.edu/aqm/308/reports/final/2002_MPE_report_main_body_FINAL.pdf

The 2018 visibility projections (PRP18a) were developed using the Plan02c and Base 18b CMAQ 36-km modeling results. Projections were 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.

The CMAQ modeling included emission inputs from the following sources:

- Smoke Management Program accounted for using Emissions Reduction Techniques (ERTs) applied to the 2000-2004 average fire emissions.
- New permits and State/EPA consent agreements since 2002 reviewed with each state through 2007.
- Ozone and PM10 SIPs in place within the WRAP region
- State Oil and Gas emission control programs.
- Mobile sources:
  - Heavy Duty Diesel (2007) Engine Standard
  - Tier 2 Tailpipe
  - Large Spark Ignition and Recreational Vehicle rule
  - Nonroad Diesel Rule
- Combustion Turbine and Industrial Boiler/Process Heater/RICE MACT
- Known BART control in the WRAP region.
- Presumptive SO_2 BART for EGUs in the WRAP region.

Generally, emission inputs were prepared by individual states and tribes for point, area, and most dust emissions categories. The following WRAP Forums were relied upon to summarize this data and provide it to the RMC.

- Point Source emissions were obtained from project commissioned by the Stationary Source Joint Forum and the Emission Forum.
- Area Source emissions wee obtained from project commissioned by the Stationary Source Joint Forum and the Emission Forum.
- Mobile Source emissions were from project commissioned by the Emissions Forum.
- Fire (natural and anthropogenic) emissions were from projects commissioned by the Fire Emissions Joint Forum
- Ammonia, Dust, & Biogenic emissions were from projects commissioned by the Dust Emissions Joint Forum and the Modeling Forum.
- Emissions from Pacific Offshore shipping were from a project conducted by the RMC.
- Other emissions from North America were from projects commissioned by the Emission Forum and the Modeling Forum. The Mexico emission fare from 1999 and were held constant for 2018. Canada emissions are from 2000 and were held constant for 2018.
- Boundary conditions reaching North America from the rest of the world were from a project commissioned by the VISTAs Regional Planning Organization, on behalf of the five regional planning organizations working on regional haze.

The 2018 Preliminary Reasonable Progress, version B (PRP18b), makes a second revision to the 2018 emissions inventory projections for point and area sources in the WRAP region to provide a more current assessment of the reasonable progress toward visibility goals by the WRAP. The PRP18b addresses changes that occurred since January 2007 in the following areas.

- BART determinations (or expected BART control levels where BART had not been finalized);
- Projections of "future" fossil-fuel plants needed to achieve 2018 federal electrical generation demand forecasts;
- New rulemaking, permit limits, and consent decrees; and
- Other outstanding issues that were identified by the federal, state, or local agencies within the WRAP domain as needing to be corrected or updated.

The results from the CMAQ regional modeling analysis is provided and discussed in Section 9.2 of this chapter, and are also discussed determination of Reasonable Progress Goals in Section 11.4.

9.1.2 Particulate Matter Source Apportionment Technology (PSAT)

The RMC also developed Riverside developed the Particulate Matter Source Apportionment Technology (PSAT) algorithm in the Comprehensive Air Quality Model with extensions (CAMx) model to assess source attribution. The PSAT analysis is used to attribute particle species, particularly sulfate and nitrate from a specific location within the WRAP modeling domain. The PSAT algorithm applies nitrate-sulfate-ammonia chemistry to a system of tracers or "tags" to track the chemical transformations, transport and removal of emissions. A final report was prepared for the WRAP that discusses the 2002 performance evaluation, http://pah.cert.ucr.edu/aqm/308/reports/final/2002_MPE_report_main_body_FINAL.pdf

Each state or region (i.e. Mexico, Canada) is assigned a unique number that is used to tag the emissions from each 36-kilometer grid cell within the WRAP modeling domain. Due to time and computational limitations, only point, mobile, area and fire emissions were tagged. PSAT utilized the Plan 02c and Base 18b inventories.

The PSAT algorithm was also used, in a limited application (e.g. no state or regional attribution) due to resource constraints, to track natural and anthropogenic species of organic aerosols at each CIA. The organic aerosol tracer tracked both primary and secondary organic aerosols (POA & SOA). Appendix C includes more information on PSAT methodology.

The results from the PSAT regional modeling analysis is provided and discussed in Section 9.3 of this chapter, and are also discussed determination of Reasonable Progress Goals in Section 11.4.

9.1.3 Weighted Emissions Potential (WEP)

The Weighted Emissions Potential (WEP) is a screening tool that helps to identify source regions that have the potential to contribute to haze formation at specific Class I areas. Unlike PSAT, this method does not account for chemistry or deposition. The WEP combines emissions inventories, wind patterns, and residence time of air mass over each area where emissions occur, to estimate the percent contribution of different pollutants. Like PSAT, the WEP tool compares baseline (2000-2004) to 2018, to show the improvement expected by the 2018 URP, for sulfate, nitrate, organic carbon, elemental carbon, fine PM, and coarse PM.

9.2 Modeling Results for CMAQ: Summary of 2018 Projected Visibility Conditions

This section provides the visibility projections for Arizona's Class I areas using the CMAQ model. The projections were calculated form modeled results by multiplying a species-specific relative response factor (RRF) with the baseline monitored results, and then converting to extinction and deciview. The RRF is defined as the ratio of future-to-current modeled mass. A more detailed description of the RRF can be found in Appendix C, Section 2. The projected visibility conditions are used to define the reasonable progress goals found in Chapter 11.

Table 9.1 provides the 2018 uniform progress for each Class I area and the visibility modeling projection for 2018 for both 20% worst and 20% best days. None of Arizona's Class I areas are projected to meet the URP for 2018, although all are projected to be below baseline conditions. The following section provides a breakdown of the visibility impairment for each pollutant. Modeling shows degradation on best days for two of the IMPROVE monitors. This is addressed in the Chapter 12 discussion regarding the Long Term Strategy.

Table 9.1 – Summary of CMAQ Modeling Progress Towards 2018

Arizona Class I Area	20% Worst Days Visibility			20% Best Days Visibility		
	Worst Days Baseline (dv)	2018 URP Goal (dv)	2018 Projected Visibility (dv)	Best Days Baseline (dv)	2018 Projected Visibility (dv)	2018 Projection less than Baseline?
Chiricahua NM, Chiricahua W, Galiuro W	13.43	11.98	13.35	4.91	4.94	No
Grand Canyon NP	11.66	10.58	11.14	2.16	2.12	Yes
Mazatzal W, Pine Mountain W	13.35	11.79	12.76	5.40	5.17	Yes
Mount Baldy W	11.85	10.54	11.52	2.98	2.86	Yes
Petrified Forest NP	13.21	11.64	12.85	5.02	4.73	Yes

Arizona Class I Area	20% Worst Days Visibility			20% Best Days Visibility		
	Worst Days Baseline (dv)	2018 URP Goal (dv)	2018 Projected Visibility (dv)	Best Days Baseline (dv)	2018 Projected Visibility (dv)	2018 Projection less than Baseline?
Saguaro NP – West Unit	16.22	13.90	15.99	8.58	8.34	Yes
Saguaro NP – East Unit	14.83	12.88	14.82	6.94	7.04	No
Sierra Ancha W	13.67	12.02	13.17	6.16	5.88	Yes
Superstition W	14.16	12.38	13.89	6.46	6.22	Yes
Sycamore Canyon W	15.25	13.25	15	5.58	5.49	Yes

9.2.1 CMAQ Modeling by Pollutant

The following graphs and tables show the breakdown of visibility impairment for each pollutant on 20% worst days. The visibility projections for the individual pollutants at each Class I area shows that most pollutants will not meet their respective 2018 goal for worst days. The tables summarize the impairment of each pollutant and identify the relative impact from anthropogenic or non-anthropogenic pollutants.

The results of the breakdown show that nitrate (anthropogenic) has greater improvement than the other pollutants. With the exceptions of organic carbon and fine soil, all other pollutants are below the baseline condition. The tables also show that the primary contributors to extinction are organic carbon, sulfate, and coarse mass. The sulfate is likely from industrial sources while the organic carbon can be attributed mostly to fire and coarse mass from natural sources.

Figure 9.1 – URP by Pollutant on 20% Worst Days for Chiricahua NM, Chiricahua WA, and Galiuro WA

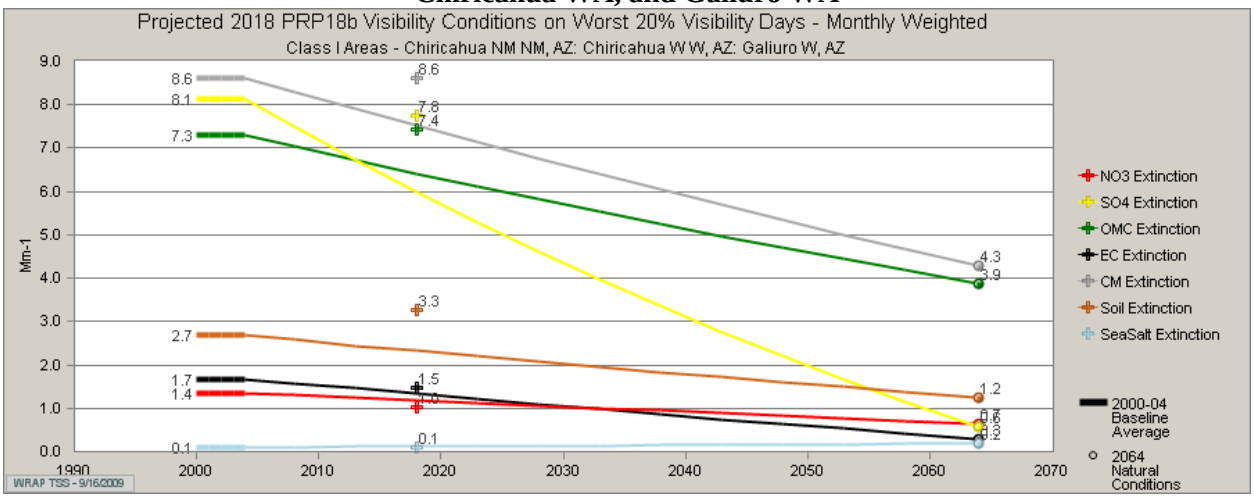


Table 9.2 – Pollutant Breakdown on 20% Worst Days for Chiricahua NM, Chiricahua WA, & Galiuro WA

Pollutant	Chiricahua NM, Chiricahua WA, & Galiuro WA				
	2000-2004 Baseline (Mm-1)	2018 URP Goal (Mm-1)	2018 Projected Visibility (Mm-1)	2064 Natural Conditions (Mm-)	2018 under URP Goal?
Sulfate	8.13	5.98	7.75	0.57	No
Nitrate	1.35	1.18	1.02	0.65	Yes
Organic Carbon	7.29	6.42	7.42	3.87	No
Elemental Carbon	1.68	1.34	1.46	0.28	No
Fine Soil	2.68	2.33	3.28	1.24	No
Coarse Mass	8.63	7.52	N/A*	4.30	N/A*
Sea Salt	0.1	0.12	N/A*	0.19	N/A*

*Visibility projections not available due to poor model performance.

Figure 9.2 – URP by Pollutant on 20% Worst Days for Grand Canyon National Park

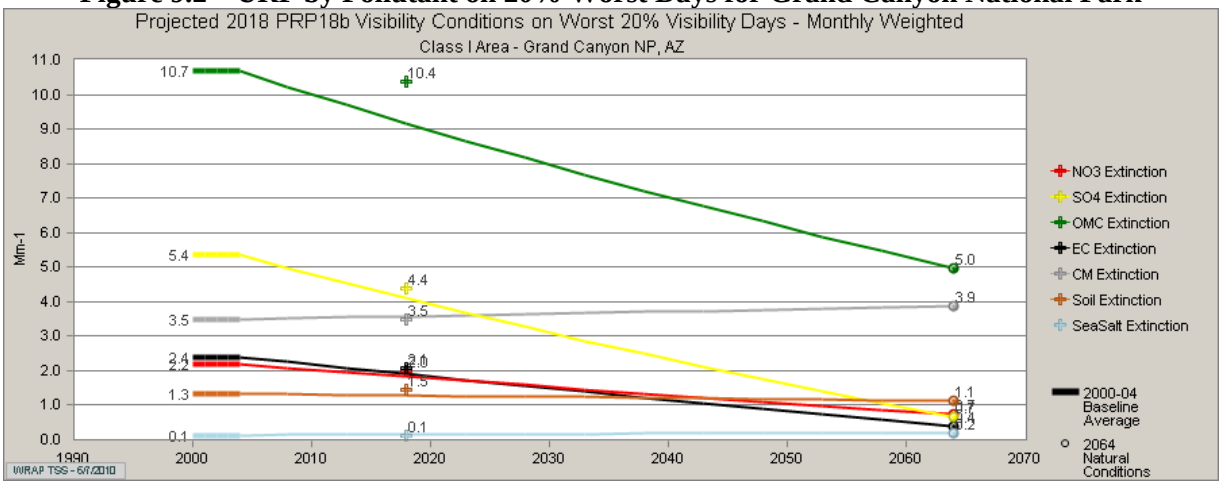


Table 9.3 – Pollutant Breakdown on 20% Worst Days for Grand Canyon NP

Pollutant	Grand Canyon National Park				
	2000-2004 Baseline (Mm-1)	2018 URP Goal (Mm-1)	2018 Projected Visibility (Mm-1)	2064 Natural Conditions (Mm-)	2018 under URP Goal?
Sulfate	5.36	4.11	4.38	0.66	No
Nitrate	2.19	1.83	1.99	0.74	No
Organic Carbon	10.67	9.17	10.38	4.99	No
Elemental Carbon	2.4	1.9	2.07	0.41	No
Fine Soil	1.33	1.29	1.45	1.13	No
Coarse Mass	3.49	3.58	NA*	3.86	N/A*
Sea Salt	0.13	0.15	NA*	0.21	N/A*

*Visibility projections not available due to poor model performance.

Figure 9.3 – URP by Pollutant on 20% Worst Days for Mazatzal WA and Pine Mountain WA

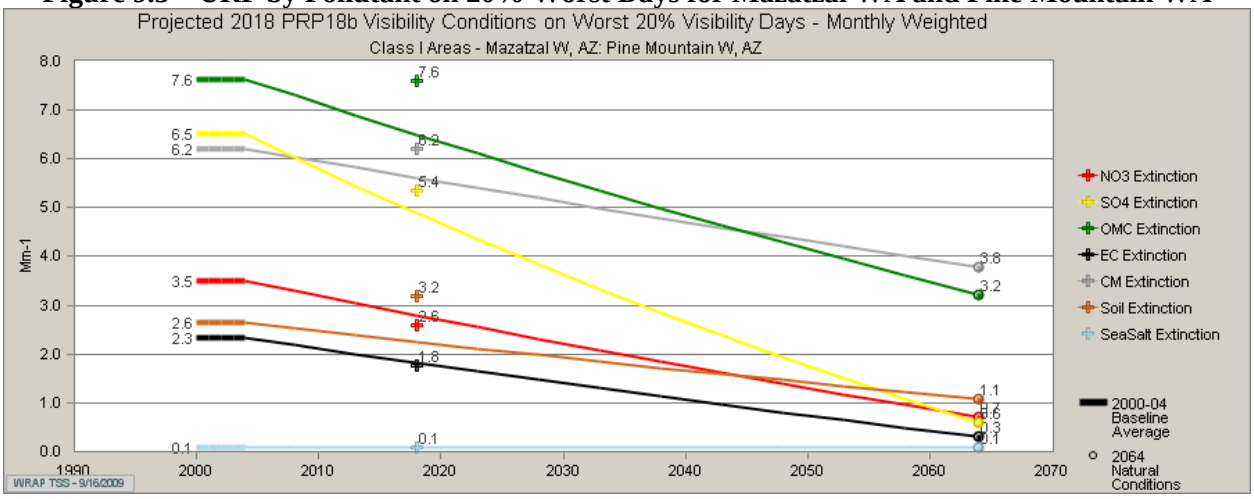


Table 9.4 – Pollutant Breakdown on 20% Worst Days for Mazatzal WA and Pine Mountain WA

Pollutant	Mazatzal WA and Pine Mountain WA				
	2000-2004 Baseline (Mm-1)	2018 URP Goal (Mm-1)	2018 Projected Visibility (Mm-1)	2064 Natural Conditions (Mm-)	2018 under URP Goal?
Sulfate	6.51	4.89	5.36	0.60	No
Nitrate	3.51	2.80	2.60	0.71	Yes
Organic Carbon	7.64	6.50	7.59	3.23	No
Elemental Carbon	2.33	1.82	1.77	0.30	Yes
Fine Soil	2.64	2.25	3.18	1.07	No
Coarse Mass	6.22	5.61	N/A*	3.79	N/A*
Sea Salt	0.08	0.08	N/A*	0.09	N/A*

*Visibility projections not available due to poor model performance.

Figure 9.4 – URP by Pollutant on 20% Worst Days for Mount Baldy WA

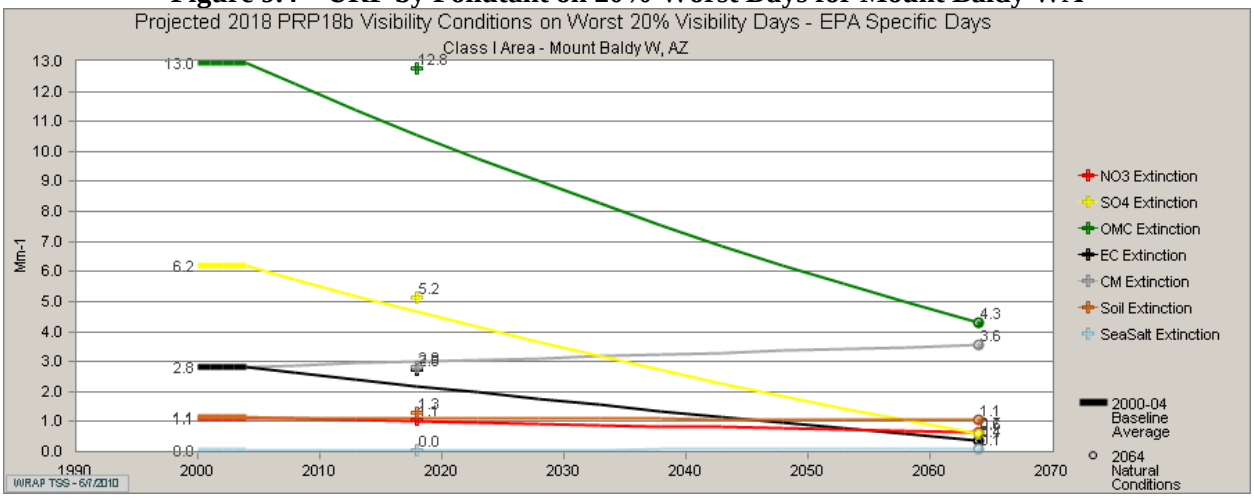


Table 9.5 – Pollutant Breakdown on 20% Worst Days for Mount Baldy WA

Pollutant	Mount Baldy WA				
	2000-2004 Baseline (Mm-1)	2018 URP Goal (Mm-1)	2018 Projected Visibility (Mm-1)	2064 Natural Conditions (Mm-)	2018 under URP Goal?
Sulfate	6.20	4.67	5.48	0.59	No
Nitrate	1.12	1.01	1.05	0.65	Yes
Organic Carbon	12.96	10.56	12.63	4.30	No
Elemental Carbon	2.8	2.19	2.56	0.37	Yes
Fine Soil	1.14	1.12	1.44	1.05	No
Coarse Mass	2.83	3.00	N/A*	3.57	N/A*
Sea Salt	0.04	0.05	N/A*	0.09	N/A*

*Visibility projections not available due to poor model performance.

Figure 9.5 – URP by Pollutant on 20% Worst Days for Petrified Forest NP

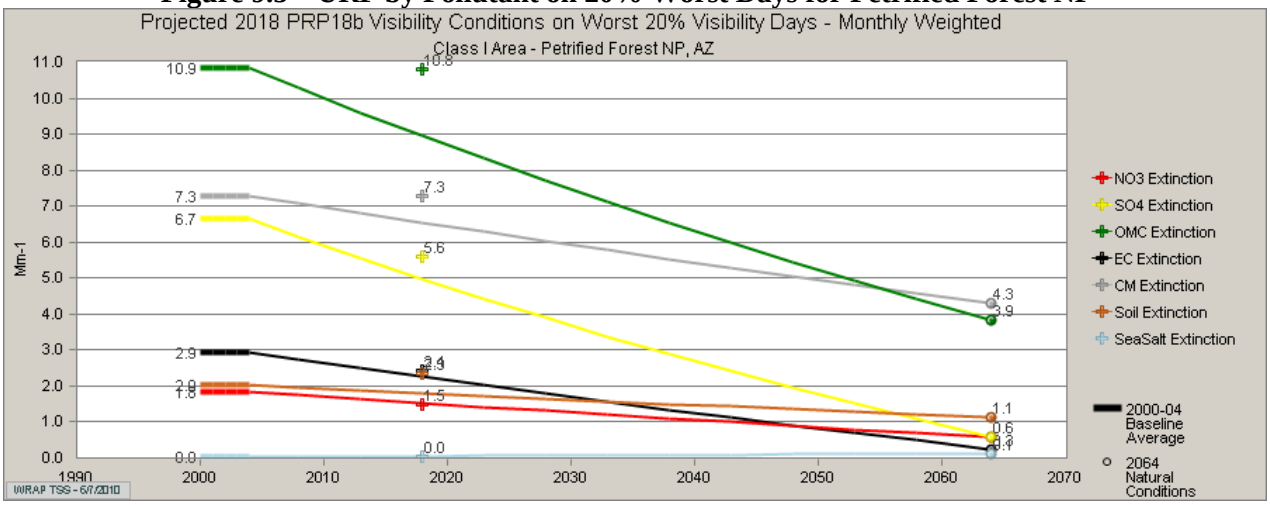


Table 9.6 – Pollutant Breakdown on 20% Worst Days for Petrified Forest NP

Pollutant	Petrified Forest NP				
	2000-2004 Baseline (Mm-1)	2018 URP Goal (Mm-1)	2018 Projected Visibility (Mm-1)	2064 Natural Conditions (Mm-)	2018 under URP Goal?
Sulfate	6.65	4.98	5.81	0.60	No
Nitrate	1.84	1.53	1.61	0.57	No
Organic Carbon	10.85	8.96	10.77	3.85	No
Elemental Carbon	2.94	2.26	2.44	0.25	No
Fine Soil	2.02	1.80	2.29	1.12	No
Coarse Mass	7.30	6.55	N/A*	4.30	N/A*
Sea Salt	0.03	0.05	N/A*	0.13	N/A*

*Visibility projections not available due to poor model performance.

Figure 9.6 – URP by Pollutant on 20% Worst Days for Saguaro NP – West Unit

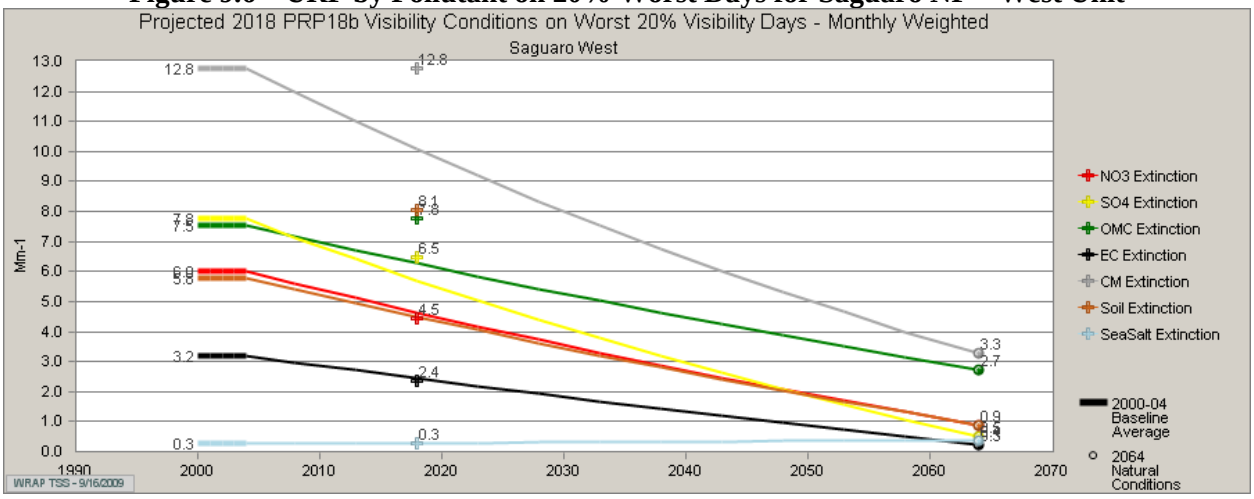


Table 9.7 – Pollutant Breakdown on 20% Worst Days for Saguaro NP – West Unit

Pollutant	Saguaro National Park – West Unit				
	2000-2004 Baseline (Mm-1)	2018 URP Goal (Mm-1)	2018 Projected Visibility (Mm-1)	2064 Natural Conditions (Mm-)	2018 under URP Goal?
Sulfate	7.75	5.71	6.46	0.52	No
Nitrate	6.02	4.64	4.45	0.90	Yes
Organic Carbon	7.54	6.28	7.79	2.74	No
Elemental Carbon	3.20	2.45	2.35	0.25	Yes
Fine Soil	5.80	4.49	8.05	0.90	No
Coarse Mass	12.78	10.08	N/A*	3.27	N/A*
Sea Salt	0.27	0.29	N/A*	0.38	N/A*

*Visibility projections not available due to poor model performance.

Figure 9.7 – URP by Pollutant on 20% Worst Days for Saguaro NP–East Unit

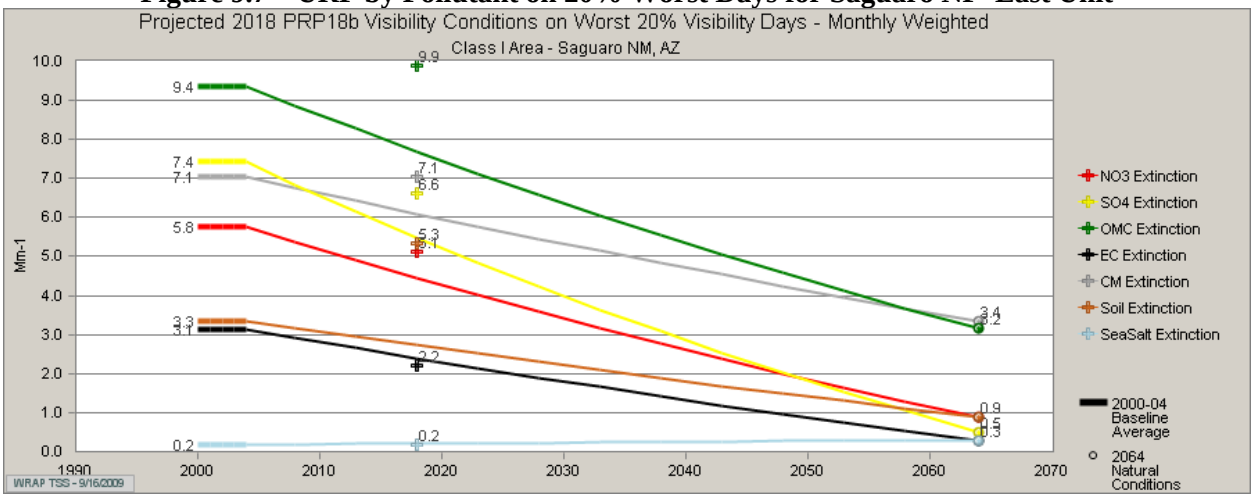


Table 9.8 – Pollutant Breakdown on 20% Worst Days for Saguaro NP–East Unit

Pollutant	Saguaro National Park – East Unit				
	2000-2004 Baseline (Mm-1)	2018 URP Goal (Mm-1)	2018 Projected Visibility (Mm-1)	2064 Natural Conditions (Mm-)	2018 under URP Goal?
Sulfate	7.42	5.48	6.61	0.50	No
Nitrate	5.77	4.46	5.13	0.88	No
Organic Carbon	9.37	7.70	9.89	3.15	No
Elemental Carbon	3.14	2.40	2.22	0.27	Yes
Fine Soil	3.35	2.73	5.34	0.89	No
Coarse Mass	7.05	6.10	N/A*	3.35	N/A*
Sea Salt	0.18	0.21	N/A*	0.30	N/A*

*Visibility projections not available due to poor model performance.

Figure 9.8 – URP by Pollutant on 20% Worst Days for Sierra Ancha WA

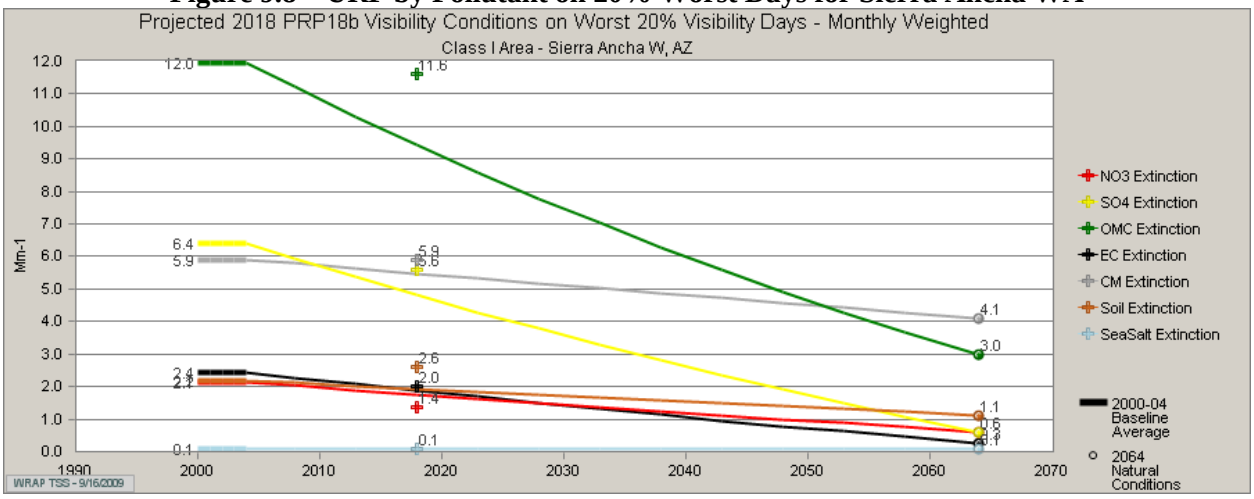


Table 9.9 – Pollutant Breakdown on 20% Worst Days for Sierra Ancha WA

Pollutant	Sierra Ancha WA				
	2000-2004 Baseline (Mm-1)	2018 URP Goal (Mm-1)	2018 Projected Visibility (Mm-1)	2064 Natural Conditions (Mm-)	2018 under URP Goal?
Sulfate	6.41	4.82	5.59	0.60	No
Nitrate	2.14	1.76	1.36	0.61	Yes
Organic Carbon	11.97	9.43	11.62	2.97	No
Elemental Carbon	2.44	1.89	2.00	0.25	No
Fine Soil	2.19	1.93	2.62	1.13	No
Coarse Mass	5.91	5.48	N/A*	4.12	N/A*
Sea Salt	0.07	0.07	N/A*	0.08	N/A*

*Visibility projections not available due to poor model performance.

Figure 9.9 – URP by Pollutant on 20% Worst Days for Superstition WA

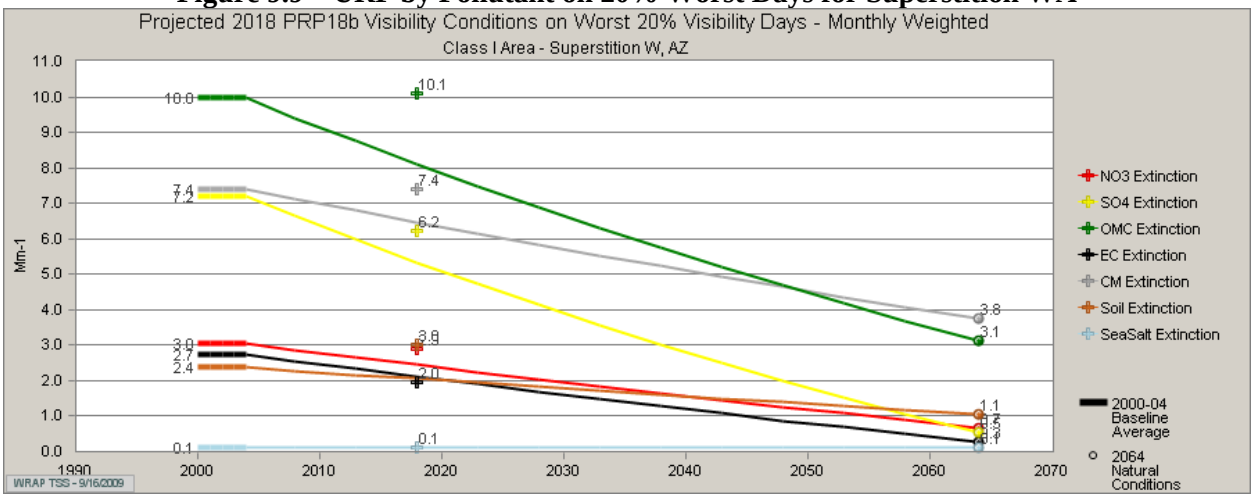


Table 9.10 – Pollutant Breakdown on 20% Worst Days for Superstition WA

Pollutant	Superstition WA				
	2000- 2004 Baseline (Mm-1)	2018 URP Goal (Mm-1)	2018 Projected Visibility (Mm-1)	2064 Natural Conditions (Mm-)	2018 under URP Goal?
Sulfate	7.19	5.33	6.24	0.54	No
Nitrate	3.05	2.45	2.90	0.68	No
Organic Carbon	9.97	8.10	10.10	3.12	No
Elemental Carbon	2.73	2.11	1.95	0.28	Yes
Fine Soil	2.38	2.06	3.03	1.50	No
Coarse Mass	7.40	6.47	N/A*	3.75	N/A*
Sea Salt	0.11	0.11	N/A*	0.12	N/A*

*Visibility projections not available due to poor model performance.

Figure 9.10 – URP by Pollutant on 20% Worst Days for Sycamore Canyon WA

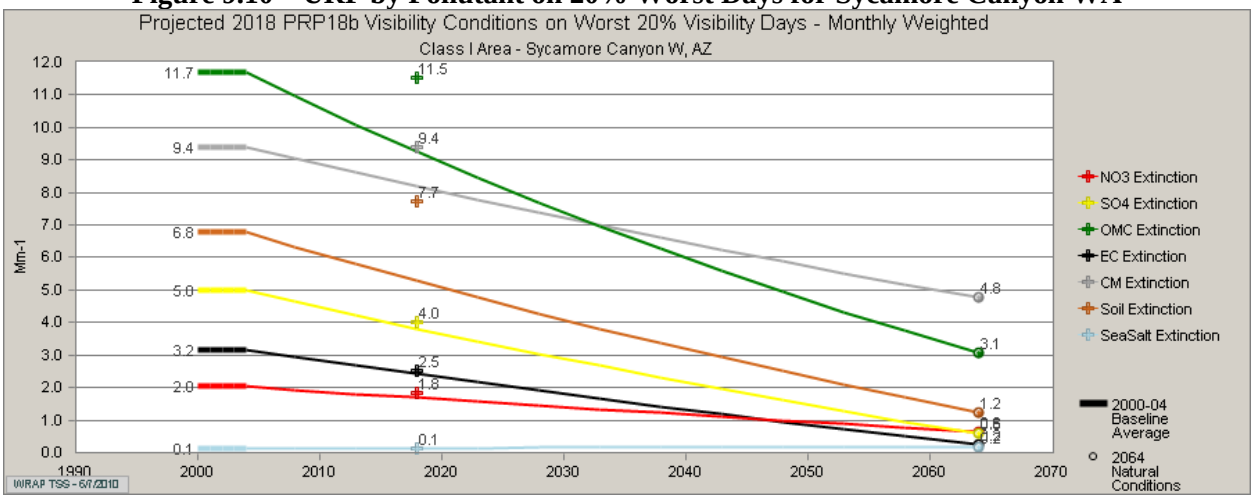


Table 9.11 – Pollutant Breakdown on 20% Worst Days for Sycamore Canyon WA

Pollutant	Sycamore Canyon WA				
	2000- 2004 Baseline (Mm-1)	2018 URP Goal (Mm-1)	2018 Projected Visibility (Mm-1)	2064 Natural Conditions (Mm-1)	2018 under URP Goal?
Sulfate	4.99	3.82	4.02	0.58	No
Nitrate	2.03	1.69	1.82	0.64	No
Organic Carbon	11.68	9.26	11.51	3.06	No
Elemental Carbon	3.17	2.42	2.54	0.24	No
Fine Soil	6.78	5.28	7.72	1.24	No
Coarse Mass	9.39	8.20	N/A*	4.78	N/A*
Sea Salt	0.12	0.14	N/A*	0.18	N/A*

*Visibility projections not available due to poor model performance.

9.3 Summary of PSAT Modeling Results

This section provides a summary of the PSAT modeling results for the baseline and 2018 projections. The figures and graphs show the relative contribution of in-state versus out-of-state sources that contribute to visibility impairment at Arizona's Class I areas. Results for both the 20% worst and 20% best days are shown.

The PSAT modeling focuses on sulfate and nitrate contribution only and takes into account chemistry and deposition. Modeling shows contribution from all regions including the WRAP States, CENRAP States, the eastern US States, Canada, Mexico, Pacific Offshore (shipping), and "Outside Domain" (global transport). The WEP analysis does not consider sulfate and nitrate chemistry and deposition, but does estimate contributions from Canada, Mexico, and Pacific Offshore regions. Because of these differences, the results show PSAT for sulfate and nitrate contributions (the primary anthropogenic pollutants) and WEP results for identifying the contribution from organic carbon, elemental carbon, fine soil, and coarse matter (common non-anthropogenic pollutants).

The following sections contain pie charts and graphs showing the state and regional contributions of sulfate and nitrate mass at the IMPROVE monitoring sites for the Class I areas. The pie charts show the regional contributions from the WRAP States, Canada, Mexico, Pacific offshore (PO), and outside the domain (OD). The WRAP States are indicated by the "break-out" slice of the pie chart. The PSAT bar graphs show the breakdown of contribution from the individual WRAP States for organic carbon, elemental carbon, fine PM, and coarse PM. The figures compare the baseline conditions with the projected concentration in 2018 based on PSAT modeling.

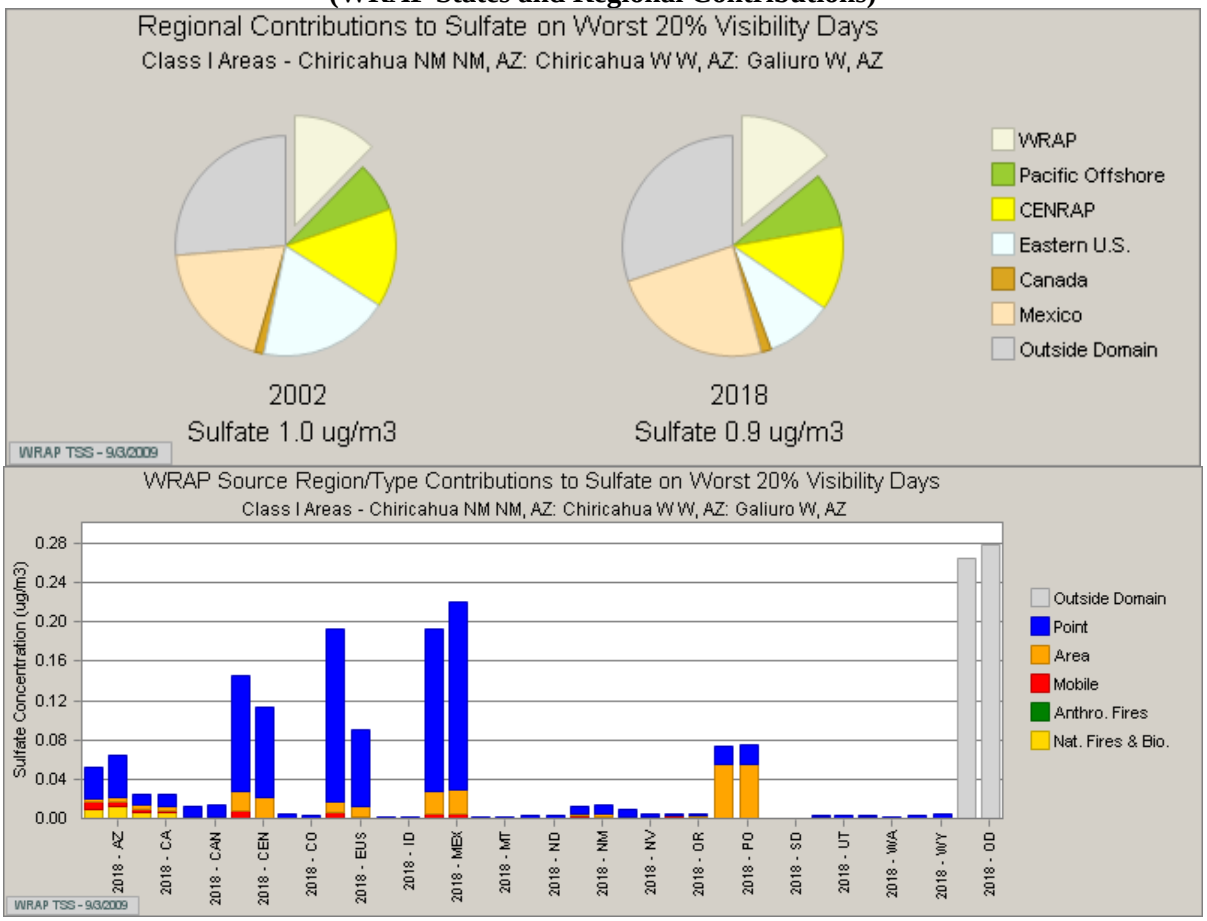
9.3.1 Chiricahua NM, Chiricahua WA, and Galiuro WA

Sulfate

Figure 9.11 shows the concentration of sulfate for the 20% worst days. The overall concentration is projected to decrease by 2018. Contributions from WRAP States, Pacific offshore, Mexico, and the outside domain are however, showing increased concentrations. CENRAP States and Eastern U.S. States are decreasing. Concentrations from Mexico are increasing, mostly from point sources, which may be due to increasing emissions from industrial sources within Mexico.

The breakdown of the contributions from WRAP States and regionally, shows that point sources are the primary source of sulfate (Figure 9.23). Among the primary regional contributors, modeling shows that sulfate concentrations are decreasing by 2018, except for sulfate from Arizona and Mexico

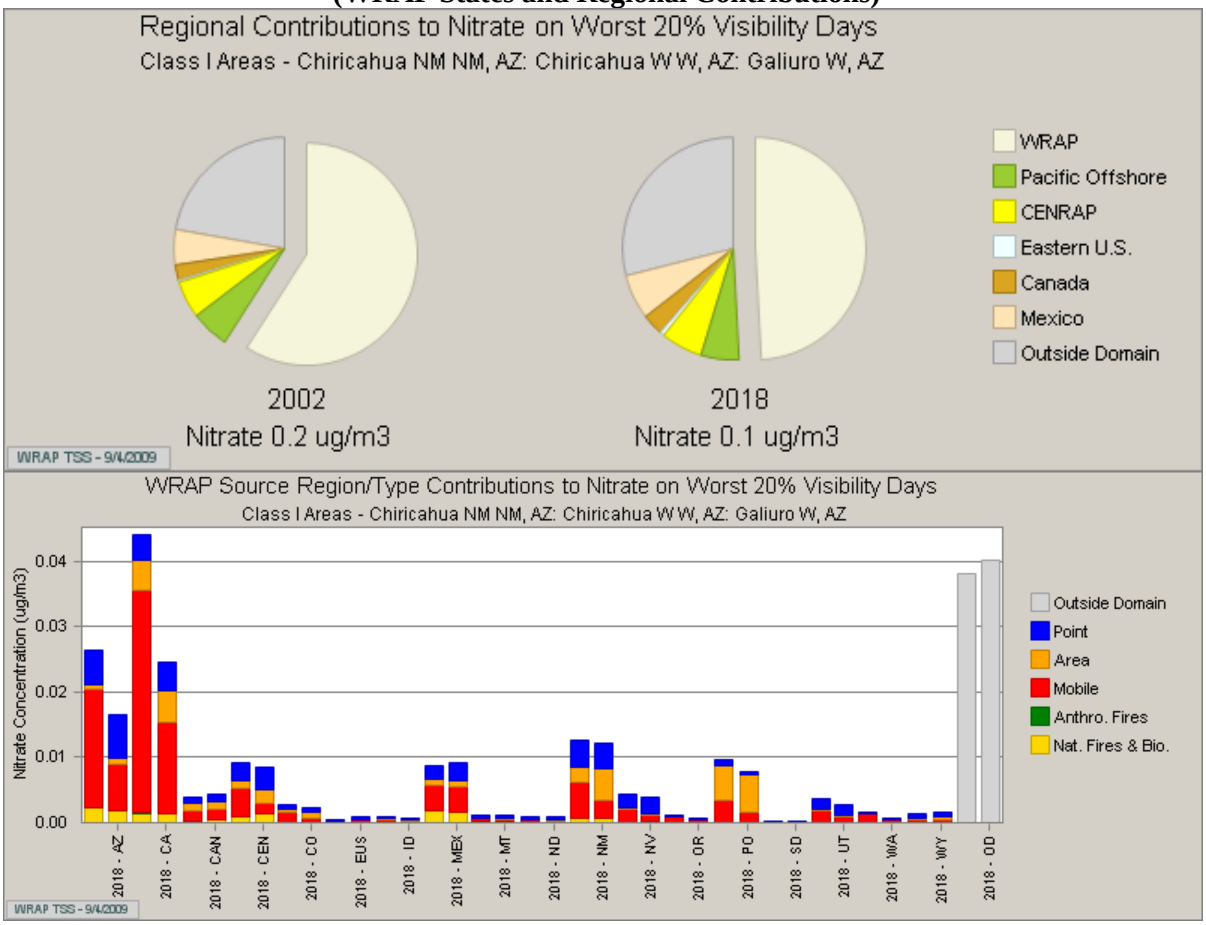
Figure 9.11 – PSAT for Sulfate on 20% Worst Days at CHIR1
(WRAP States and Regional Contributions)



Nitrate

Figure 9.12 shows the concentration of nitrate for the 20% worst days. The overall concentration is projected to decrease by 2018 and contributions from WRAP States decrease significantly. Pacific offshore, CENRAP States, Canada, and Mexico show increased nitrate concentrations in 2018. Among the WRAP States, California contributes the most to nitrate concentrations followed by Arizona in both the baseline period and the 2018 projections. Nitrate concentrations are primarily from mobile sources, which show significant decreases in 2018 from both Arizona and California. New Mexico is the third largest contributor to nitrate, although at less amounts than Arizona and California. The 2018 projections for nitrate from New Mexico show decreasing concentrations from mobile sources while nitrates from area sources increasing.

Figure 9.12 – PSAT for Nitrate on 20% Worst Days at (CHIR1)
(WRAP States and Regional Contributions)

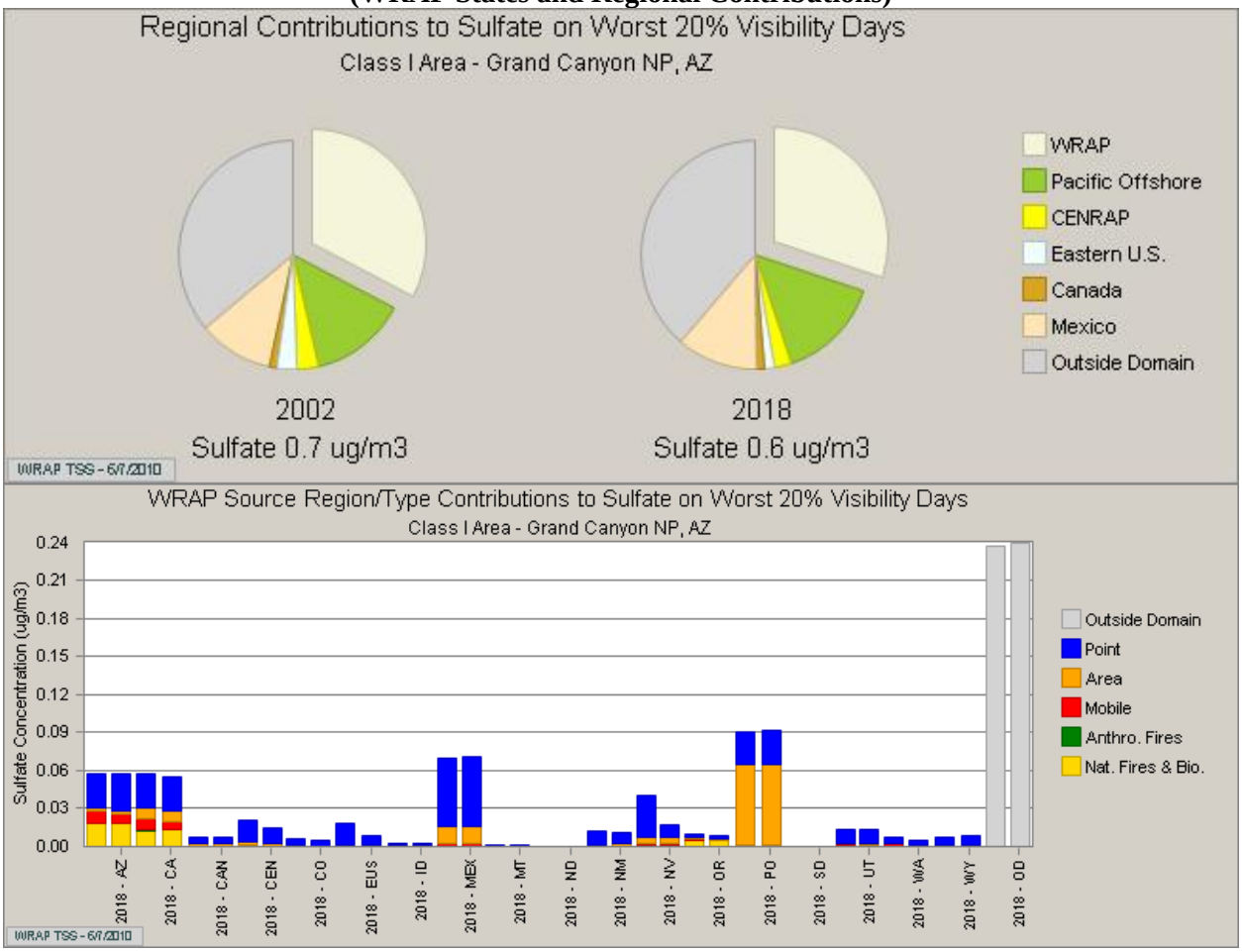


9.3.2 Grand Canyon NP

Sulfate

The overall concentration of sulfate at Grand Canyon National Park is projected to decrease by 2018. Figure 9.13 shows that contributions from WRAP States are expected to decrease by 2018, while contributions from the other source regions are either remaining constant or slightly increasing. Arizona, California, Mexico, and Pacific Offshore are the primary source of sulfate. Among the regional contributors, modeling shows that sulfate concentrations are decreasing by 2018, except for sulfate from Arizona, Mexico, and Pacific Offshore.

Figure 9.13 – PSAT Sulfate on 20% Worst Days at GRCA2
(WRAP States and Regional Contributions)

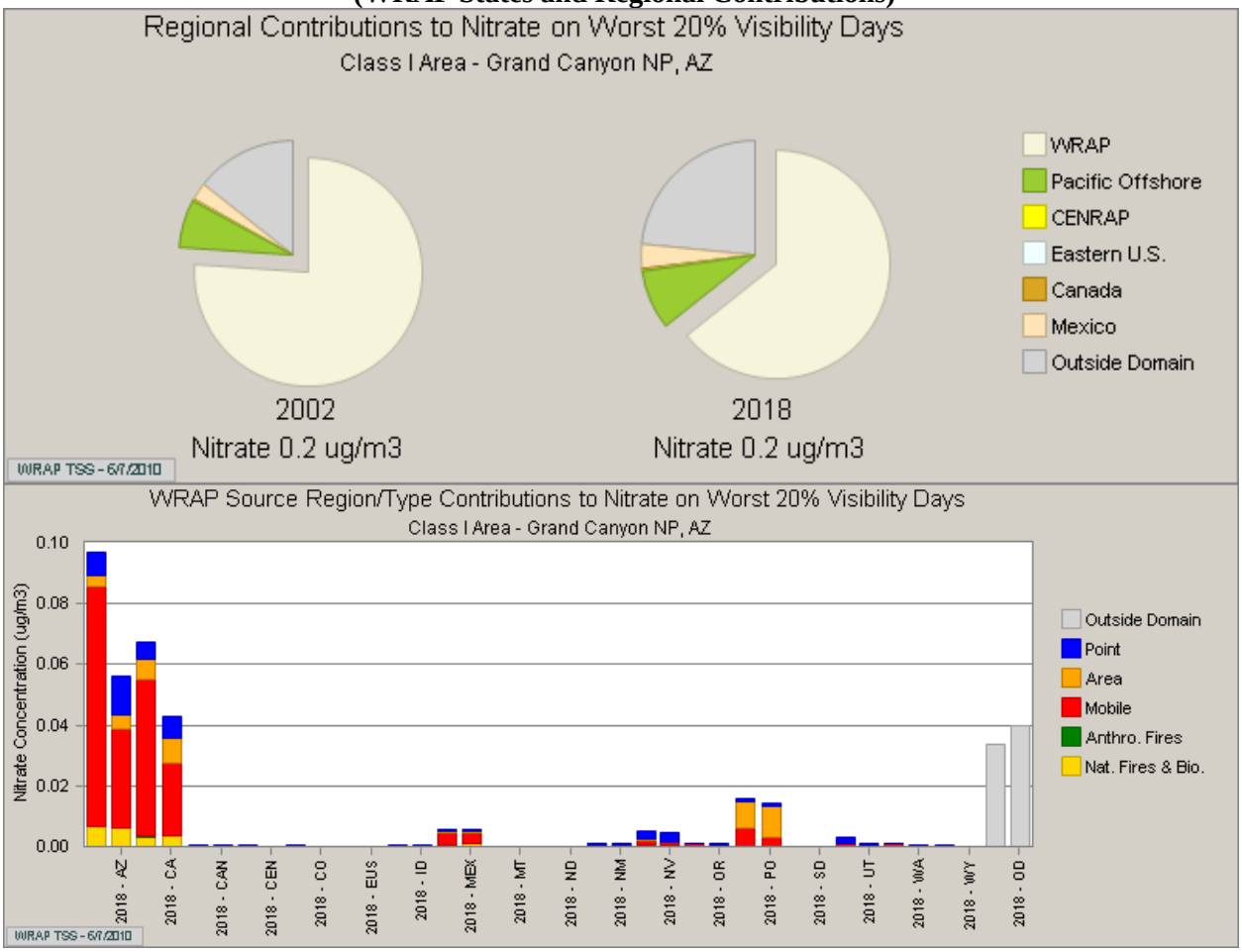


Nitrate

Figure 9.14 shows the concentration of nitrate for the 20% worst days at Grand Canyon NP. The overall concentration is projected to decrease by 2018. The contributions from WRAP States show decreasing concentrations, while Pacific Offshore, Mexico, and the Outside Domain show increased nitrate concentrations by 2018.

Among the WRAP States, California contributes the most to nitrate concentrations followed by Arizona in both the baseline period and the 2018 projections. Nitrate concentrations are primarily from mobile sources, which decrease in 2018 from both Arizona and California. The Outside Domain is the third largest contributor to nitrate, which are projected to increase in 2018.

Figure 9.14 – PSAT Nitrate on 20% Worst Days at GRCA2 (WRAP States and Regional Contributions)



9.3.3 Mazatzal WA and Pine Mountain WA

Sulfate

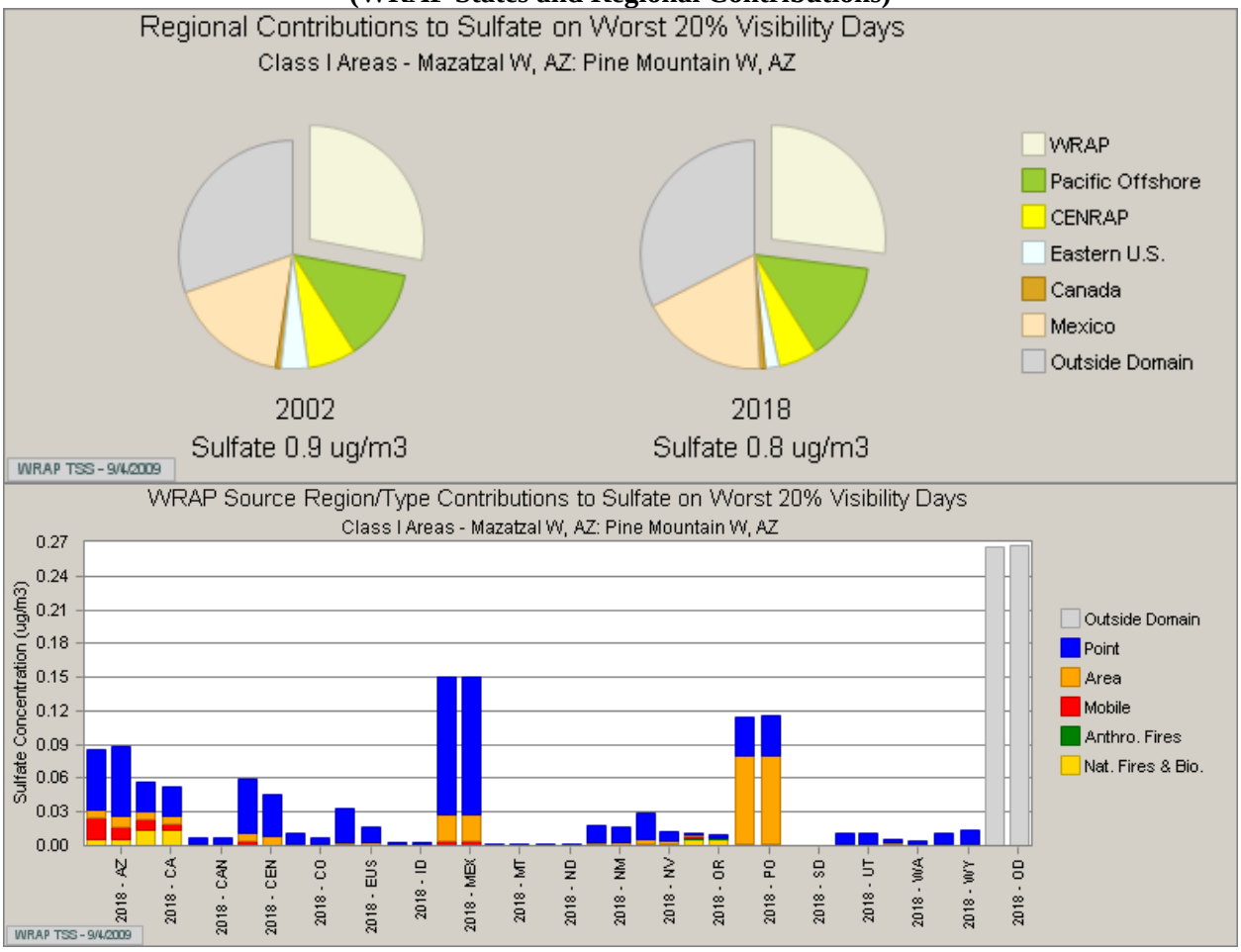
Figure 9.15 shows sulfate concentrations from the baseline period and projection in 2018 for Mazatzal and Pine Mountain Wilderness (as represented by IKBA1). The States and regions contributing to most of the sulfate concentrations include WRAP States, outside domain, and Mexico. Pacific offshore, CENRAP States, and Eastern US States also contribute but at lower concentrations.

The breakdown of sulfate contributions indicates that Mexican sources are the highest regional contributor, mostly from point sources. Back trajectory analysis shows sources from the northwest portion of the State of Sonora have the greatest potential to contribute to sulfate concentrations. Pacific offshore also contributes to sulfate concentrations, predominantly from area and point sources. Arizona contributions to sulfate concentrations are mostly from point sources, which are projected to slightly increase in 2018. Increasing concentrations could be linked to projected increases in SO_2 emissions increases from Gila and Yavapai Counties.

California also contributes to sulfate concentrations, approximately one-half comes from point sources while the remaining sulfate is from natural fire/biogenic, mobile, and area sources. The primary sources

of sulfate emissions from California include point, area, natural fire, and mobile sources. Projections show that SO_2 emissions from point and area sources are increasing by 2018.

Figure 9.15 – PSAT Sulfate on 20% Worst Days at IKBA1
(WRAP States and Regional Contributions)

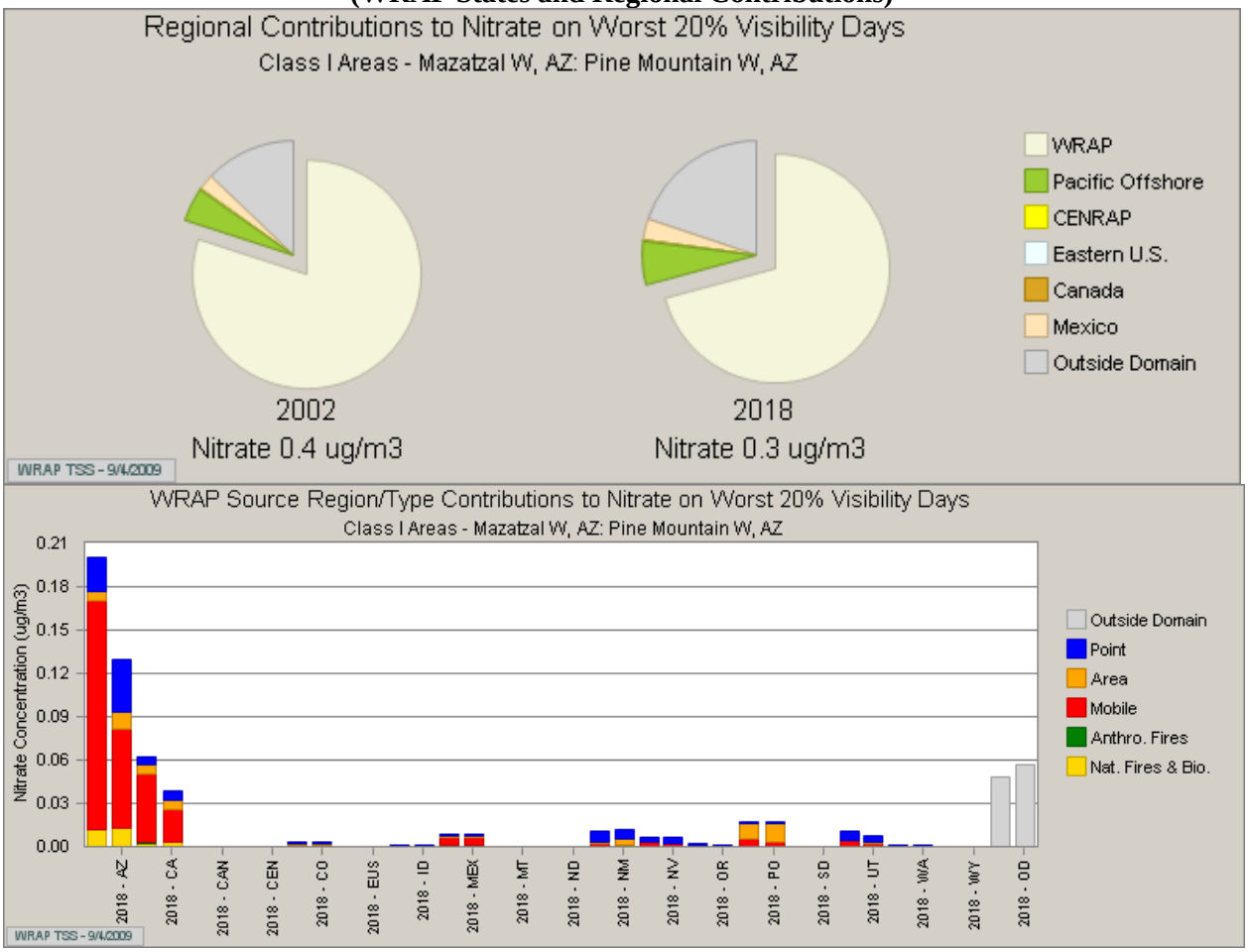


Nitrate

Regional nitrate concentrations at Mazatzal and Pine Mountain Wilderness Area are shown in Figure 9.16. Contributions to nitrate concentrations are mostly from WRAP States, which are projected to decrease by 2018. Arizona is the primary contributor to nitrate, followed by outside domain and California. Arizona source types contributing to nitrate concentrations include natural fire/biogenic, mobile, area, and point sources. Most of the concentrations are from mobile sources. Source types projected to have increasing concentrations include mobile, area, and point. Looking at nitrogen oxide emissions in Arizona, projections show that emissions from point and area sources will increase by 2018. Most of the emissions are projected to be from sources in Maricopa County, followed by Navajo and Pima Counties. Nitrogen oxide emissions from Navajo County are primarily from point sources (about one-half), the remaining emissions are from natural fire/biogenics, on-road mobile, and off-road mobile.

The outside domain is the second highest contributor to nitrate concentrations. This category is not differentiated and source types cannot be determined. At the regional level, California has the third highest contribution to nitrate concentrations, which are primarily from mobile sources.

Figure 9.16 – PSAT for Nitrate on 20% Worst Days at IKBA1 (WRAP States and Regional Contributions)



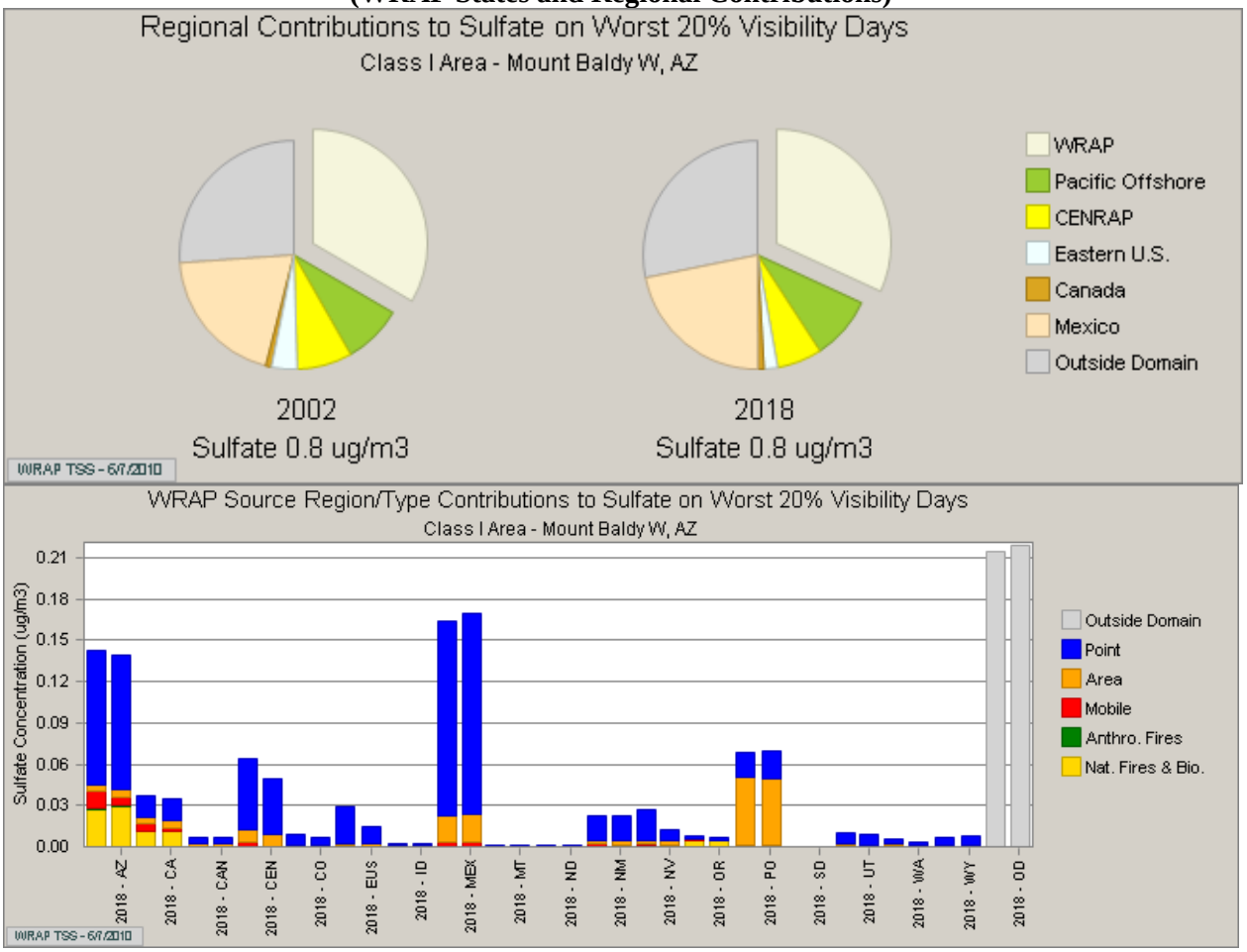
9.3.4 Mount Baldy WA

Sulfate

At the Mount Baldy Wilderness Area, the states and regions contributing to most of the sulfate concentrations include WRAP States, outside domain, and Mexico (Figure 9.17). Pacific offshore, CENRAP States, and Eastern US States also contribute but at lower concentrations.

The breakdown of sulfate contributions, as shown in Figure 9.17, indicates that Mexican sources are the highest regional contributor, mostly from point sources. The second highest sulfate contributions are from Arizona, mostly from point sources, which are projected to slightly decrease in 2018.

Figure 9.17 – PSAT for Sulfate on 20% Worst Days at BALD1
(WRAP States and Regional Contributions)

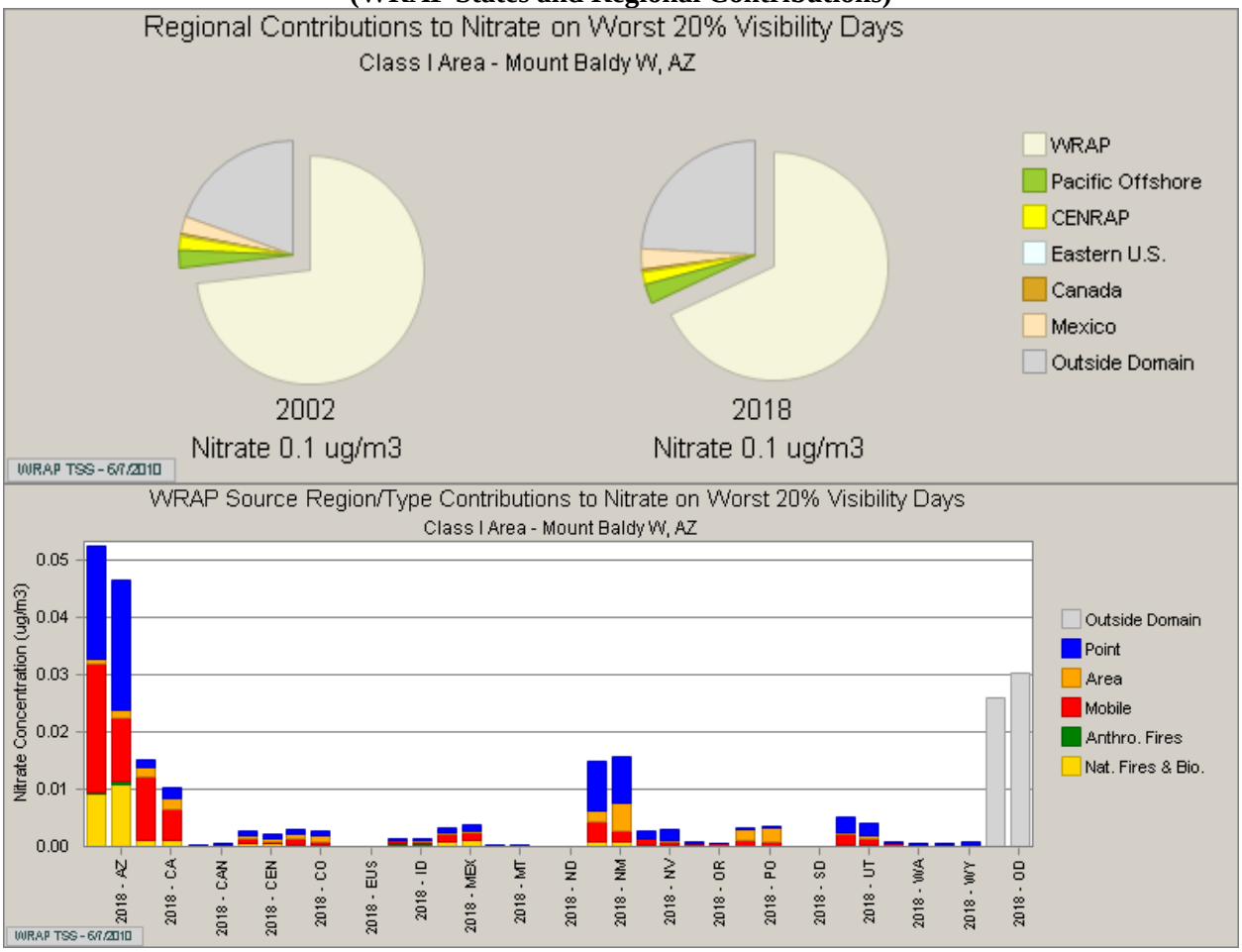


Nitrate

Regional nitrate concentrations at Mount Baldy Wilderness Area are shown in Figure 9.18. Contributions to nitrate concentrations are mostly from WRAP States, which are projected to decrease by 2018. The second highest contributor to nitrate is the outside domain. Nitrate from the outside domain is projected to increase by 2018. Arizona is the primary contributor to nitrate, followed by outside domain and New Mexico. Arizona source types contributing to nitrate concentrations include natural fire/biogenic, mobile, area, and point sources. Most of the concentrations are from mobile sources. Source types projected to have increasing concentrations include mobile, area, and point. Looking at nitrogen oxide emissions in Arizona, projections show that emissions from point and area sources will increase by 2018. Most of the emissions are projected to be from sources in Maricopa County, followed by Navajo and Pima Counties. Nitrogen oxide emissions from Navajo County are primarily from point sources (about one-half), the remaining emissions are from natural fire/biogenics, on-road mobile, and off-road mobile.

The outside domain is the second highest contributor to nitrate concentrations. This category is not differentiated and source types cannot be determined. At the regional level, New Mexico has the third highest contribution to nitrate concentrations, primarily from mobile sources.

Figure 9.18 – PSAT for Nitrate on 20% Worst Days at BALD1
(WRAP States and Regional Contributions)

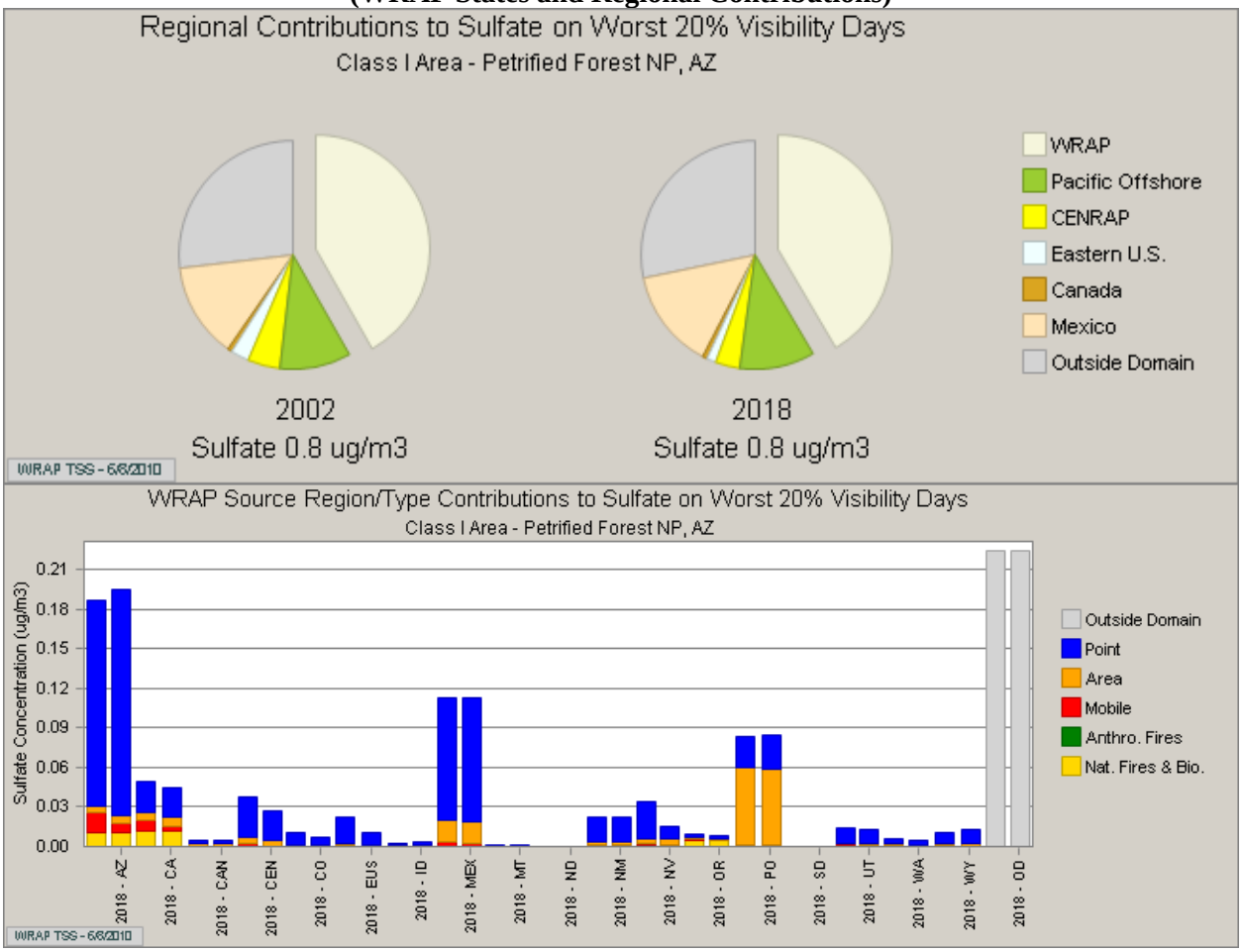


9.3.5 Petrified Forest NP

Sulfate

Sulfate concentrations at Petrified Forest National Park are from predominately from WRAP States (Figure 9.19). The remaining concentrations are mostly from the outside domain, Mexico, and Pacific offshore. Sources from the outside domain are not differentiated and source types cannot be determined. The next highest contributors are Arizona, Mexico, and Pacific offshore. The primary source in Arizona and Mexico are point sources. Projections for 2018 show that overall concentrations will not decrease significantly.

Figure 9.19 – PSAT for Sulfate on 20% Worst Days at PEFO1
(WRAP States and Regional Contributions)

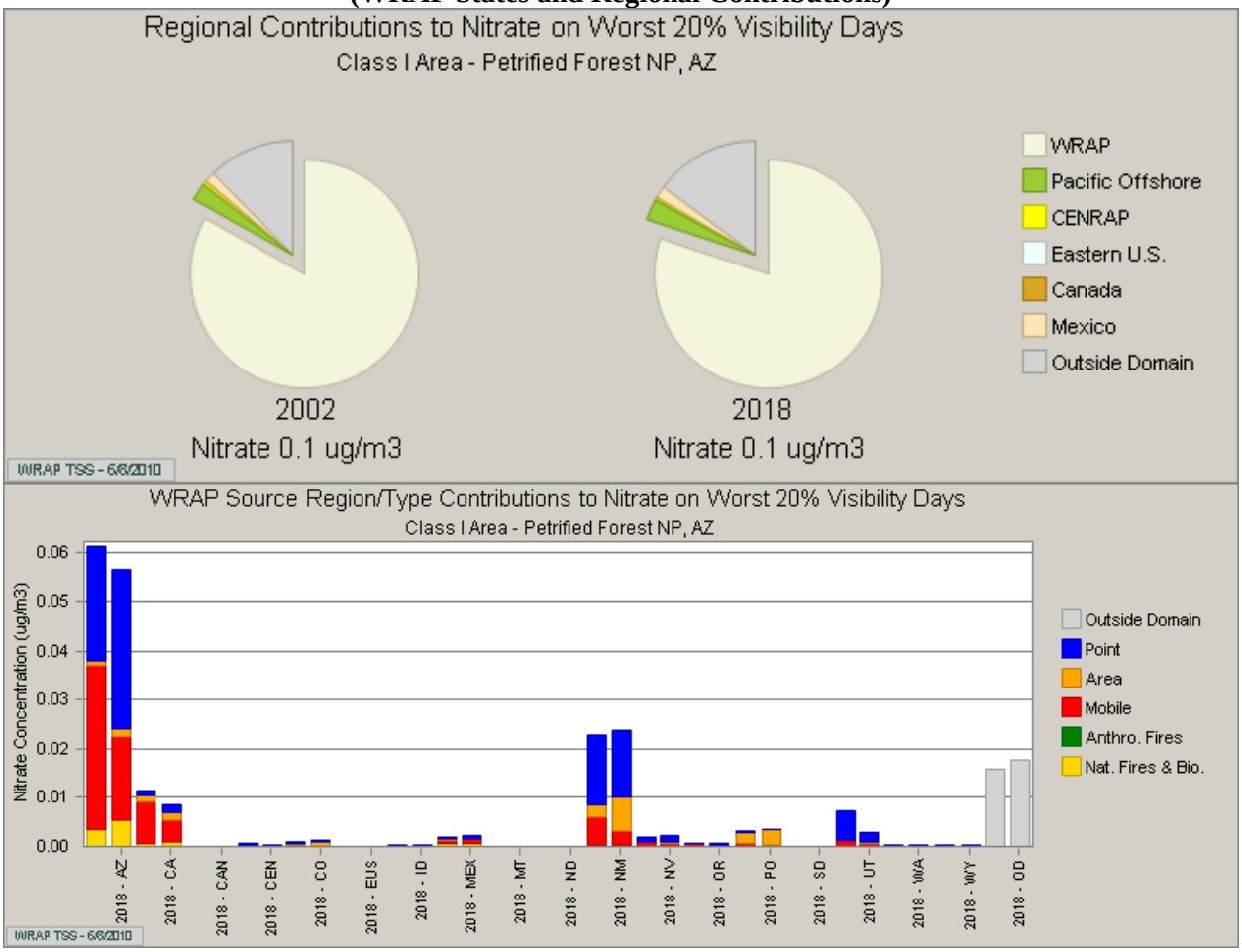


Nitrate

Figure 9.20 shows at Petrified Forest National Park, over three-quarters of nitrate concentrations are from WRAP States followed by the outside domain, Pacific offshore, and Mexico. Within each source category, concentrations are not projected to increase or decrease significantly by 2018.

Breaking down the nitrate contributions from WRAP States shows that Arizona is the highest contributor (Figure 9.20). The majority of nitrate concentrations are from point and mobile sources. Modeling shows that in 2018, nitrate from mobile sources will decrease; however, nitrate concentrations from point sources are projected to increase by 2018. The second highest contributor to nitrate is New Mexico, mostly from point sources.

Figure 9.20 – PSAT for Nitrate on 20% Worst Days at PEFO1
(WRAP States and Regional Contributions)



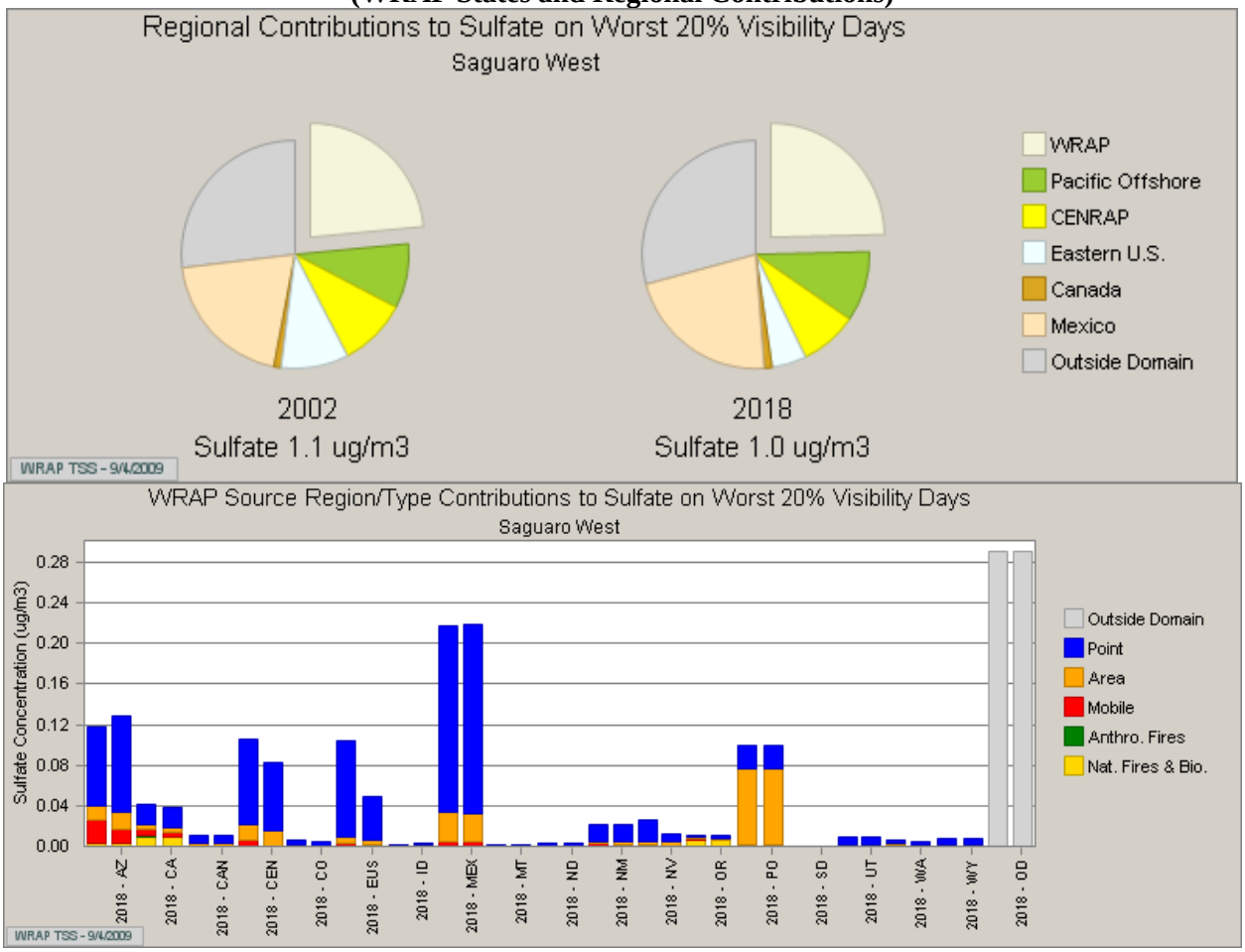
9.3.6 Saguaro National Park – West Unit

Sulfate

Source apportionment shows that WRAP States, outside domain, and Mexico each contribute approximately one-fourth of the total sulfate concentrations at the West Unit of Saguaro National Park (Figure 9.21). The regional contributions from each of these categories are expected to increase in 2018, although total concentrations are projected to decrease.

As shown in Figure 9.21, the primary regional contributor to sulfate is Mexico, followed by Arizona, and CENRAP States. Point sources from Mexico and Arizona show increasing concentrations by 2018. It is evident that point sources account for most of the sulfate concentrations from all contributors, except Pacific offshore. In the Pacific offshore category, most of the sulfates are from area sources.

Figure 9.21 – P SAT for Sulfate on 20% Worst Days at SAWE1
(WRAP States and Regional Contributions)

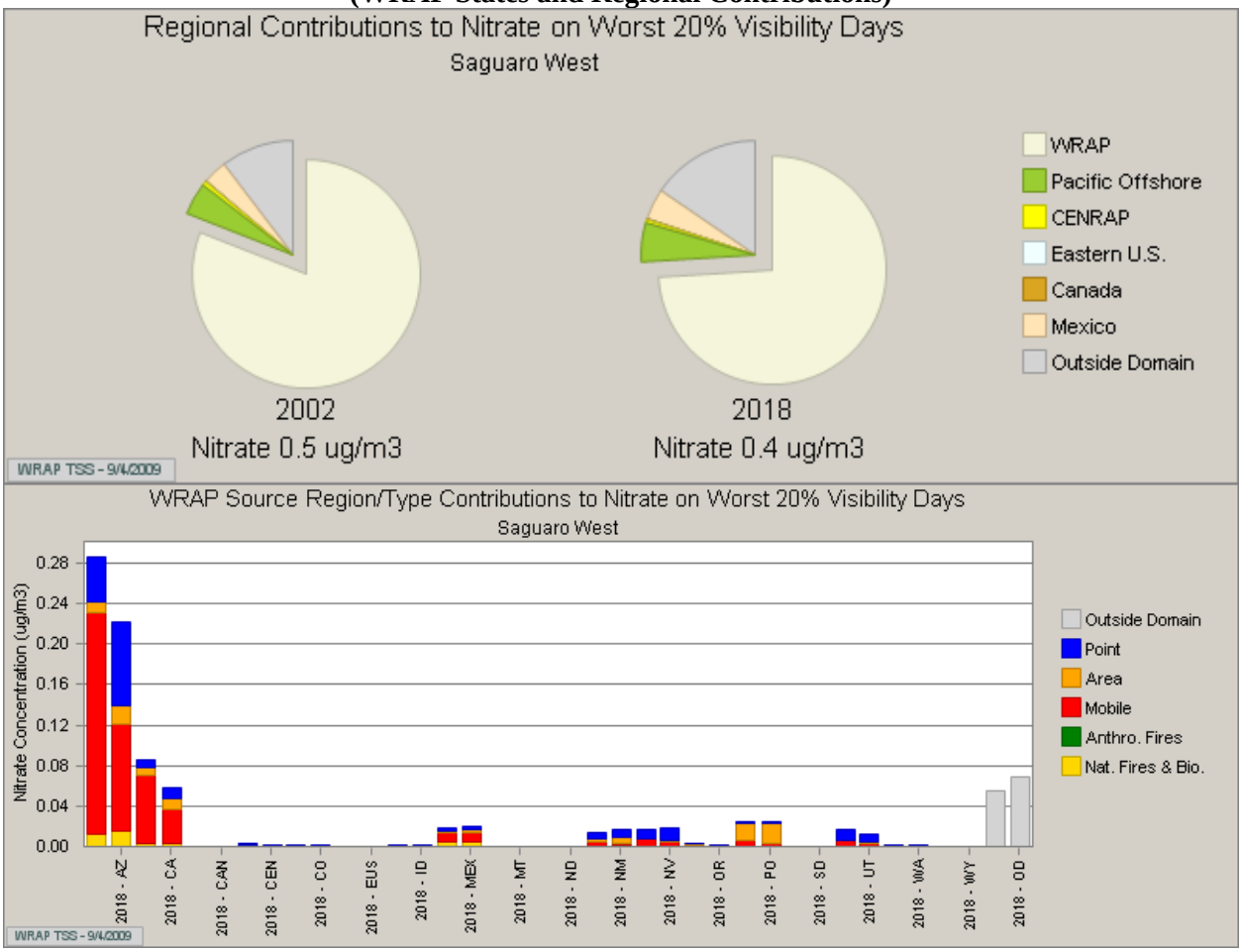


Nitrate

Figure 9.22 shows the regional contribution to nitrate at the West Unit of Saguaro National Park. On 20% worst days, the primary contributors are WRAP States. Regional contributions are projected to decrease in 2018.

Breaking down the contributions from WRAP State, Figure 9.22 shows that Arizona contributes the most to nitrate followed by California. Most of the concentrations are from mobile sources with a smaller amount from point sources. Nitrate from mobile sources is projected to decrease in 2018. It should be noted that nitrate concentrations from point sources in Arizona are projected to increase in 2018.

Figure 9.22 – PSAT Nitrate on 20% Worst Days at SAWE1
(WRAP States and Regional Contributions)



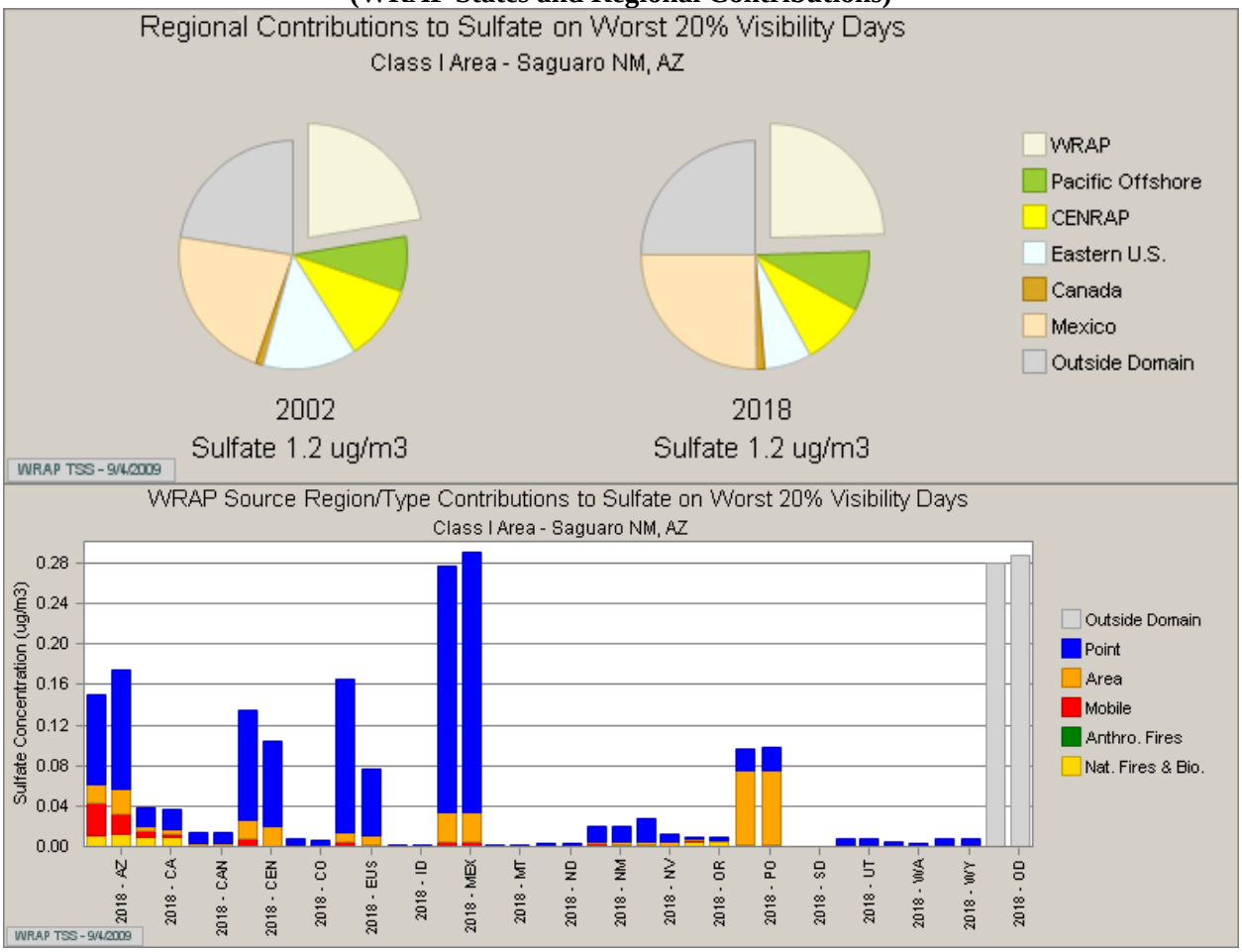
9.3.7 Saguaro National Park – East Unit

Sulfate

Figure 9.23 shows that approximately three-fourths of the sulfate concentrations at the East Unit come from WRAP States, Mexico, and outside domain sources. The overall concentrations of sulfate in 2018 are not projected to decrease.

The breakdown of sulfate from WRAP States and other regional contributors shows that Mexico is the primary contributor followed by Arizona, CENRAP States, and Eastern U.S. States (Figure 9.23). Sulfate is predominately from point sources, with a small amount from area sources within each regional contributor.

Figure 9.23 – PSAT Sulfate on 20% Worst Days at SAGU1
(WRAP States and Regional Contributions)

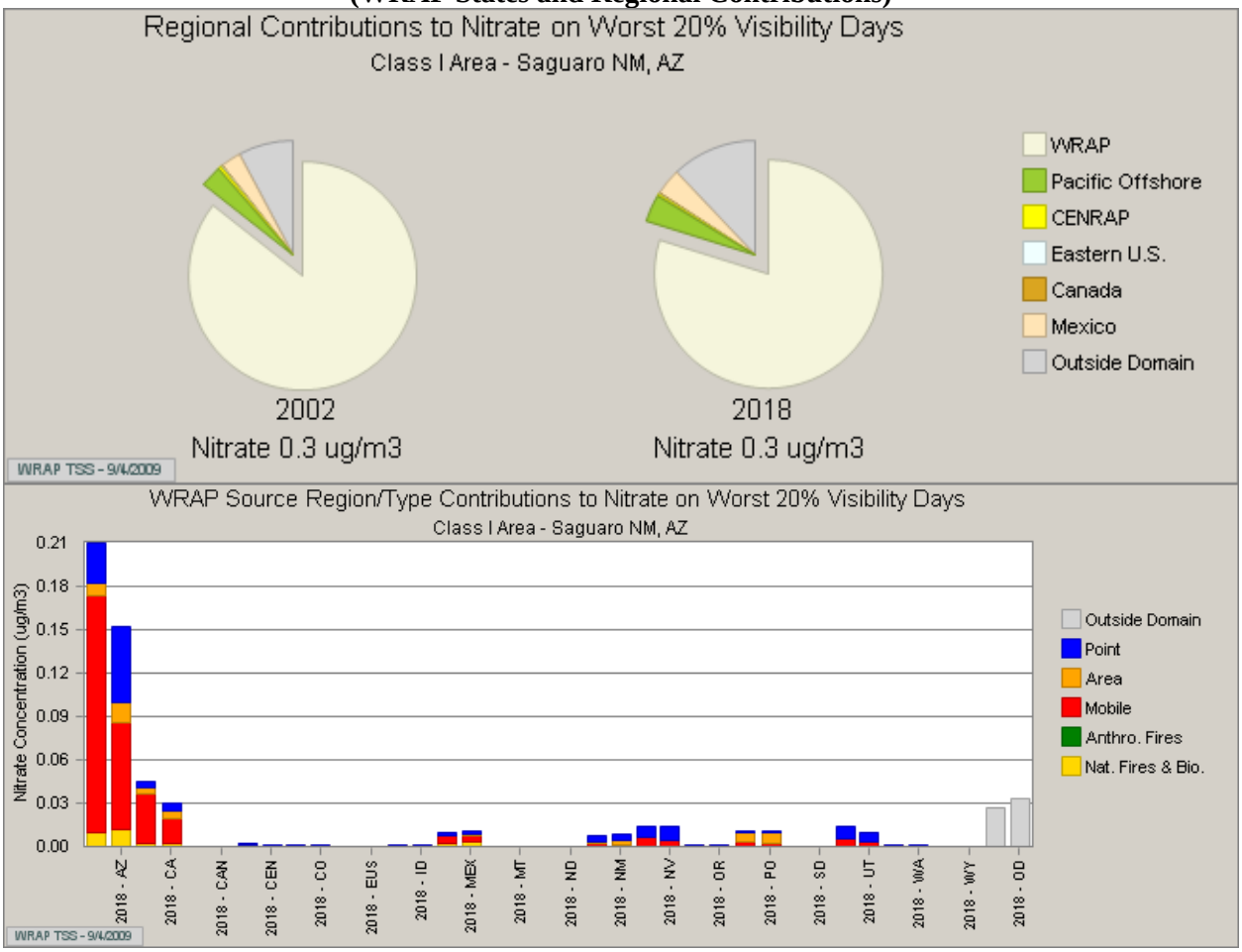


Nitrate

Similar to the West Unit, nitrate concentrations at the East Unit are predominately from WRAP States (Figure 9.24). Less than one-quarter of the remaining nitrate is from outside domain sources, Mexico, and Pacific Offshore.

Figure 9.24 shows that on 20% worst days, Arizona is the greatest contributor to nitrate concentrations. The majority of nitrate is from mobile sources, but nitrate from point sources is expected to increase by 2018. A small amount of nitrate is from California, mostly from mobile sources.

Figure 9.24 – PSAT Nitrate on 20% Worst Days at SAGU1
(WRAP States and Regional Contributions)



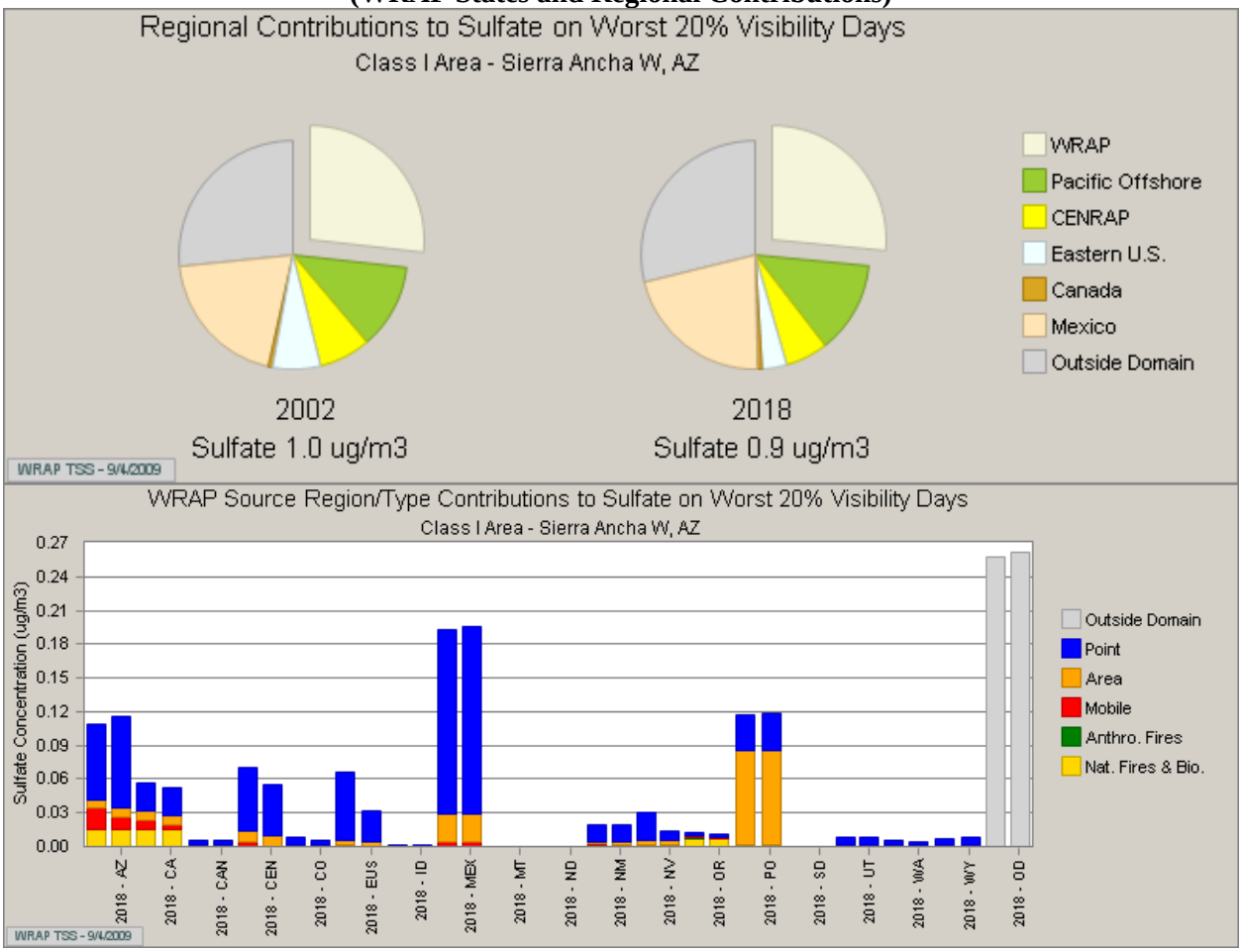
9.3.8 Sierra Ancha WA

Sulfate

On a regional level, Figure 9.25 shows that approximately one-fourth of sulfate comes from the WRAP region in both the baseline period and 2018. Another one-fourth is from the outside domain, which increases slightly in 2018. The remaining emissions are from Mexico, pacific offshore, CENRAP, eastern U.S. (EUS), and Canada.

The breakdown for WRAP States and other regional contributors in Figure 9.25 shows that the outside domain is the highest contributor to sulfate concentrations. The second highest contributor is Mexico, followed by pacific offshore. Concentrations from Mexico are predominately from point sources, with a smaller amount from area sources. Source types from pacific offshore are mostly area (about three-fourths) and approximately one-fourth from point sources. Arizona is the fourth highest contributor to sulfate concentrations. Mobile sources show decreasing concentrations in 2018, while point and area source concentrations are increasing.

Figure 9.25 – PSAT Sulfate on 20% Worst Days at SIAN1
(WRAP States and Regional Contributions)

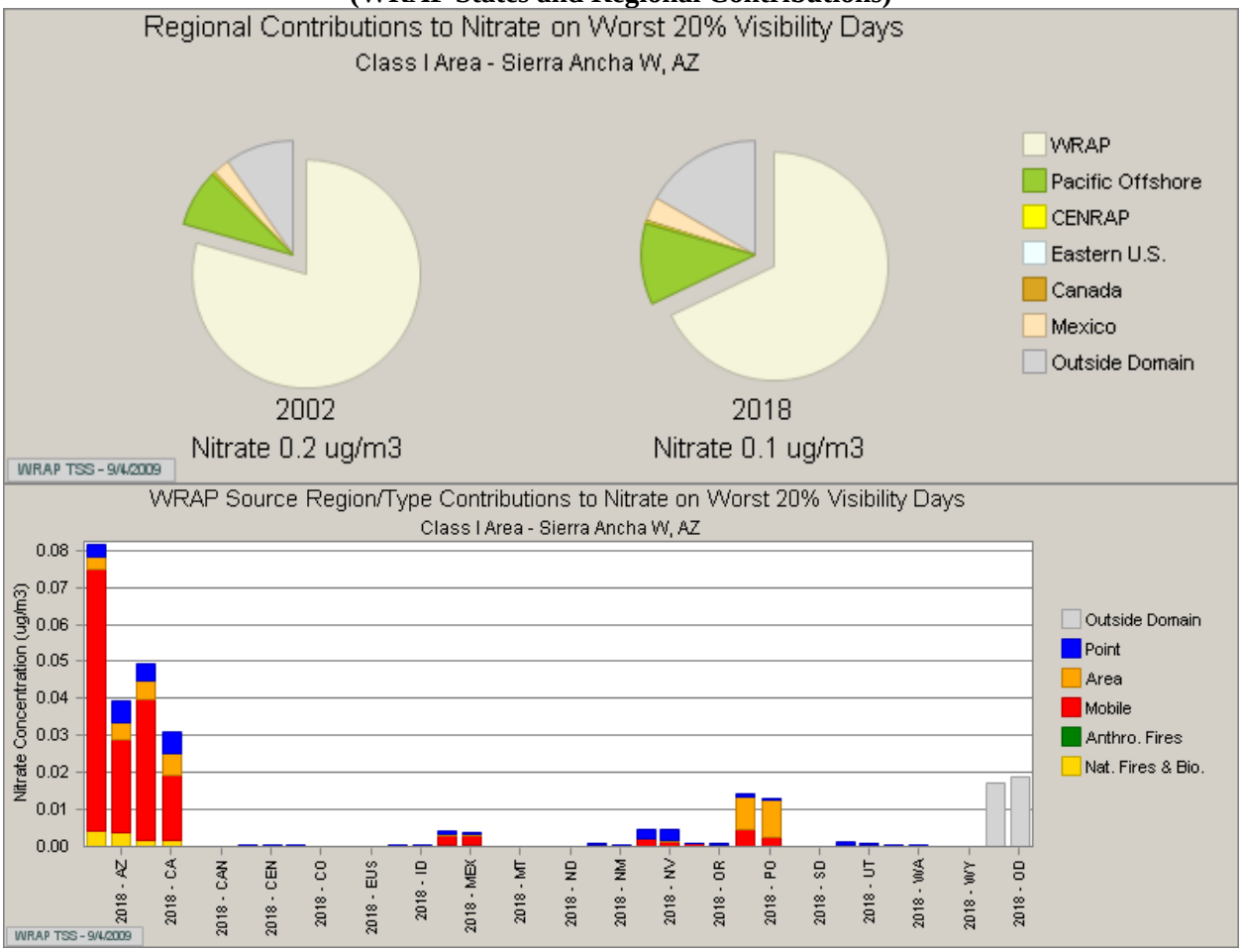


Nitrate

Almost two-thirds of emissions contributing to nitrate concentrations at Sierra Ancha in 2018 are from the WRAP region (Figure 9.26). The remaining major contributors are the outside domain, pacific offshore, and Mexico.

Looking at contributions by state/region, the primary contributor to nitrate concentrations is Arizona, followed by California. Figure 9.26 shows the primary source type from Arizona are mobile sources, with smaller concentrations from point, area, and natural fire/biogenic sources. Sources of nitrate from California are also mostly mobile with smaller amounts of nitrate from area and point sources.

Figure 9.26 – PSAT Nitrate on 20% Worst Days at SIAN1
(WRAP States and Regional Contributions)

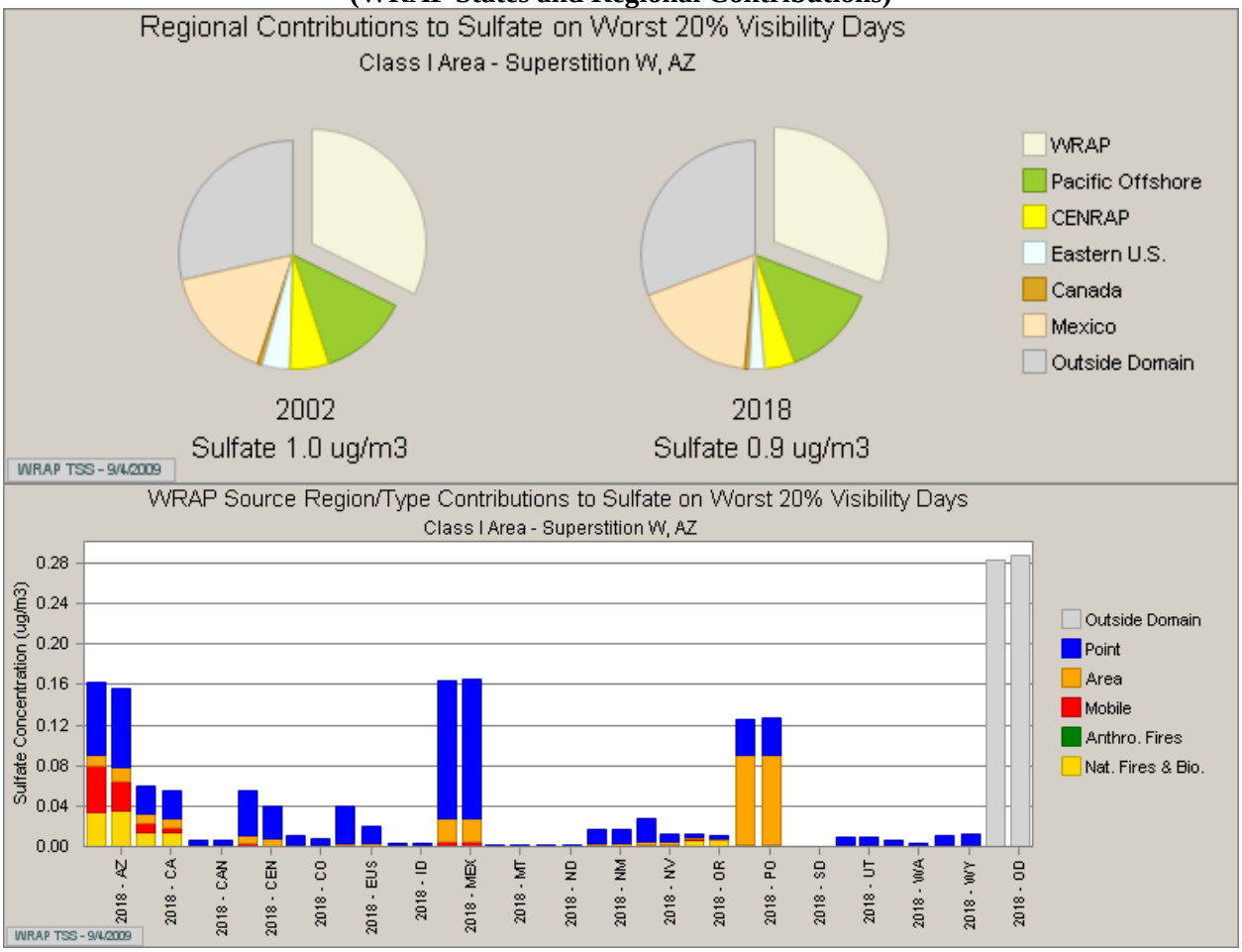


9.3.9 Superstition WA

Sulfate

Figure 9.27 shows that on a regional level, the highest concentrations are from outside domain followed by Mexico, Arizona, and Pacific offshore, which comprise about two-thirds of projected sulfate concentrations. Sulfate from Mexico is primarily from point sources. In Arizona, about one-half of the sulfates are from point sources with the remainder from area, mobile, and natural fire/biogenic sources.

Figure 9.27 – PSAT Sulfate on 20% Worst Days at TONT1
(WRAP States and Regional Contributions)

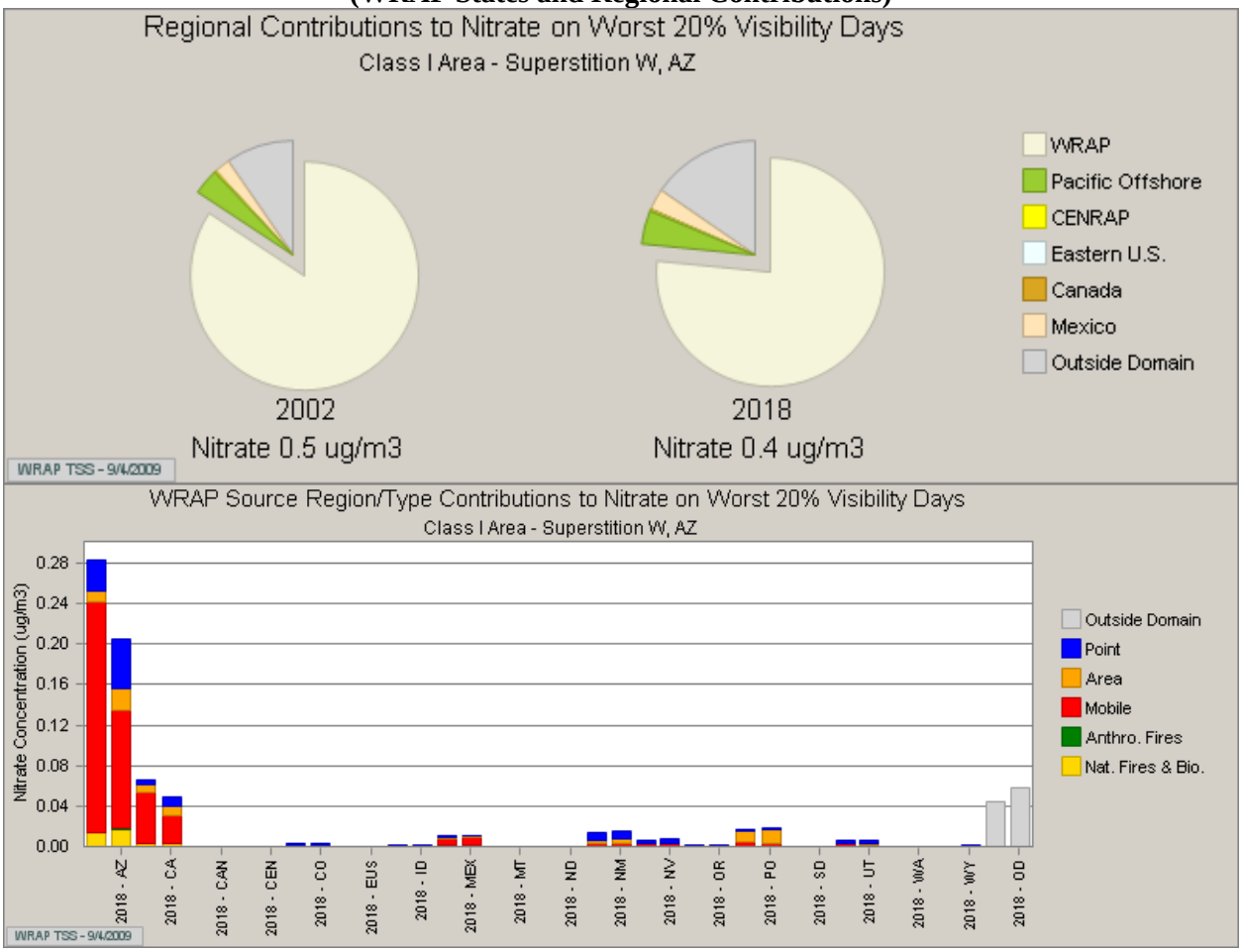


Nitrate

Figure 9.28 shows that about three-fourths of the nitrate concentrations at Superstition Wilderness Area are from the WRAP region. The next highest contributor is the outside domain with the remaining emissions from pacific offshore and Mexico.

Looking at contributions from WRAP States and other regional sources (Figure 9.28), the three highest contributors to nitrates are Arizona, outside domain, and California. The remaining half is from point, natural fire/biogenics, and area sources.

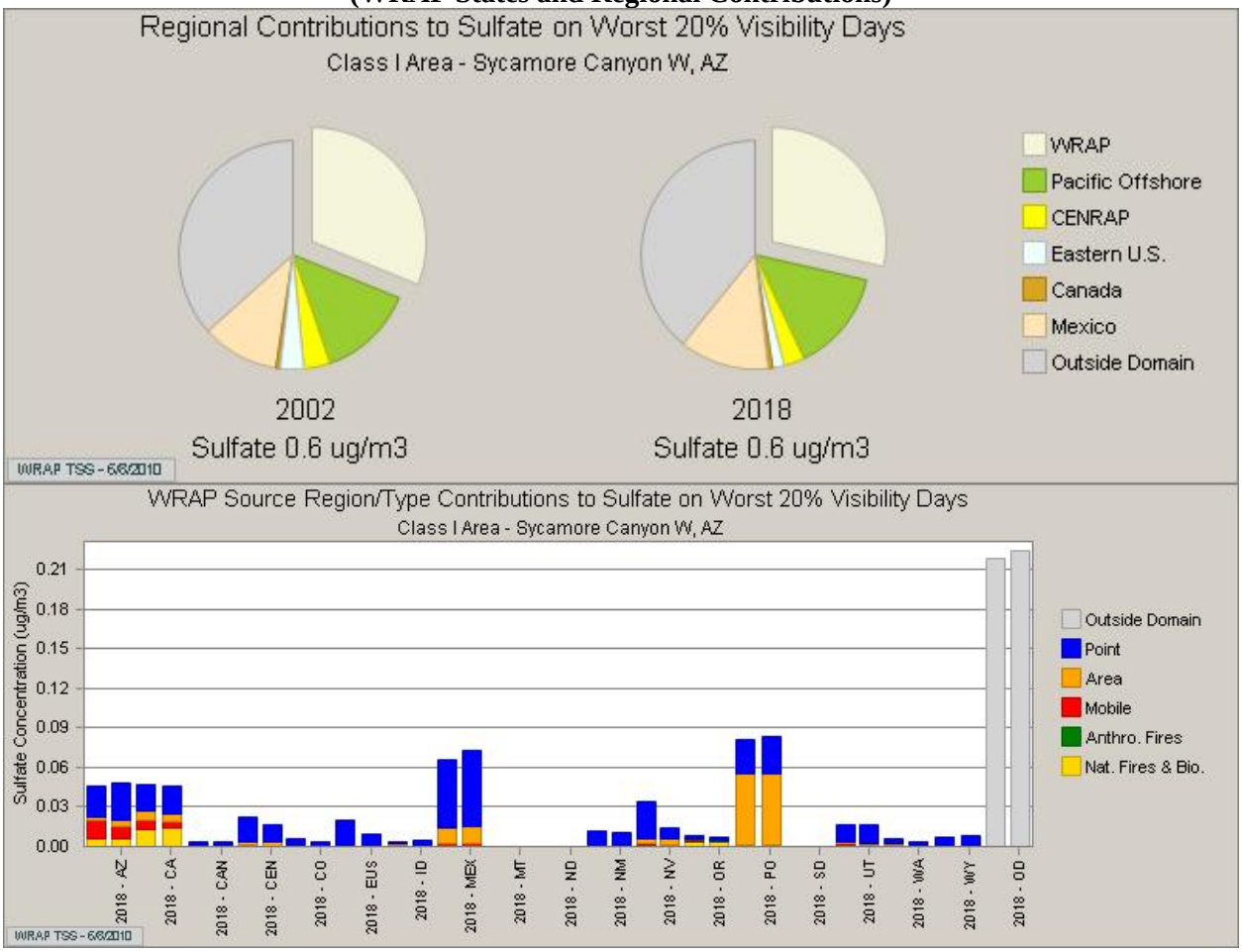
Figure 9.28 – PSAT Nitrate on 20% Worst Days at TONT1
(WRAP States and Regional Contributions)



9.3.10 Sycamore Canyon Wilderness

Figure 9.29 shows that the region contributing to approximately one-third of sulfate concentrations at Sycamore Canyon Wilderness is the outside domain. This category is undifferentiated and source types cannot be determined. WRAP States contribute about one-quarter of sulfate, with most of the concentrations coming from point sources in Arizona and California. Mexico and Pacific offshore also contribute to sulfate concentrations, mostly from point sources and area sources, respectively.

Figure 9.29 – PSAT Sulfate on 20% Worst Days at SYCA1
(WRAP States and Regional Contributions)

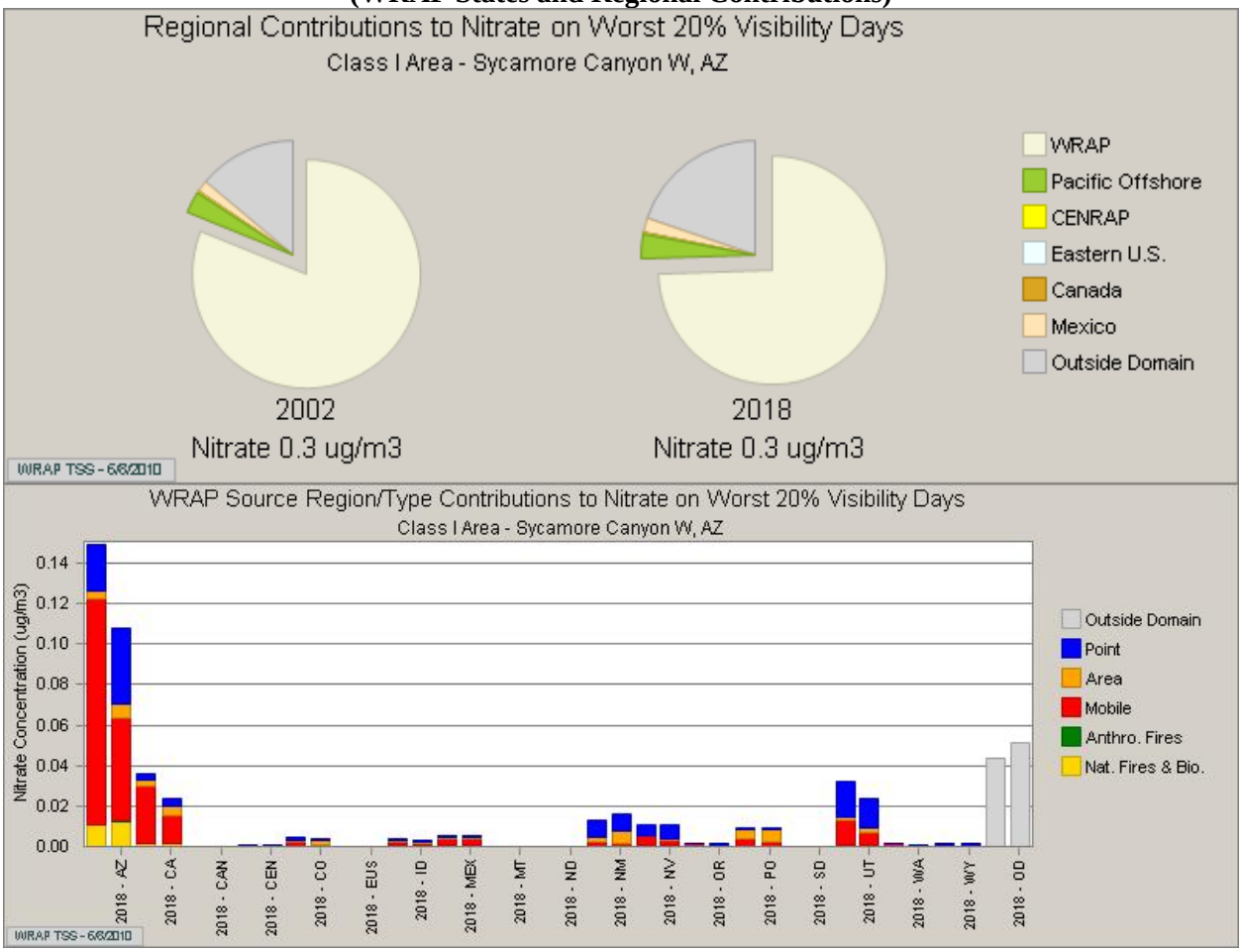


Nitrate

PSAT modeling shows that in 2018, the WRAP States will contribute three-quarters of nitrate concentrations at Sycamore Canyon Wilderness (Figure 9.30). The outside domain is the second highest contributor, this category is undifferentiated and source types cannot be determined.

Of the WRAP State, Arizona contributes the most nitrates at Sycamore. These emissions are primarily from mobile sources, with a smaller amount from point sources.

Figure 9.30 – PSAT Nitrate on 20% Worst Days at SYCA1
(WRAP States and Regional Contributions)



9.4 Summary of WEP Results

Organic carbon (primary organic aerosol), elemental carbon, fine soil, and coarse mass were analyzed using the Weighted Emissions Potential (WEP) tool. The WEP analysis 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 baseline and 2018 emissions inventories. Unlike the SOx/NOx Tracer analysis, this method does not account for chemistry and removal processes. Instead, the WEP analysis relies on an integration of gridded emissions data, meteorological 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 analysis as one piece of a larger, more comprehensive weight of evidence analysis.

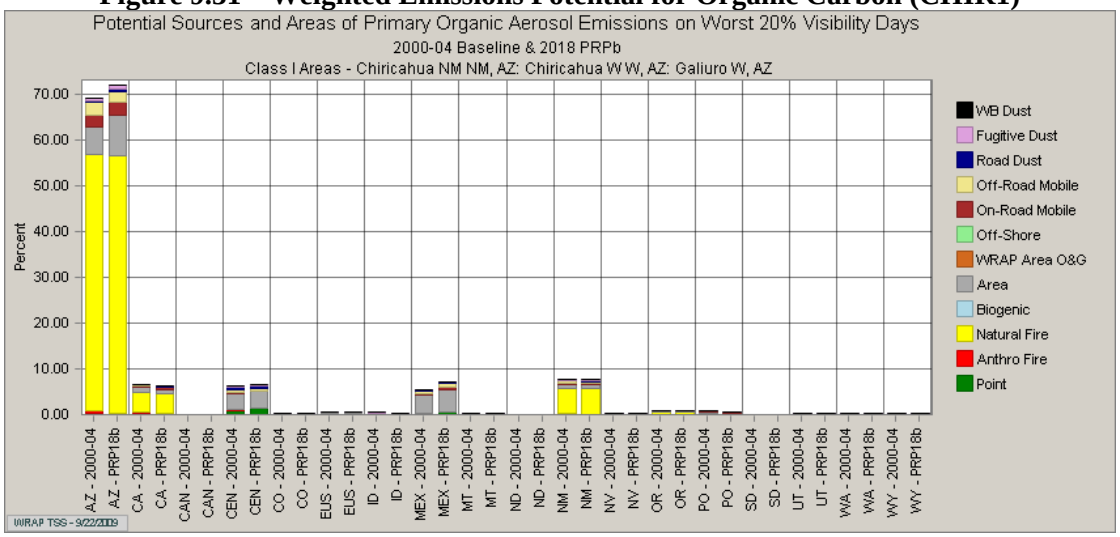
The WEP bar charts display normalized (unitless), residence time- and distance-weighted annual emissions value, by emissions source region. These WEP results are reminiscent of the SOx/NOx Tracer tool results. However, the WEP results are considered less rigorous and should be used only as a screening tool to identify regions with the potential to impact Class I areas. The bar chart presents results for the Baseline and 2018 PRPb emissions scenarios. Note that a reported change in regional percent contribution between two scenarios does not necessarily imply a larger or smaller impact on haze formation.

9.4.1 Chiricahua NM, Chiricahua WA, and Galiuro WA

Organic Carbon

Figure 9.31 shows that Arizona has the highest potential to contribute to organic carbon emissions. The source category with the greatest potential to contribute is natural fire. The other categories include area, on-road mobile, and off-road mobile sources.

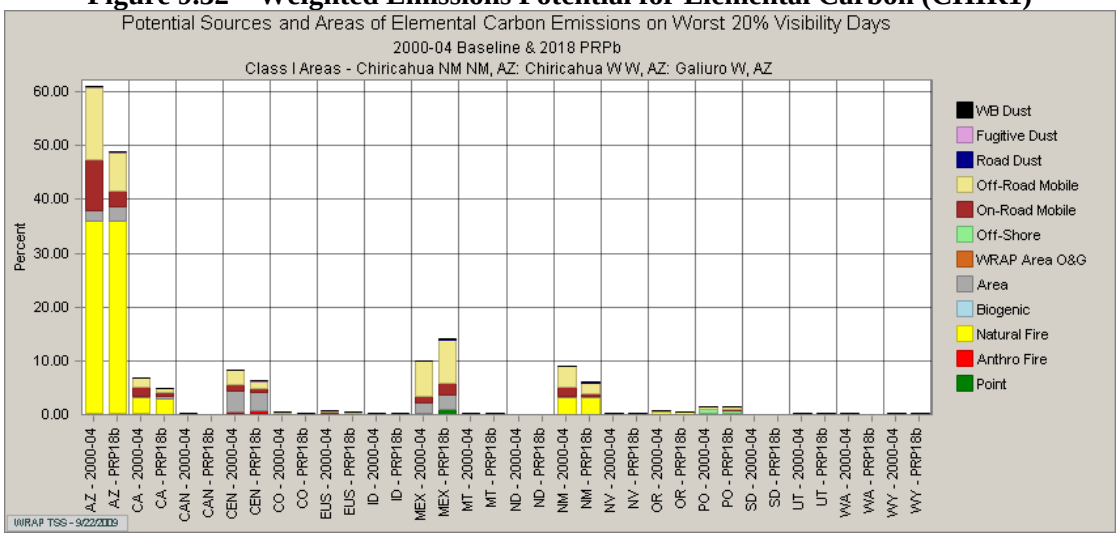
Figure 9.31 – Weighted Emissions Potential for Organic Carbon (CHIR1)



Elemental Carbon

As shown in Figure 9.32, Arizona has the greatest potential to contribute to elemental carbon. The primary source is natural fire, followed by off-road mobile sources. Elemental carbon from on-road mobile sources is expected to decrease by 2018.

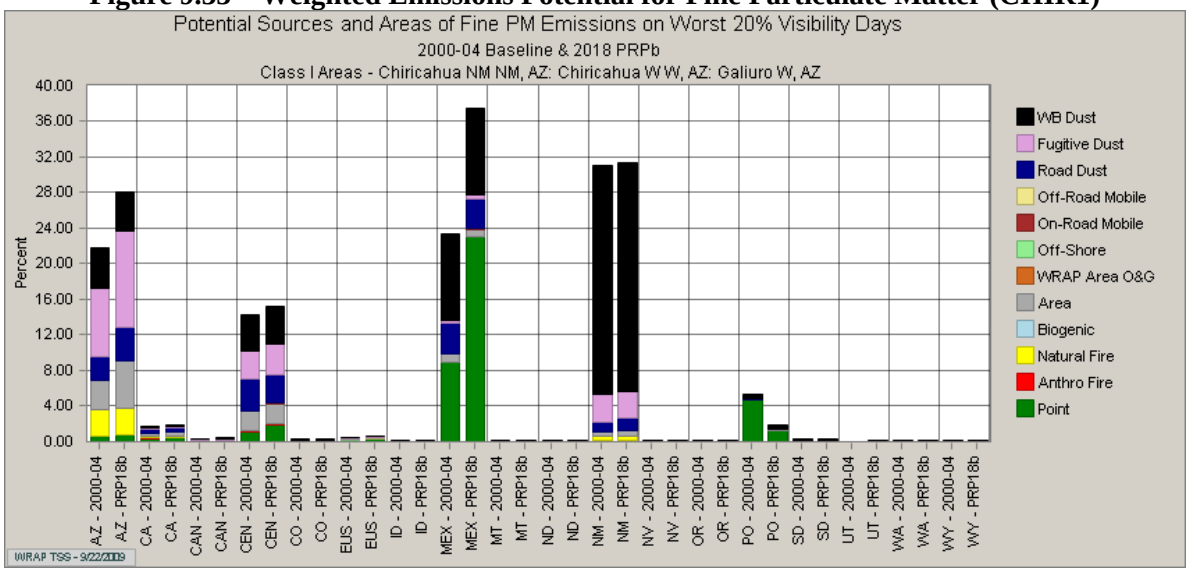
Figure 9.32 – Weighted Emissions Potential for Elemental Carbon (CHIR1)



Fine Particulate Matter

Sources of fine particulate matter from Mexico and New Mexico have the greatest potential to contribute on 20% worst days (Figure 9.33). The potential for fine PM from Mexico is expected to increase in 2018. The source categories in Mexico with the greatest potential to contribute are point and windblown dust. New Mexico also has a high potential to contribute to fine PM, mostly from windblown dust. Fine PM from Arizona also has a high potential to contribute from sources of fugitive dust, road dust, windblown dust, and area sources.

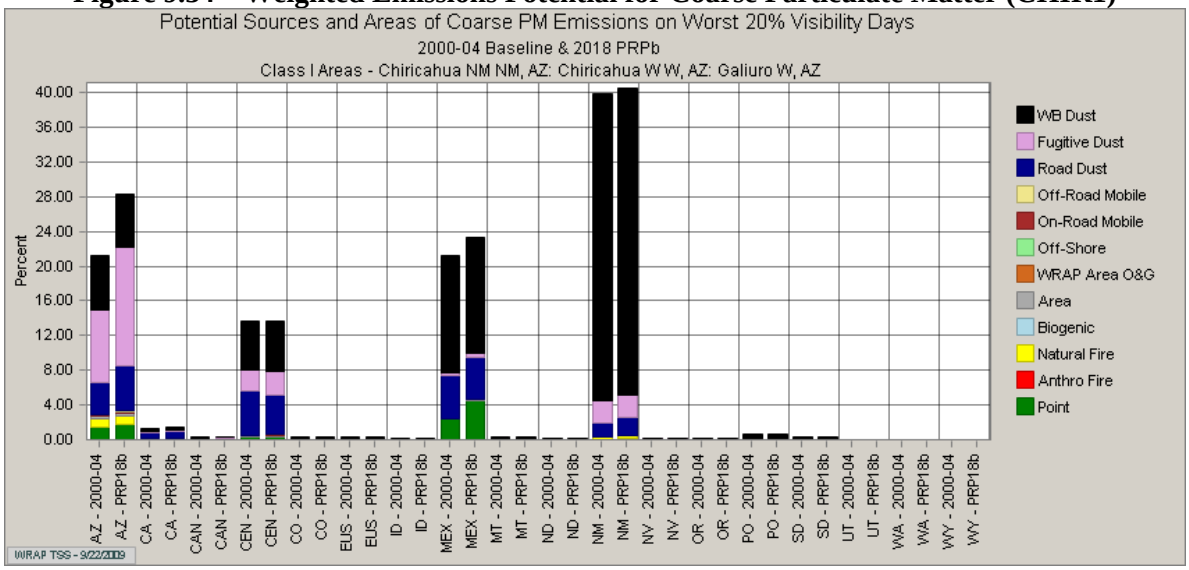
Figure 9.33 – Weighted Emissions Potential for Fine Particulate Matter (CHIR1)



Coarse Particulate Matter

Figure 9.34 shows that windblown dust from New Mexico has the greatest potential to contribute to coarse mass. Arizona sources of windblown dust, fugitive dust, and road dust also have a high potential to affect visibility.

Figure 9.34 – Weighted Emissions Potential for Coarse Particulate Matter (CHIR1)

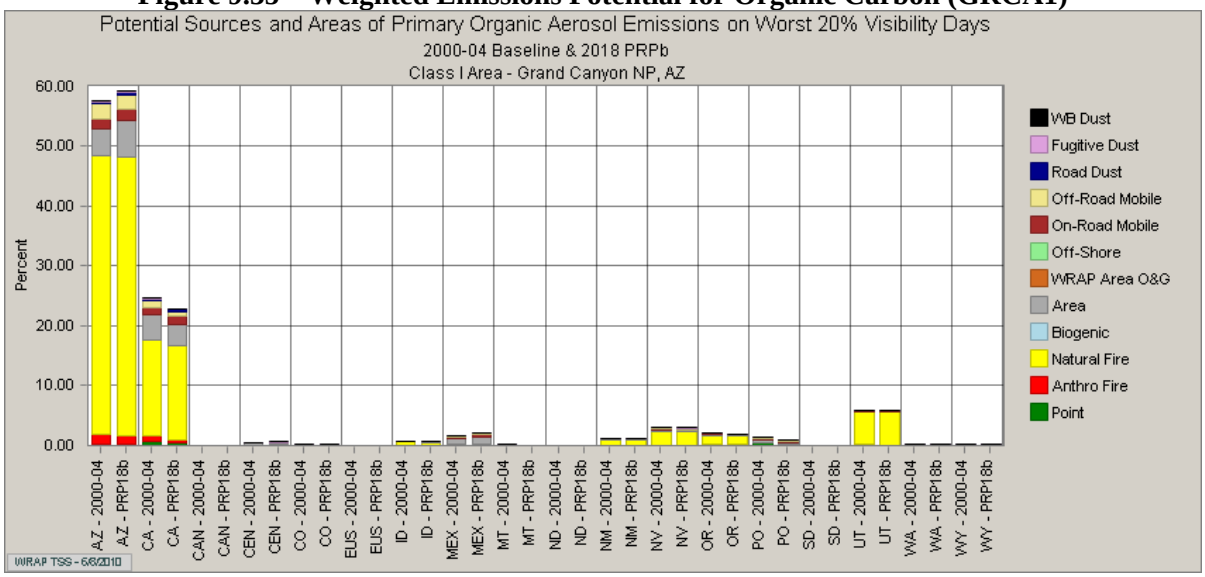


9.4.2 Grand Canyon NP

Organic Carbon

Arizona sources have the highest potential to contribute to emissions of organic carbon at Grand Canyon National Park (Figure 9.35). Modeling shows that most of the emissions are from natural fire and a small amount from area sources.

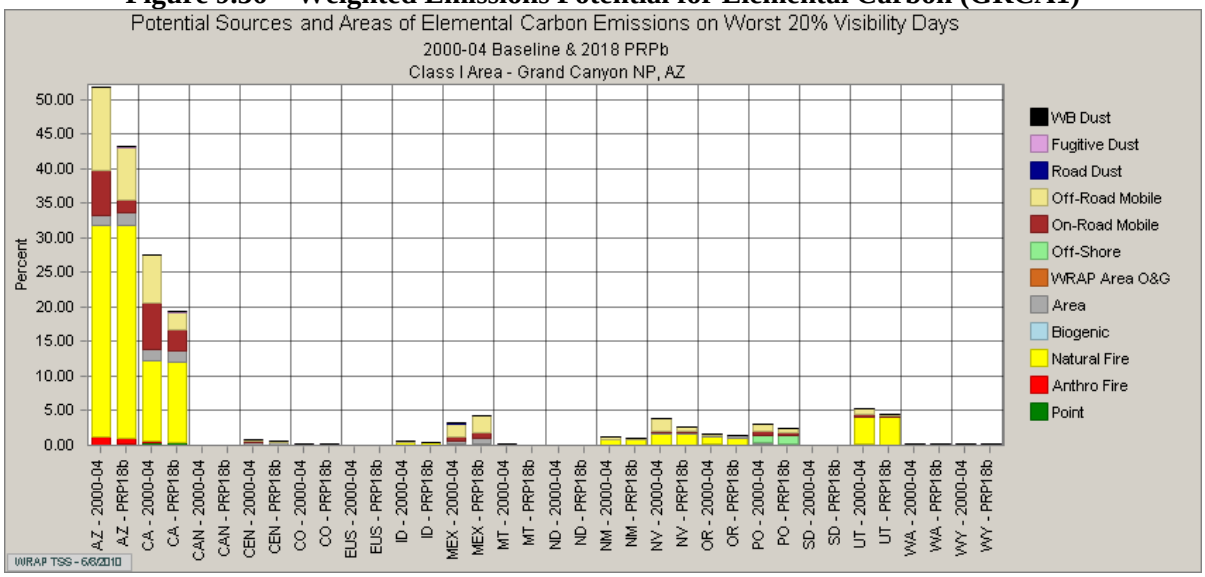
Figure 9.35 – Weighted Emissions Potential for Organic Carbon (GRCA1)



Elemental Carbon

As shown in Figure 9.36, Arizona has the greatest potential to contribute to elemental carbon emissions on worst visibility days. The primary source category is natural fire with a smaller potential from area, off-road mobile, and on-road mobile sources.

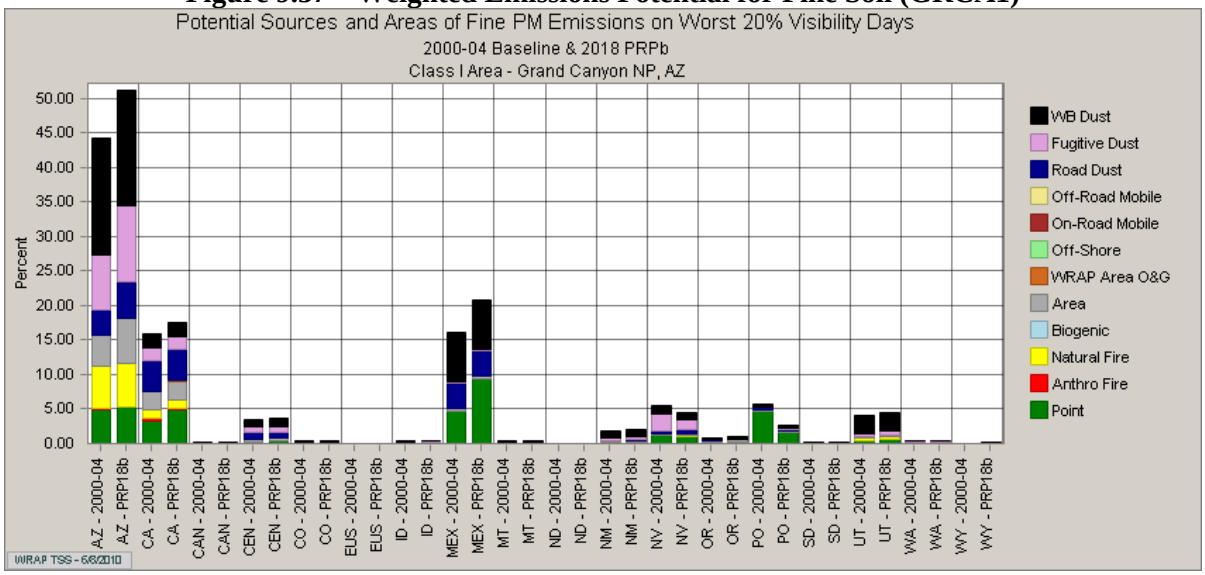
Figure 9.36 – Weighted Emissions Potential for Elemental Carbon (GRCA1)



Fine Soil

The WEP analysis for fine soil shows that Arizona sources have the highest potential to contribute to emissions. The primary source types are windblown dust, fugitive dust, and road dust (Figure 9.37).

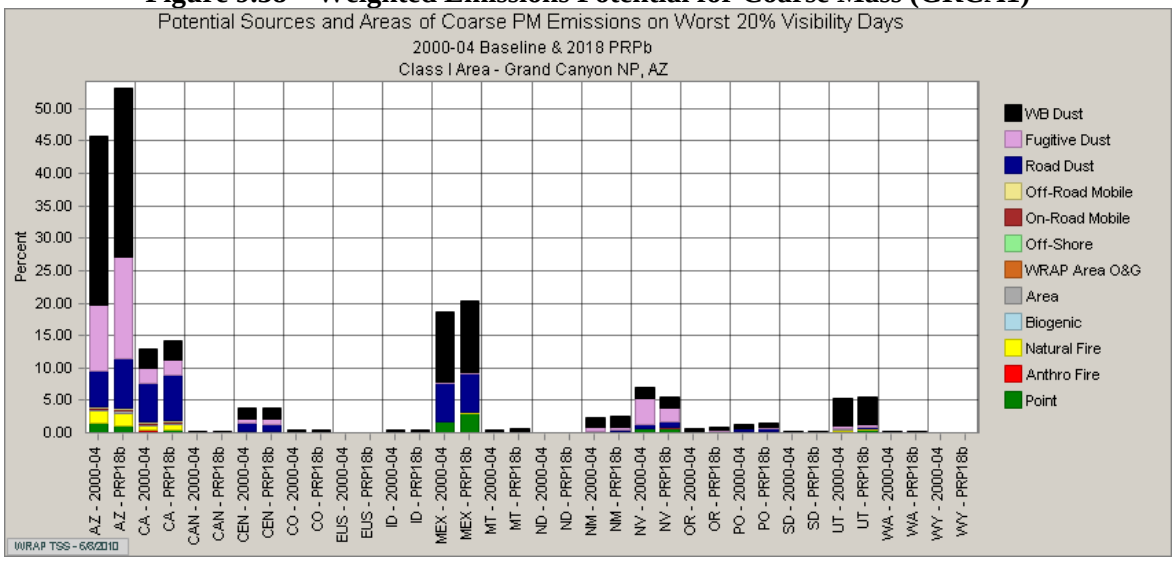
Figure 9.37 – Weighted Emissions Potential for Fine Soil (GRCA1)



Coarse Mass

Figure 9.38 shows that Arizona has the highest potential to contribute to coarse mass at Grand Canyon National Park. These emissions are predominantly from windblown dust, fugitive dust, and road dust. Emissions of windblown dust and road dust from Mexico also have the potential to affect visibility.

Figure 9.38 – Weighted Emissions Potential for Coarse Mass (GRCA1)

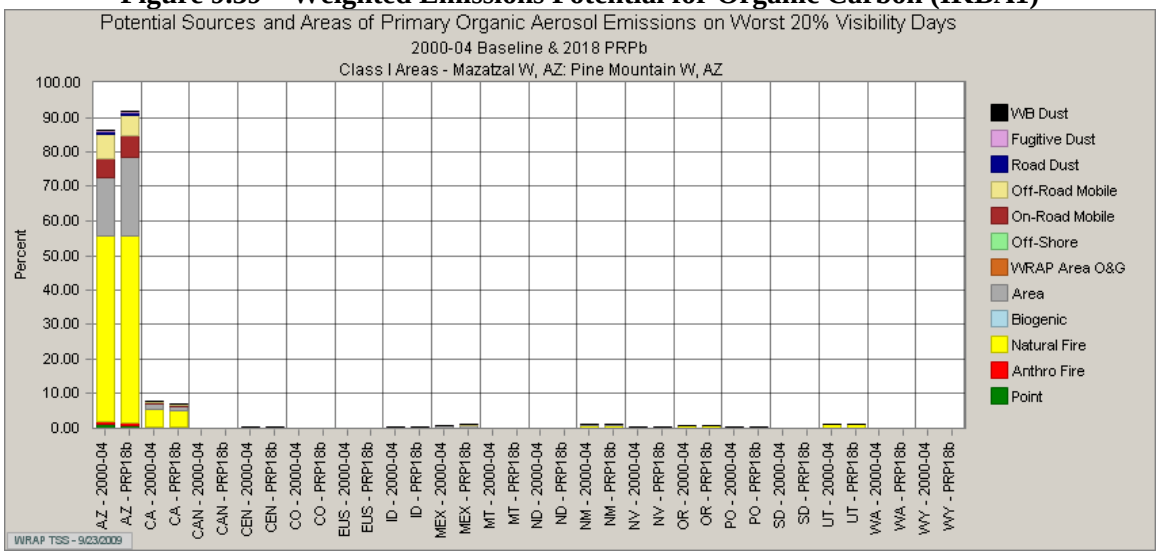


9.4.3 Mazatzal WA and Pine Mountain WA

Organic Carbon

Arizona has the greatest potential to contribute to organic carbon emissions (Figure 9.39). The source category with the greatest potential to contribute is natural fire. Other contributing categories include area, on-road mobile, and off-road mobile sources. Potential emissions from area sources are projected to increase in 2018.

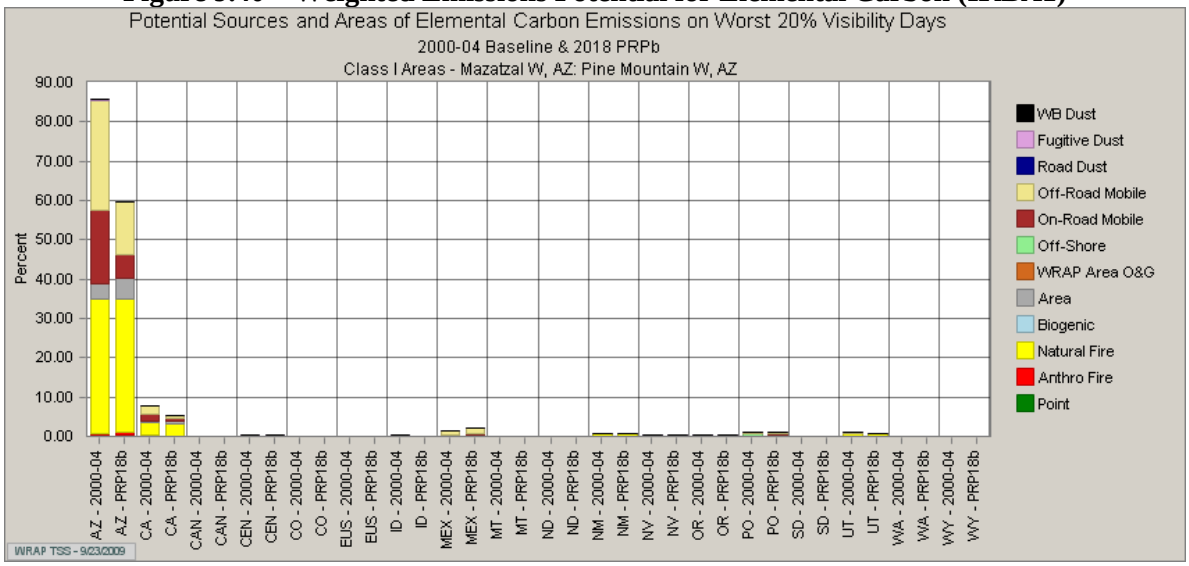
Figure 9.39 – Weighted Emissions Potential for Organic Carbon (IKBA1)



Elemental Carbon

Arizona has the greatest potential to contribute to elemental carbon emissions, mostly from natural fire (Figure 9.40). The remaining potential emissions are from off-road mobile sources, on-road mobile, and area. The overall potential elemental carbon emissions from Arizona are projected to decrease in 2018, mostly from on and off-road mobile sources.

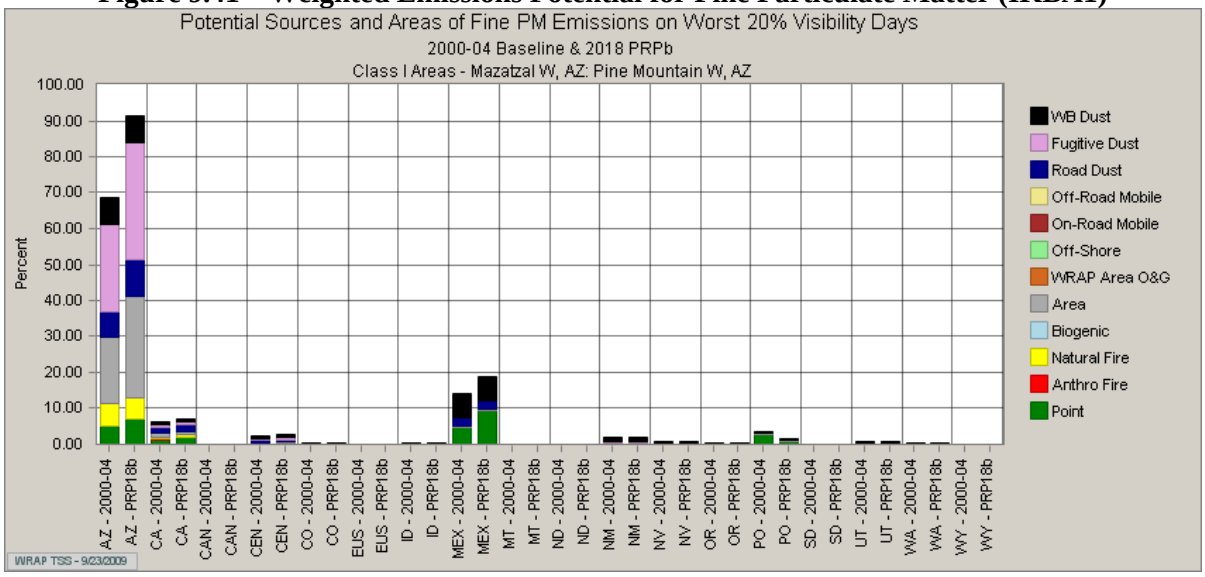
Figure 9.40 – Weighted Emissions Potential for Elemental Carbon (IKBA1)



Fine Particulate Matter

As shown in Figure 9.41, Arizona has the highest potential to contribute to fine soil emissions, primarily from fugitive dust and area sources. Mexico has a small potential to contribute to fine particulate matter at Mazatzal and Pine Mountain Wilderness Areas, mainly from point sources and windblown dust.

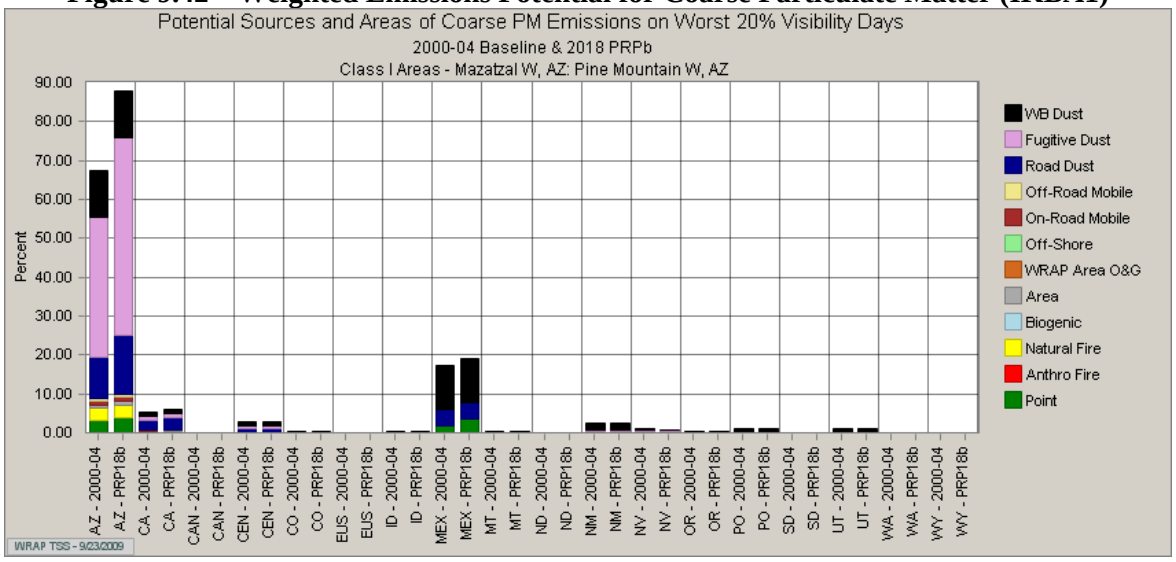
Figure 9.41 – Weighted Emissions Potential for Fine Particulate Matter (IKBA1)



Coarse Particulate Matter

On 20% worst days, Arizona has the greatest potential to contribute to coarse mass at the Mazatzal and Pine Mountain Wilderness Areas (Figure 9.42). The primary source type is fugitive dust, followed by road dust and windblown dust. Mexico has a small potential to contribute to coarse mass emissions from windblown dust.

Figure 9.42 – Weighted Emissions Potential for Coarse Particulate Matter (IKBA1)

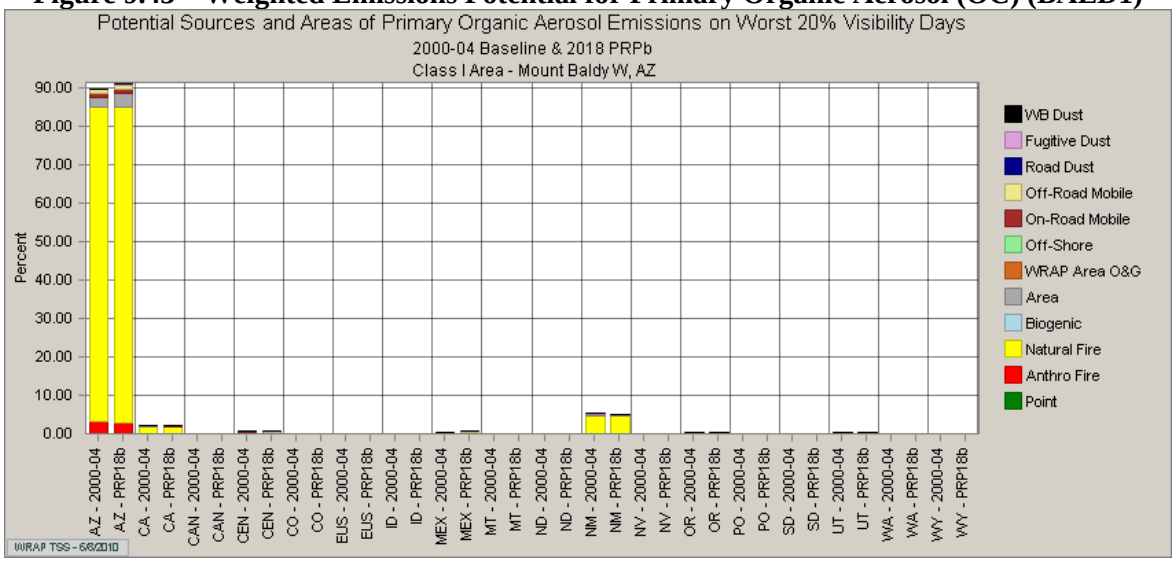


9.4.4 Mount Baldy WA

Organic Carbon

On 20% worst visibility days, sources of natural fire in Arizona have the highest potential to contribute to organic carbon at Mount Baldy (Figure 9.43).

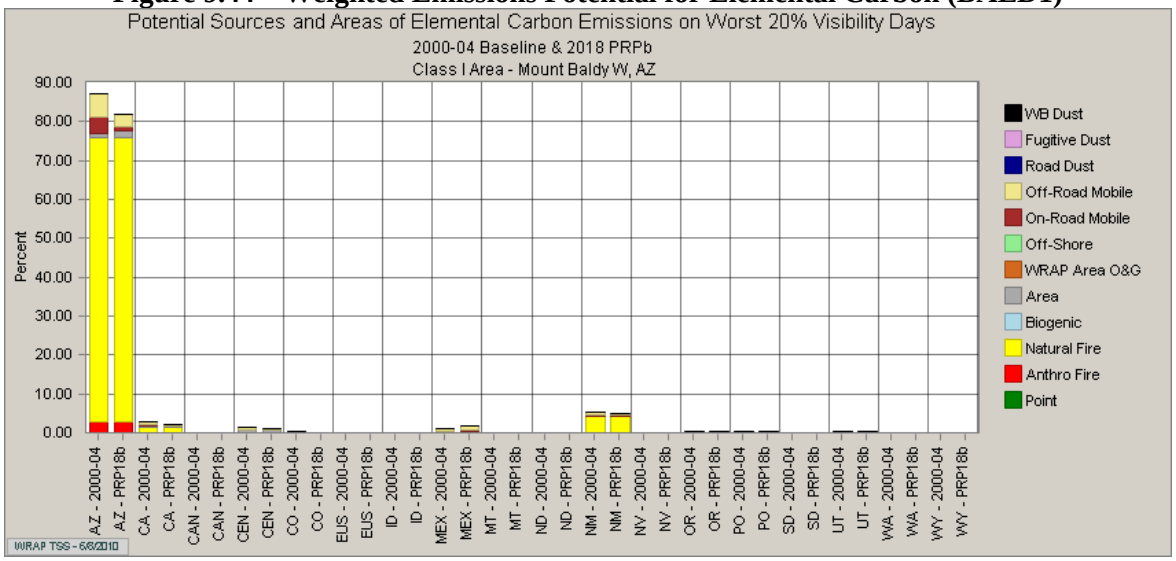
Figure 9.43 – Weighted Emissions Potential for Primary Organic Aerosol (OC) (BALD1)



Elemental Carbon

Arizona has the greatest potential to contribute to elemental carbon in 2018 on 20% worst visibility days (Figure 9.44). The emissions are predominately from sources of natural fire.

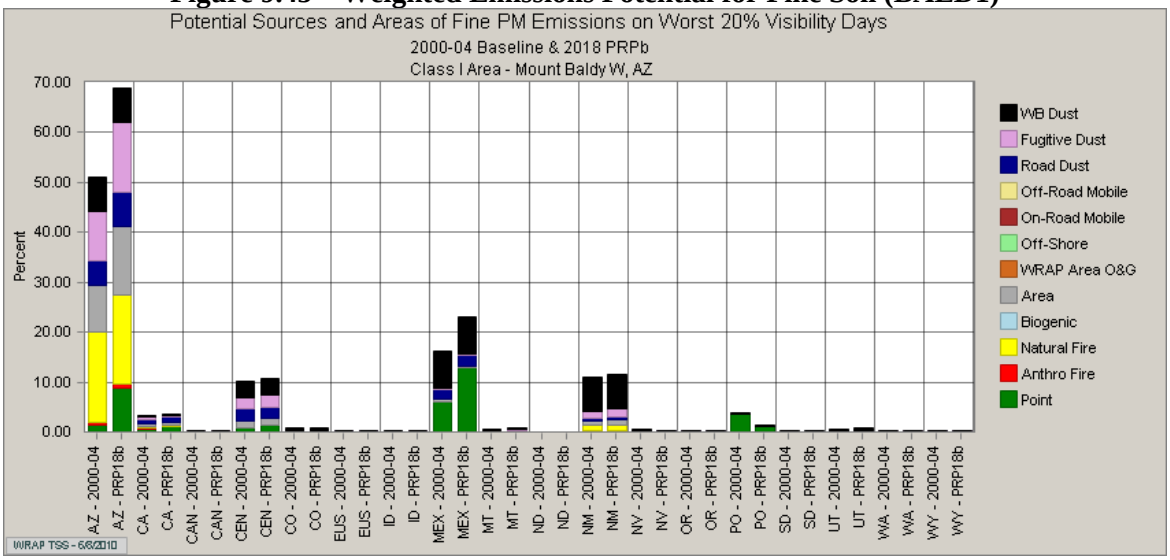
Figure 9.44 – Weighted Emissions Potential for Elemental Carbon (BALD1)



Fine Soil

On 20% worst visibility days Arizona has the highest potential to contribute to fine PM at Mount Baldy (Figure 9.45). Both point sources and windblown dust from Mexico have a small potential to contribute to fine PM. Modeling for 2018 shows an increase in the potential for fine PM to affect Mount Baldy.

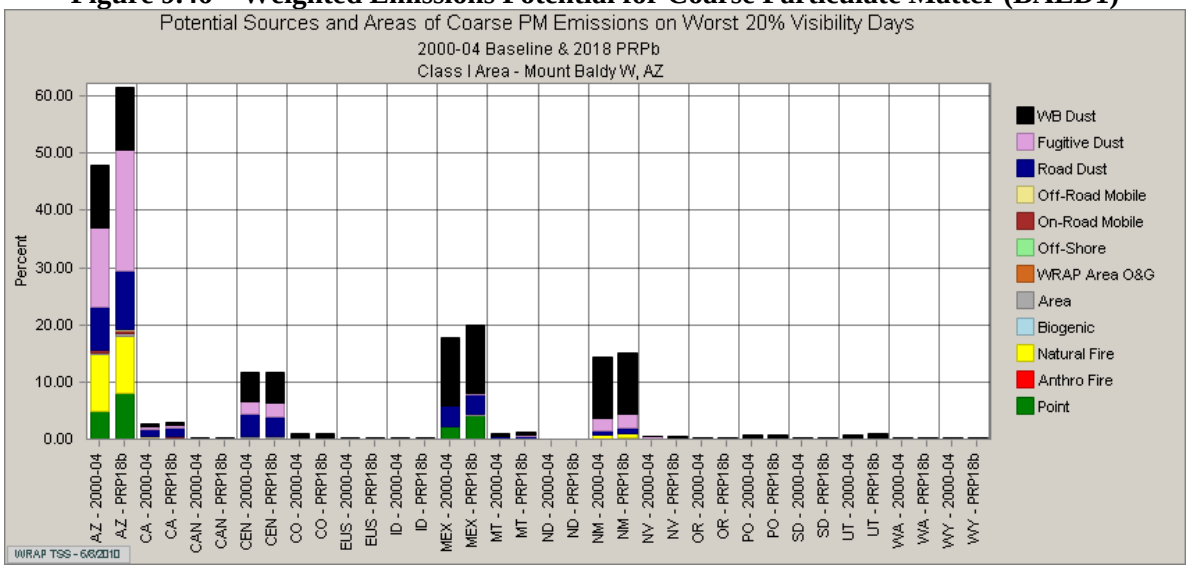
Figure 9.45 – Weighted Emissions Potential for Fine Soil (BALD1)



Coarse Mass

Sources of windblown dust, fugitive dust, road dust, and natural fire from Arizona have the highest potential to contribute to coarse mass at Mount Baldy (Figure 9.46). Mexican point sources, road dust, and windblown dust have a small potential to contribute to coarse mass. Windblown dust from New Mexico also has the potential to affect Mount Baldy.

Figure 9.46 – Weighted Emissions Potential for Coarse Particulate Matter (BALD1)

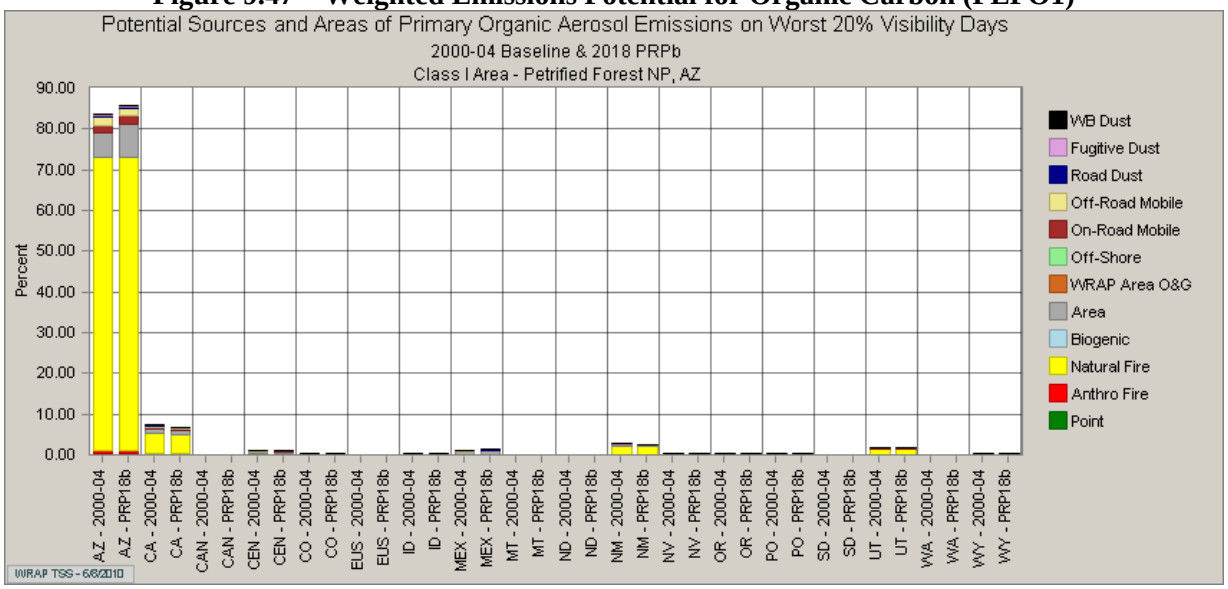


9.4.5 Petrified Forest NP

Organic Carbon

Arizona sources have the highest potential to contribute to emissions of organic carbon at Petrified Forest National Park (Figure 9.47). Modeling shows that most of the emissions are from natural fire and a small amount from area sources.

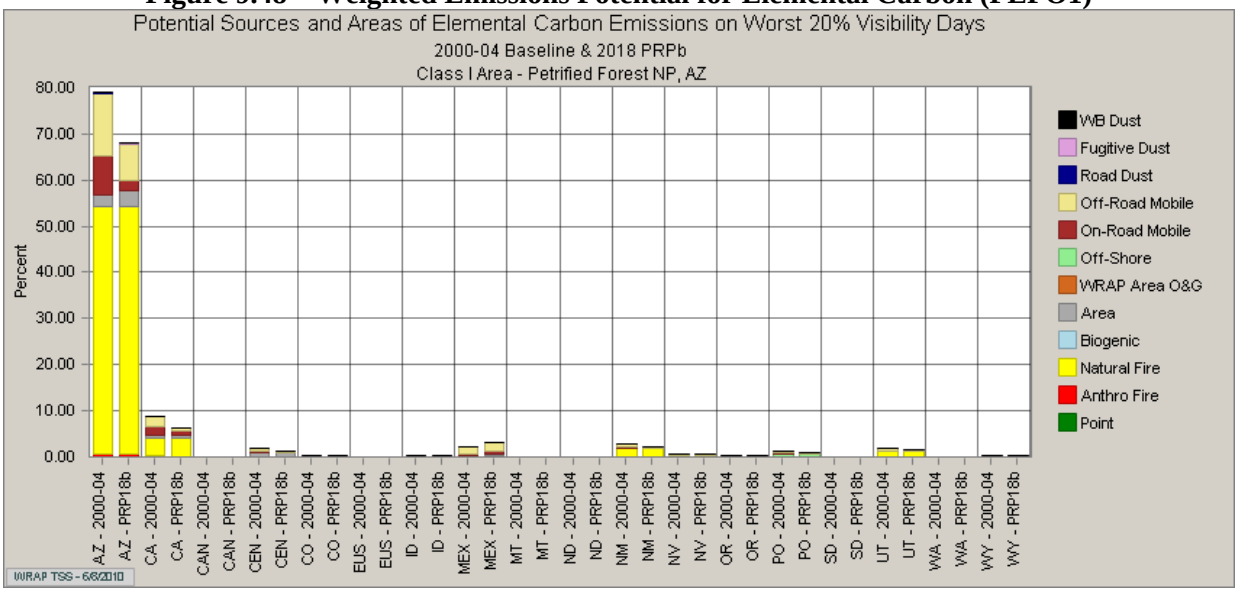
Figure 9.47 – Weighted Emissions Potential for Organic Carbon (PEFO1)



Elemental Carbon

Figure 9.48 shows that Arizona sources have the greatest potential to contribute to elemental carbon at Petrified Forest National Park. The primary source type is natural fire.

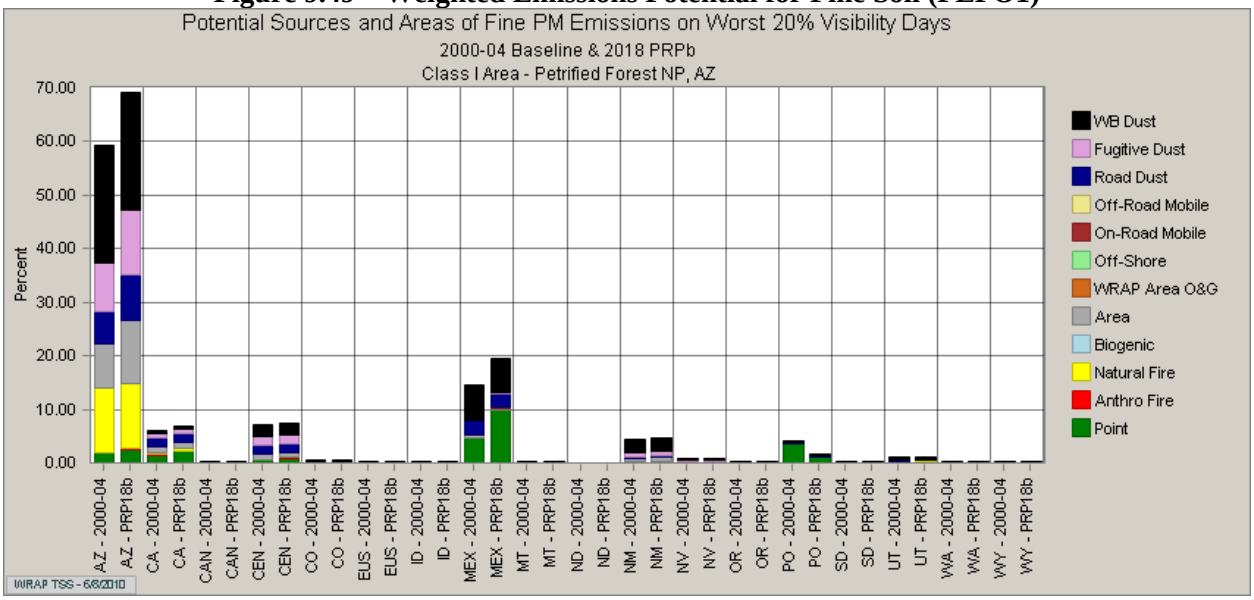
Figure 9.48 – Weighted Emissions Potential for Elemental Carbon (PEFO1)



Fine PM

Arizona has the greatest potential to contribute to fine PM, mostly from windblown dust, fugitive dust, road dust, area, and natural fire (Figure 9.49). Sources of windblown dust and point sources from Mexico have a small potential to contribute to fine PM.

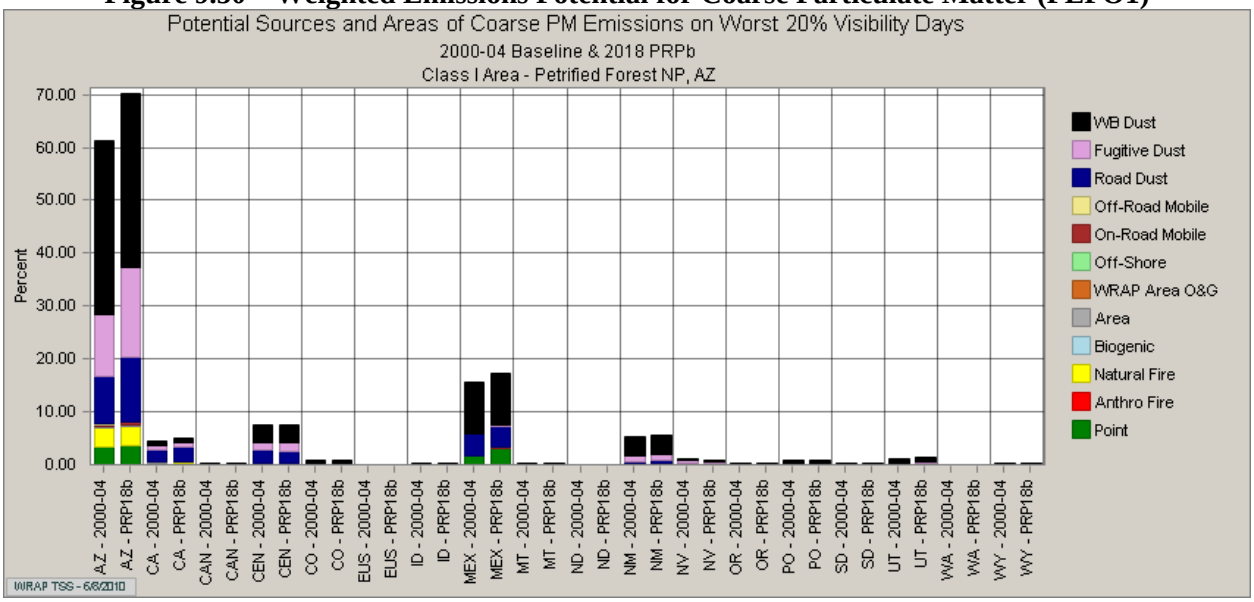
Figure 9.49 – Weighted Emissions Potential for Fine Soil (PEFO1)



Coarse Mass

Arizona has the greatest potential to contribute to coarse mass, mostly from windblown dust, fugitive dust, and road dust (Figure 9.50). Sources of windblown dust and point sources from Mexico have a small potential to contribute to fine PM.

Figure 9.50 – Weighted Emissions Potential for Coarse Particulate Matter (PEFO1)

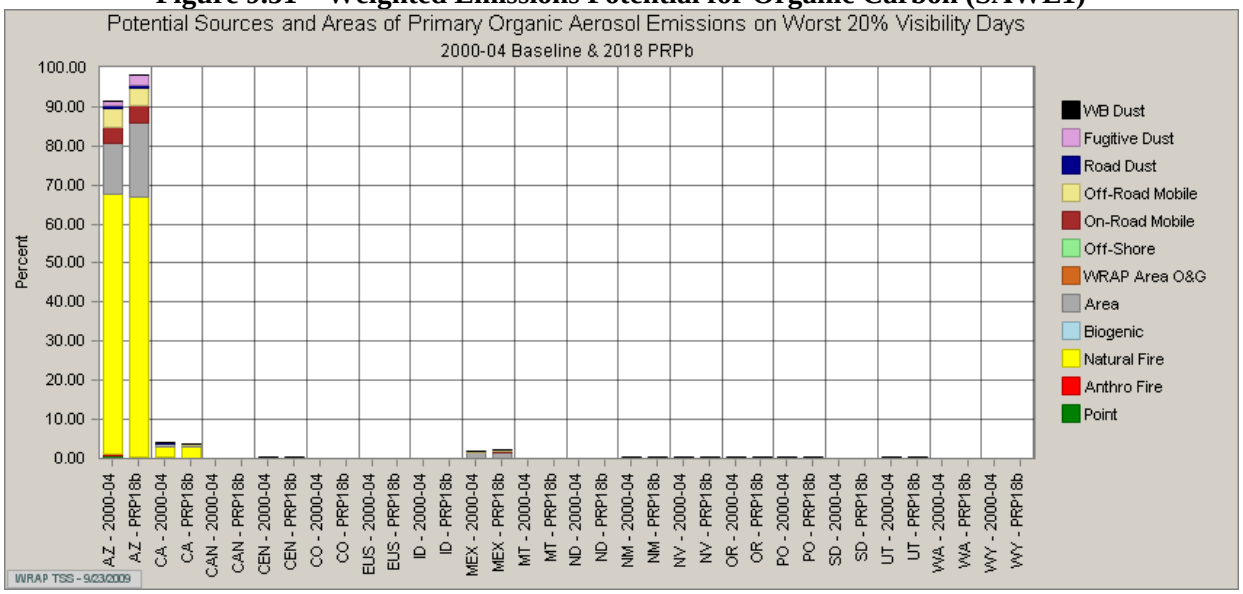


9.4.6 Saguaro National Park – West Unit

Organic Carbon

On 20% worst days, Arizona has the greatest potential to contribute to organic carbon emissions (Figure 9.51). Most of these emissions are from sources of natural fire, with a smaller amount from area sources.

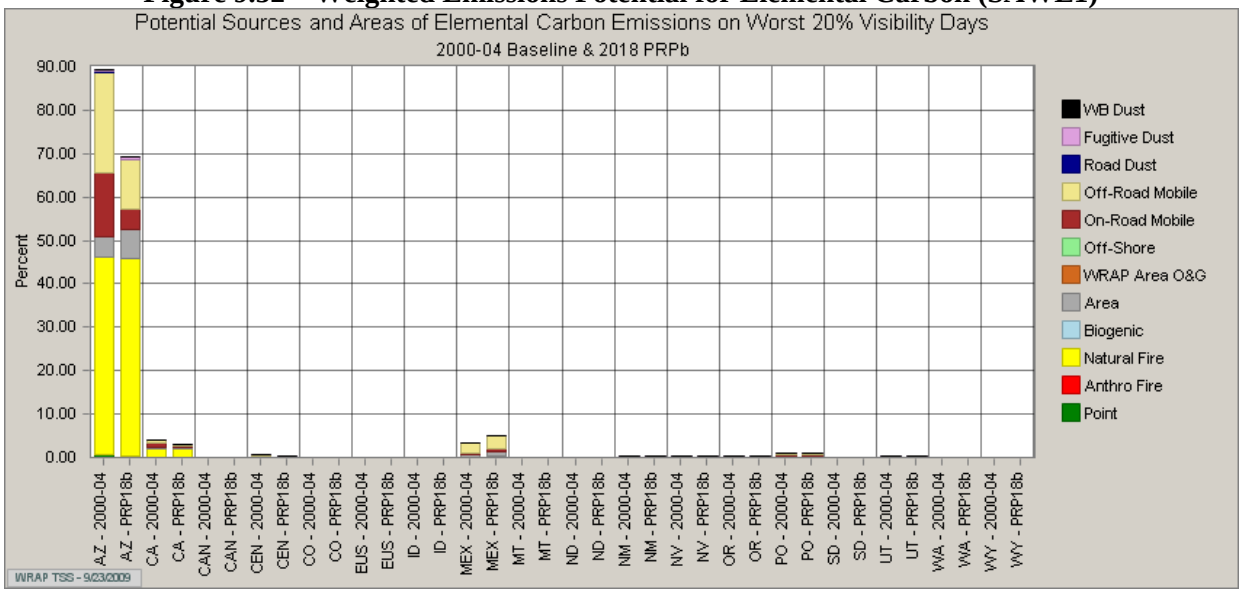
Figure 9.51 – Weighted Emissions Potential for Organic Carbon (SAWE1)



Elemental Carbon

Figure 9.52 shows that Arizona has the highest potential to contribute to elemental carbon emissions. Most of the emissions are from natural fire.

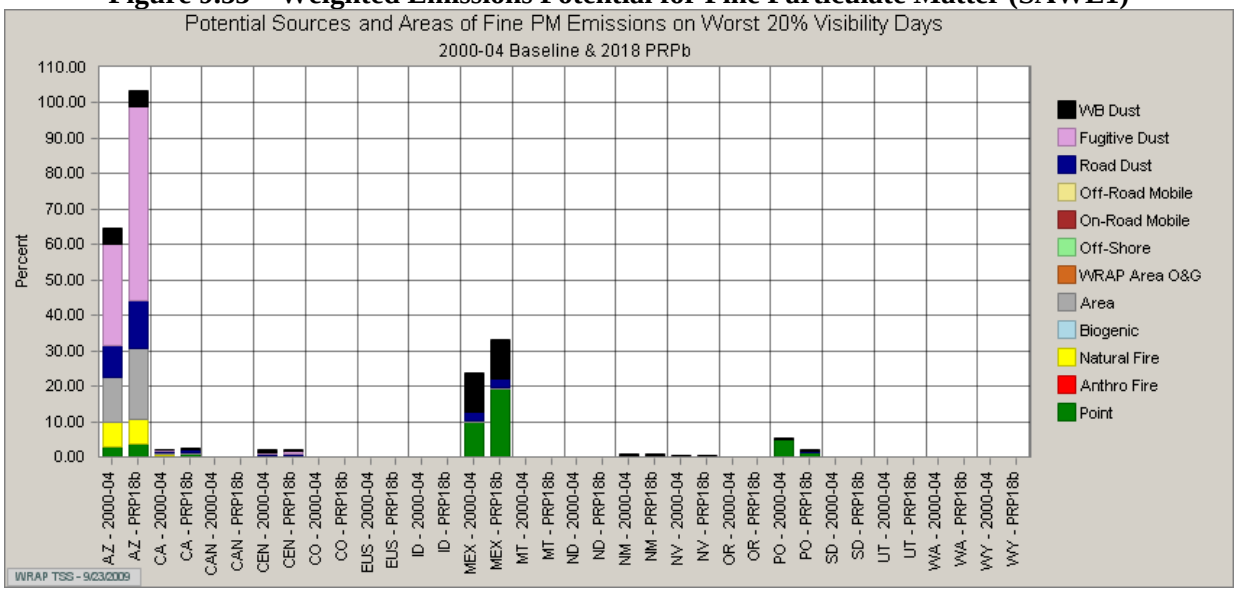
Figure 9.52 – Weighted Emissions Potential for Elemental Carbon (SAWE1)



Fine Particulate Matter

Arizona has the highest potential to contribute to fine particulate matter on 20% worst days (Figure 9.53). Most of the emissions are projected to be from sources of fugitive dust, with smaller amount from road dust and area sources. Sources within Mexico also have a potential to contribute fine particulate matter, primarily from point sources and windblown dust.

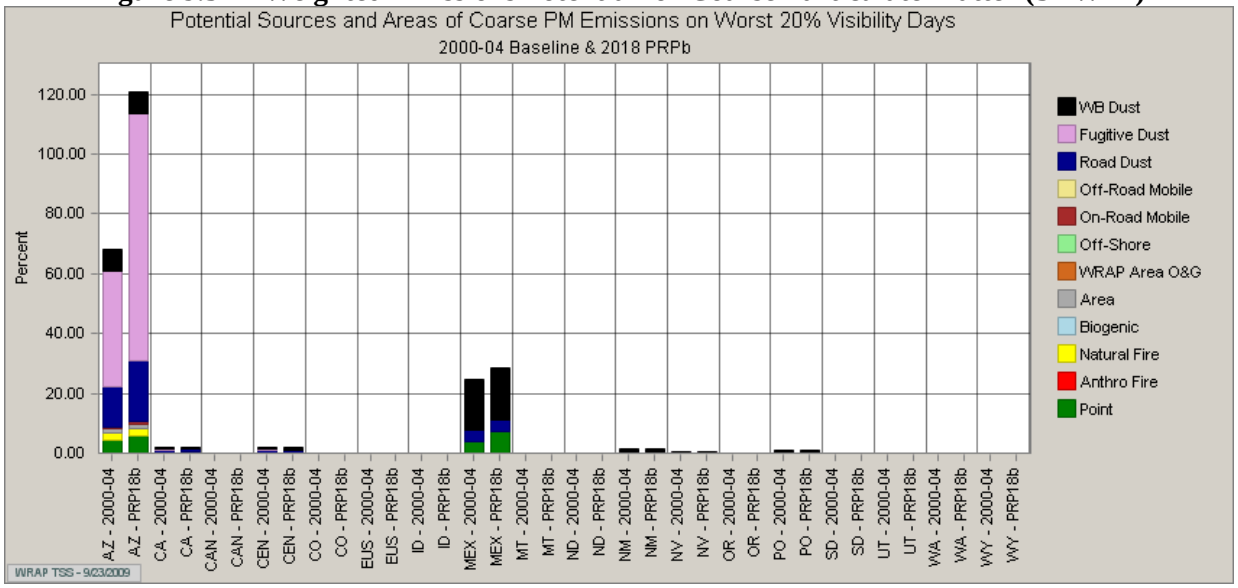
Figure 9.53 – Weighted Emissions Potential for Fine Particulate Matter (SAWE1)



Coarse Particulate Matter

Figure 9.54 shows that fugitive dust and road dust from Arizona has the highest potential to contribute to coarse PM. Mexico has a slight potential to contribute, mostly from windblown dust.

Figure 9.54 – Weighted Emissions Potential for Coarse Particulate Matter (SAWE1)

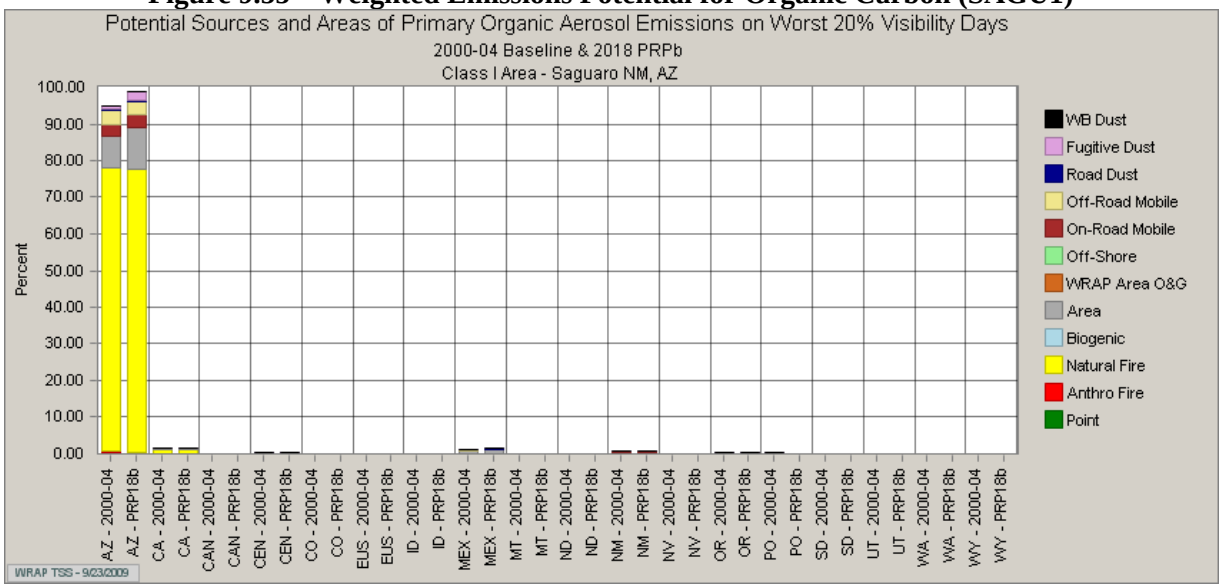


9.4.7 Saguaro National Park – East Unit

Organic Carbon

Figure 9.55 shows that at the East Unit of Saguaro National Park, Arizona has the greatest potential to contribute to organic carbon emissions. Most of these emissions are from sources of natural fire.

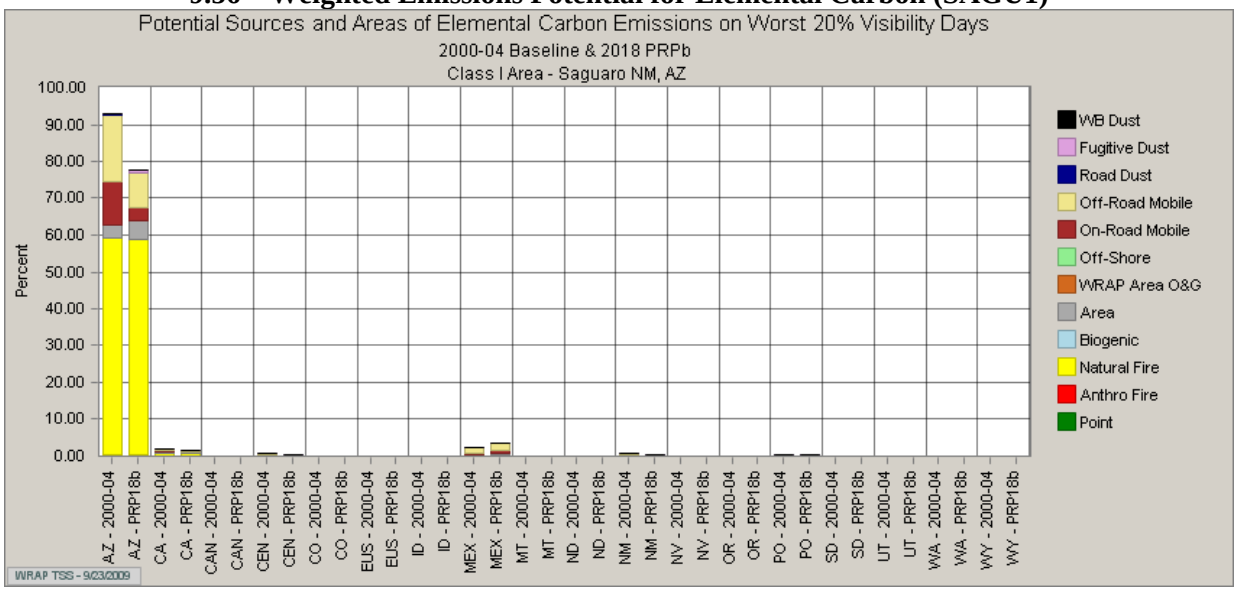
Figure 9.55 – Weighted Emissions Potential for Organic Carbon (SAGU1)



Elemental Carbon

On 20% worst days, sources of natural fire within Arizona have the greatest potential to contribute to elemental carbon emissions (Figure 9.56).

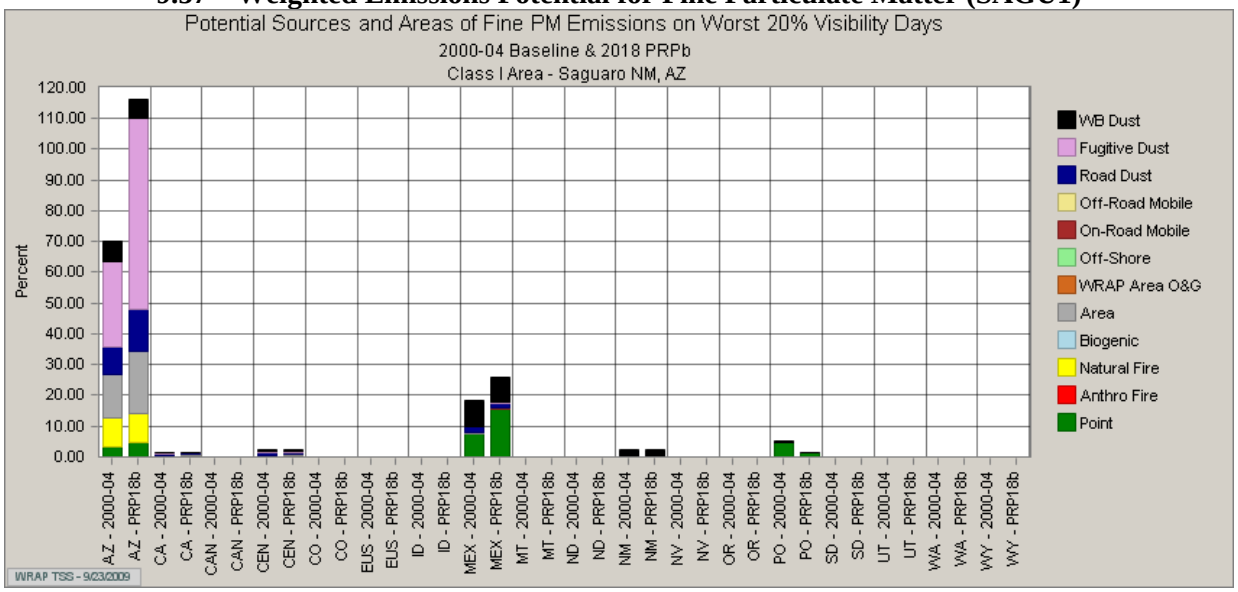
9.56 – Weighted Emissions Potential for Elemental Carbon (SAGU1)



Fine Particulate Matter

Figure 9.57 shows that Arizona has the greatest potential to contribute to fine particulate matter emissions. Contributing source types are fugitive dust, road dust, and windblown dust. The contribution potential from Arizona sources is expected to increase by 2018. The largest increase is seen in fine PM from fugitive dust, with smaller increases from road dust and area sources.

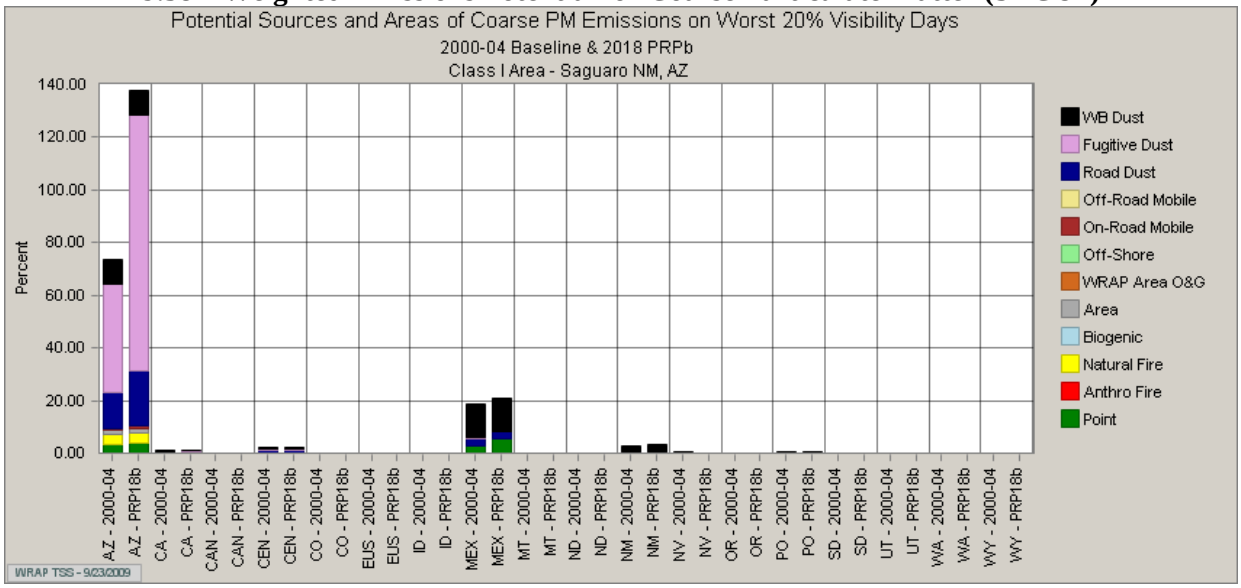
9.57 – Weighted Emissions Potential for Fine Particulate Matter (SAGU1)



Coarse Particulate Matter

Arizona sources have the greatest potential to contribute to coarse mass (Figure 9.58). The primary source category is fugitive dust. The potential increases in 2018, with the largest increase in fugitive dust.

9.58 – Weighted Emissions Potential for Coarse Particulate Matter (SAGU1)

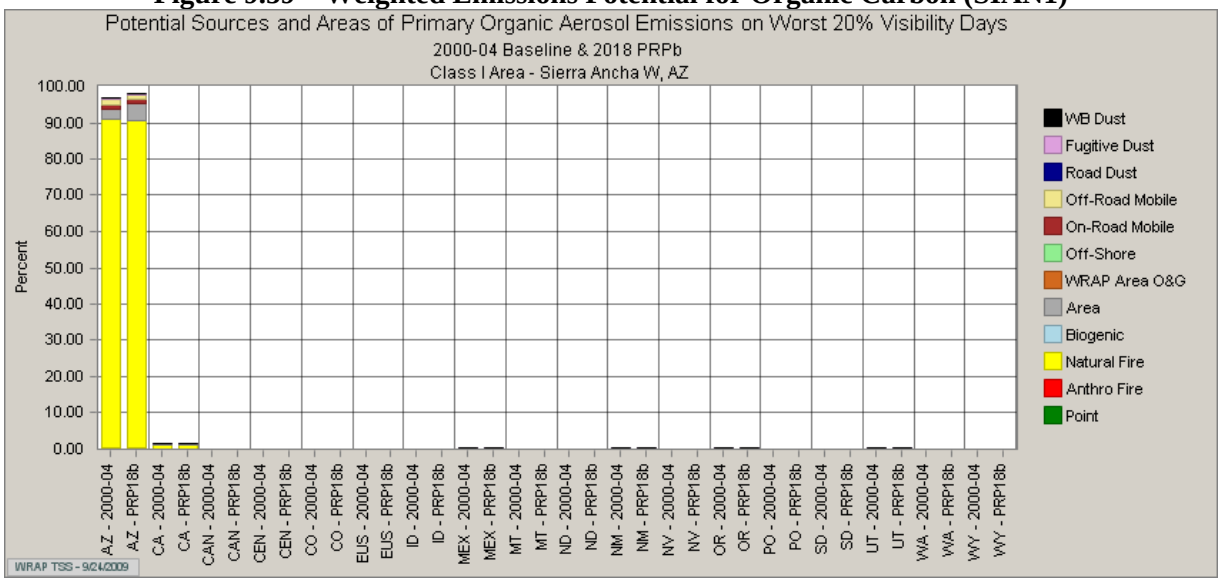


9.4.8 Sierra Ancha WA

Organic Carbon

Arizona is has the highest potential to contribute to organic carbon emissions at Sierra Ancha on 20% worst days (Figure 9.59). The source category with the greatest potential to contribute is natural fire.

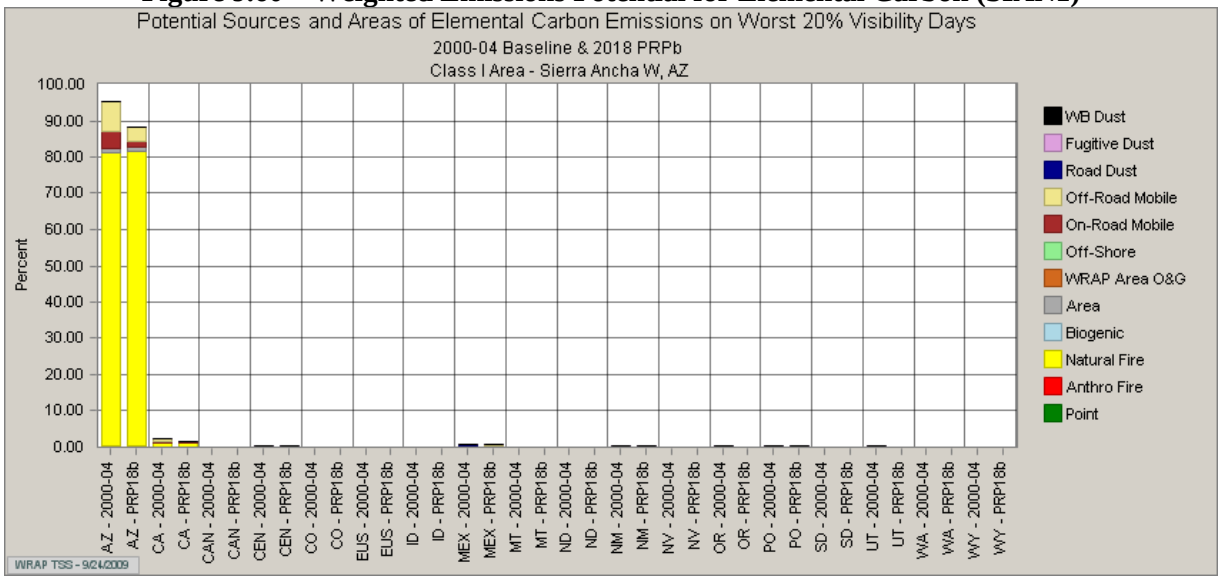
Figure 9.59 – Weighted Emissions Potential for Organic Carbon (SIAN1)



Elemental Carbon

Arizona has the greatest potential to contribute to elemental carbon emissions (Figure 9.60). Most of the potential emissions are projected to be from natural fire. Of the remaining potential emissions, most of the elemental carbon is from off-road mobile sources, which are projected to decrease in 2018.

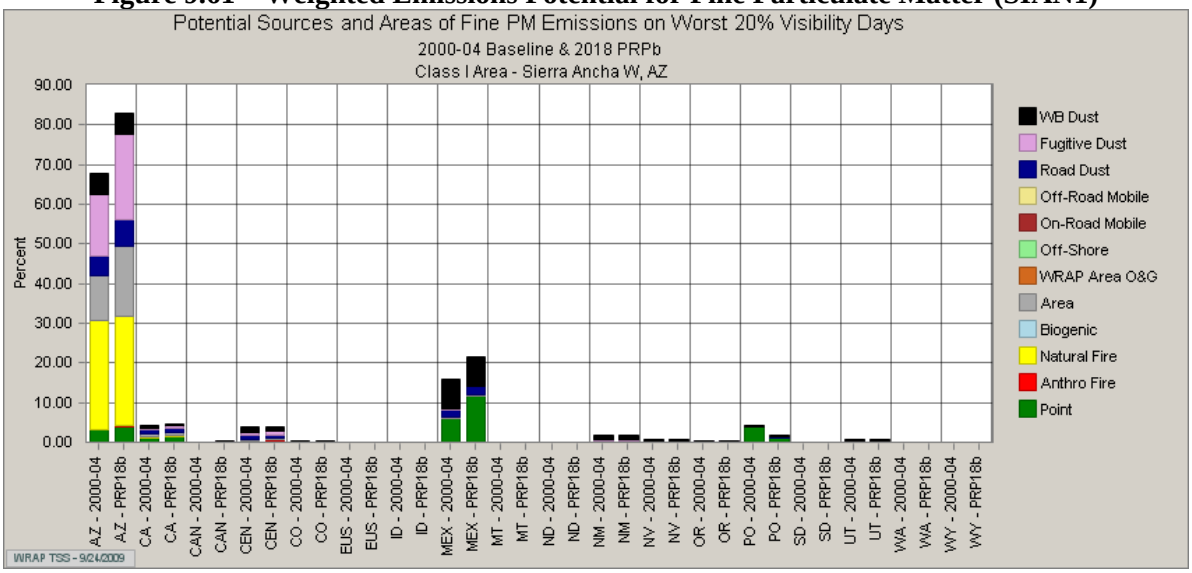
Figure 9.60 – Weighted Emissions Potential for Elemental Carbon (SIAN1)



Fine Particulate Matter

Figure 9.61 shows that Arizona has the greatest likelihood to contribute to fine soil. Contributing source types include natural fire, fugitive dust, area sources, road dust, and windblown dust. Projections show that the potential of fine soil emissions from Arizona impacting Sierra Ancha will increase by 2018. Point sources and windblown dust from Mexico have a slight potential to impact Sierra Ancha.

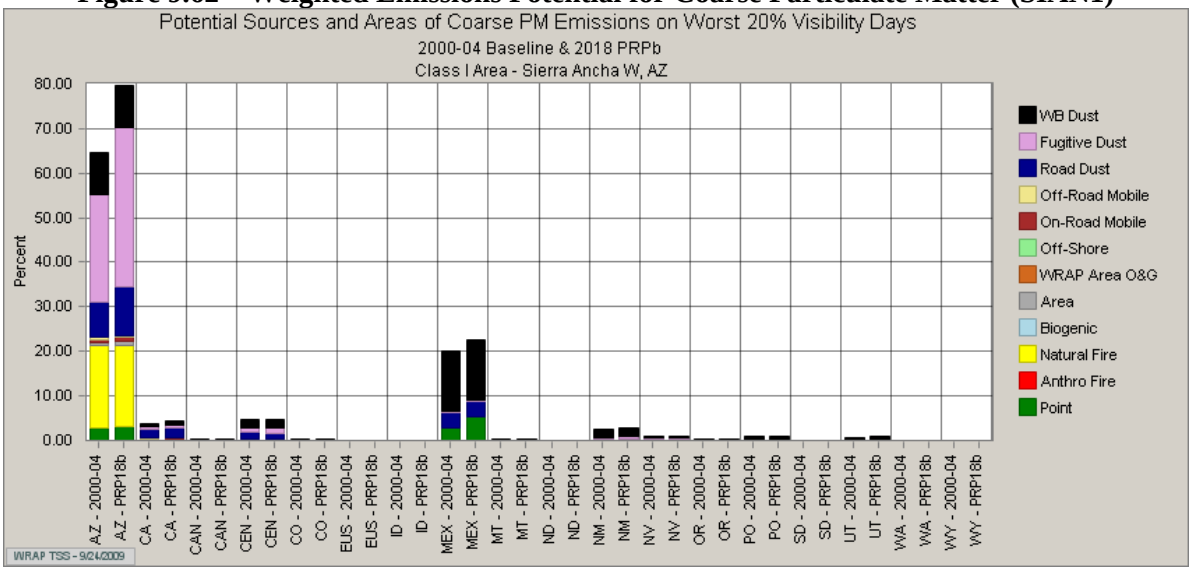
Figure 9.61 – Weighted Emissions Potential for Fine Particulate Matter (SIAN1)



Coarse Particulate Matter

Arizona has the greatest potential to contribute to coarse mass at the Sierra Ancha Wilderness, which is projected to increase in 2018 (Figure 9.62). The primary source types are natural fire, fugitive dust, area sources, road dust, and windblown dust. Mexico also has the potential to contribute to coarse mass emissions. The primary source types from Mexico are point sources and windblown dust.

Figure 9.62 – Weighted Emissions Potential for Coarse Particulate Matter (SIAN1)

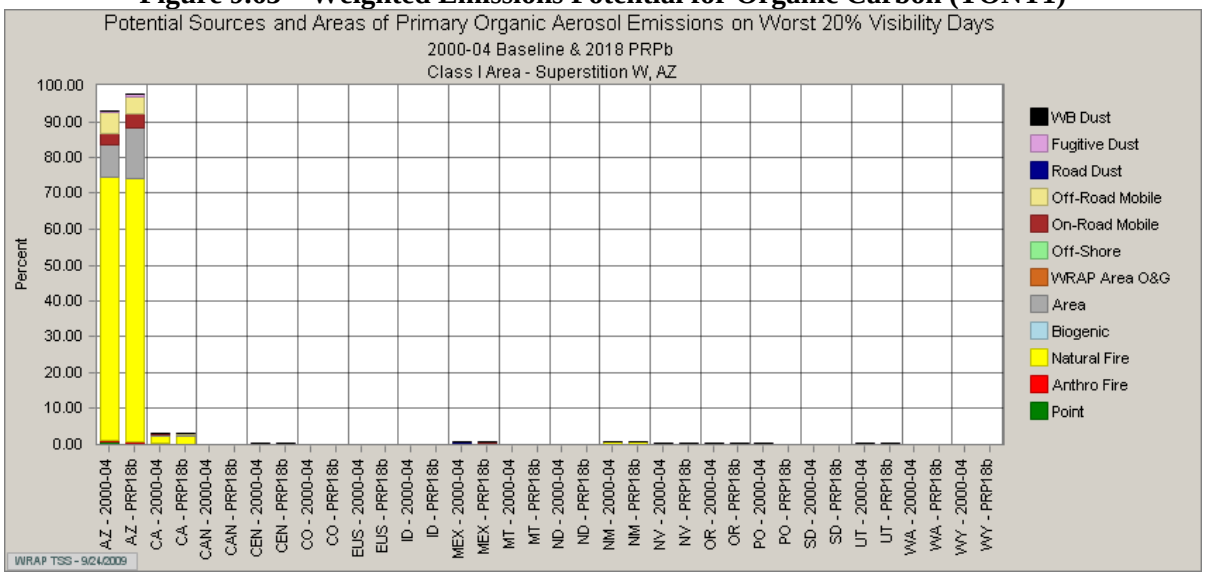


9.4.9 Superstition WA

Organic Carbon

Arizona sources of natural fire have the highest potential to contribute to organic carbon emissions at Superstition Wilderness (Figure 9.63). The other source categories include area, on-road mobile, and off-road mobile sources. Total potential for Arizona sources to emit organic carbon is projected to increase in 2018, which is projected to come from area sources.

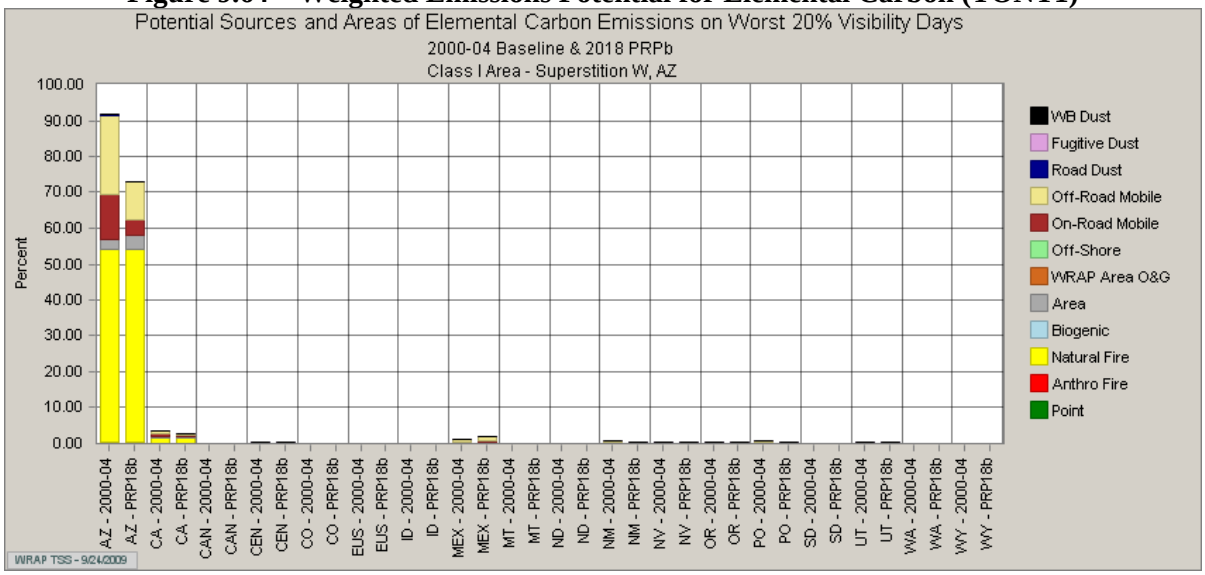
Figure 9.63 – Weighted Emissions Potential for Organic Carbon (TONT1)



Elemental Carbon

Arizona has the greatest potential to contribute to elemental carbon emissions, primarily from natural fire (Figure 9.64). The remaining potential sources of emissions are off-road mobile, on-road mobile, and area sources.

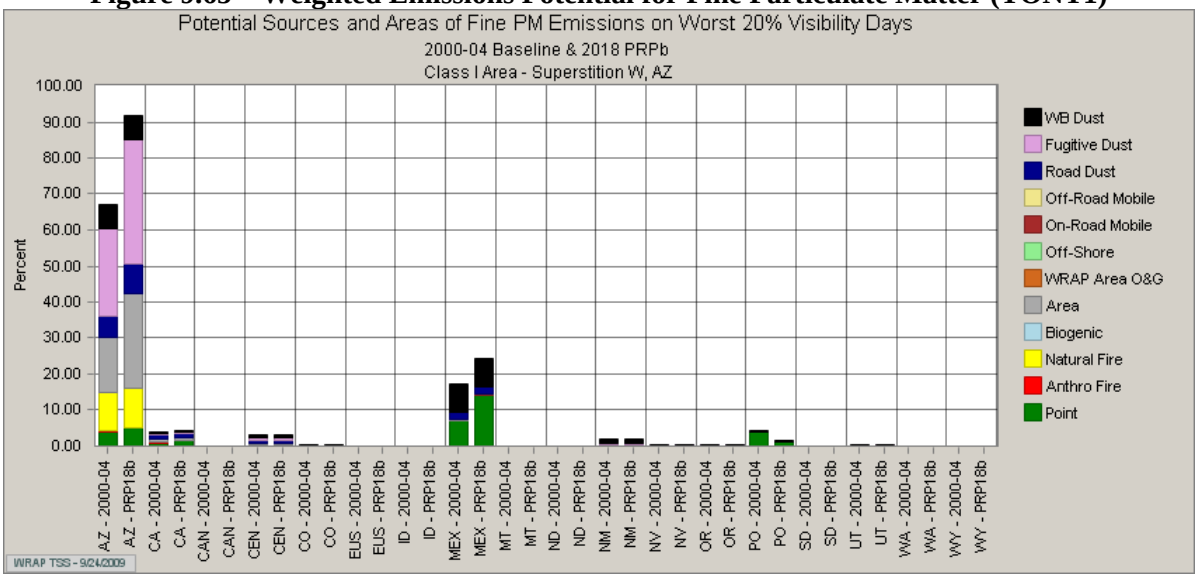
Figure 9.64 – Weighted Emissions Potential for Elemental Carbon (TONT1)



Fine Particulate Matter

Arizona has the greatest likelihood to contribute to fine soil (Figure 9.65). The primary source categories are fugitive dust, area sources, road dust, and windblown dust. Projections show that potential of fine soil emissions from Arizona will increase by 2018. Mexico also has the potential to contribute to fine soil at Superstition Wilderness. Contributing sources types include point and windblown dust.

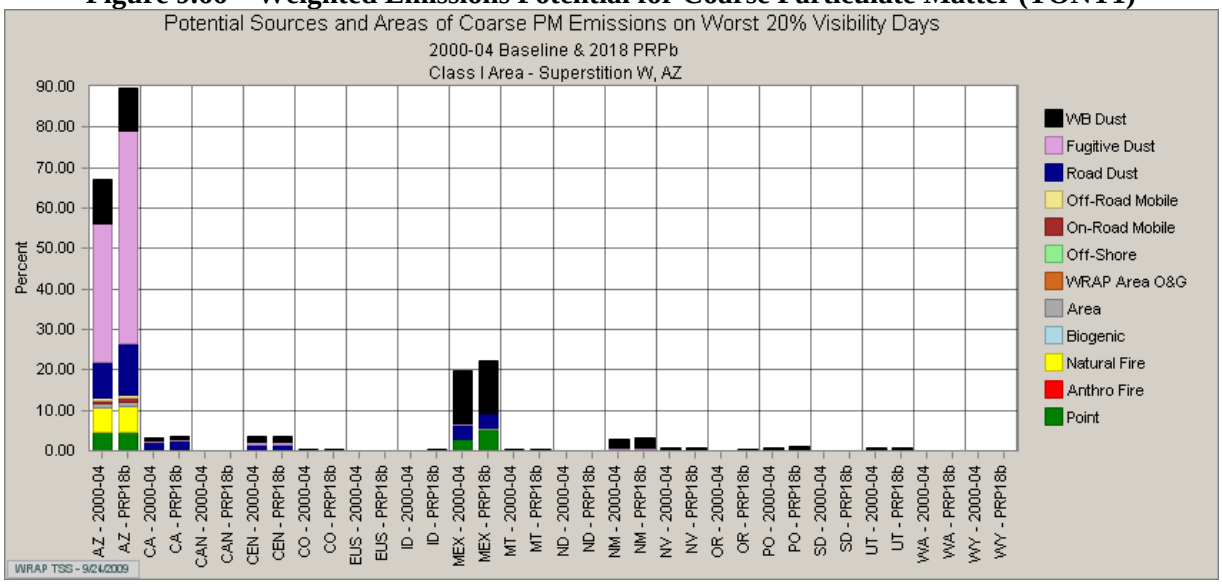
Figure 9.65 – Weighted Emissions Potential for Fine Particulate Matter (TONT1)



Coarse Particulate Matter

Figure 9.66 shows that Arizona has the greatest potential to contribute to coarse mass at Superstition Wilderness, which is projected to increase by 2018. The primary source type is fugitive dust, followed by road dust, windblown dust, and natural fire. Mexico also has a slight potential to contribute to coarse mass emissions. The primary source type from Mexico is windblown dust.

Figure 9.66 – Weighted Emissions Potential for Coarse Particulate Matter (TONT1)

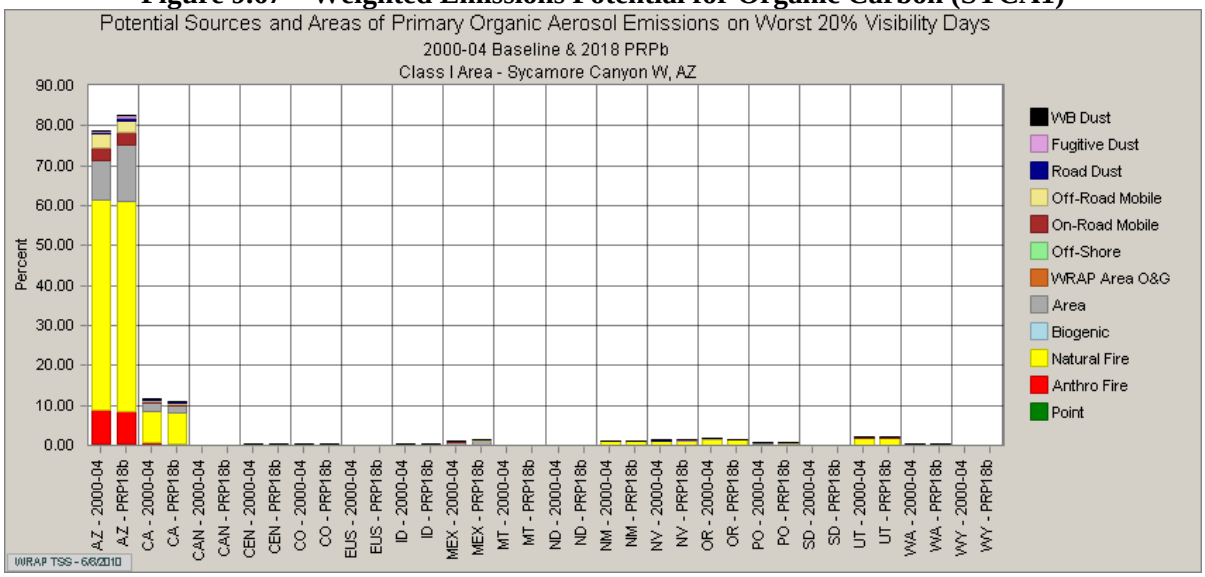


9.4.10 Sycamore Canyon WA

Organic Carbon

The WEP analysis shows that sources of anthropogenic fire, natural fire, and area sources in Arizona have the greatest potential to contribute to organic carbon (Figure 9.67).

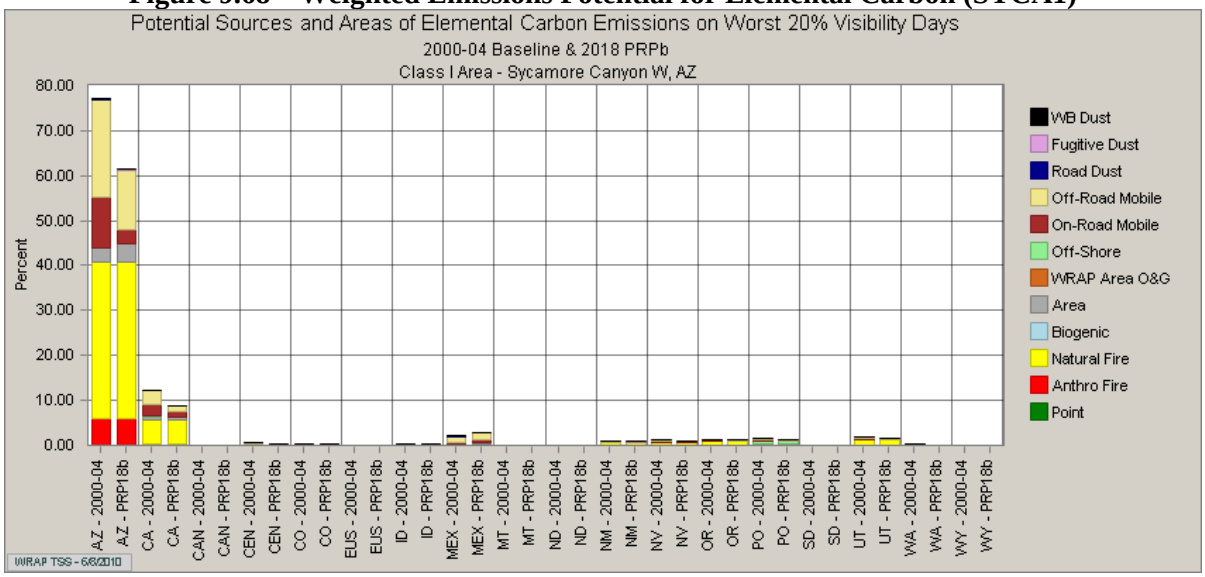
Figure 9.67 – Weighted Emissions Potential for Organic Carbon (SYCA1)



Elemental Carbon

Figure 9.68 shows that Arizona has the highest potential to contribute to elemental carbon at Sycamore Canyon. The primary sources are anthropogenic fire, natural fire, and off-road sources.

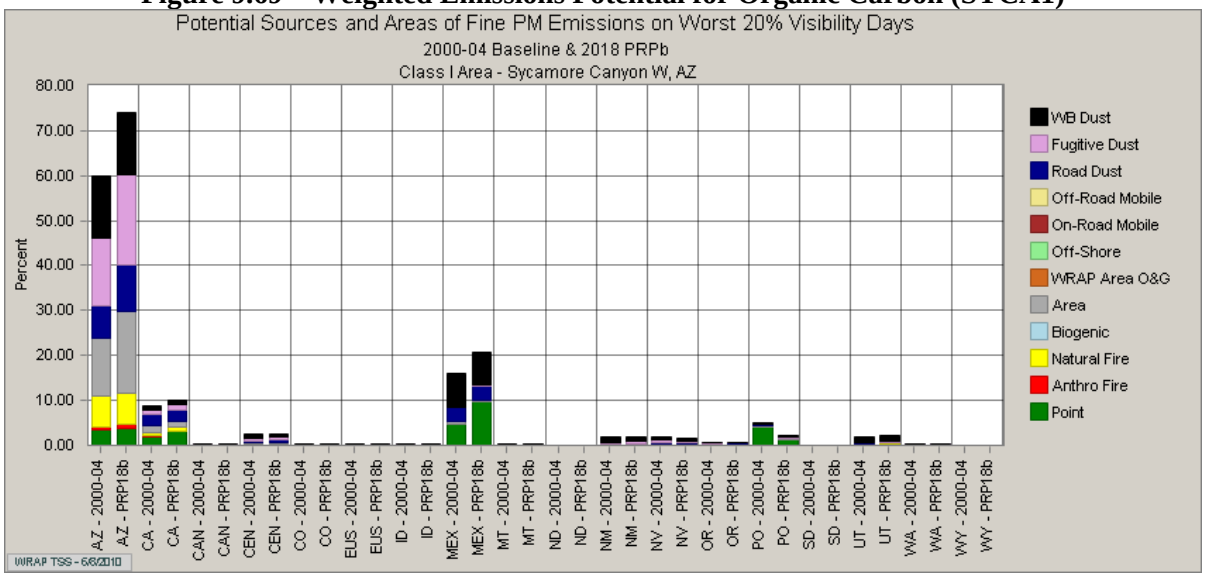
Figure 9.68 – Weighted Emissions Potential for Elemental Carbon (SYCA1)



Fine PM

Arizona has the greatest likelihood to contribute to fine PM (Figure 9.69). The primary source categories are windblown dust, fugitive dust, road dust, and area sources. Projections show that the potential of fine soil emissions from Arizona will increase by 2018. Mexico also has the potential to contribute to fine soil, many from point sources and windblown dust.

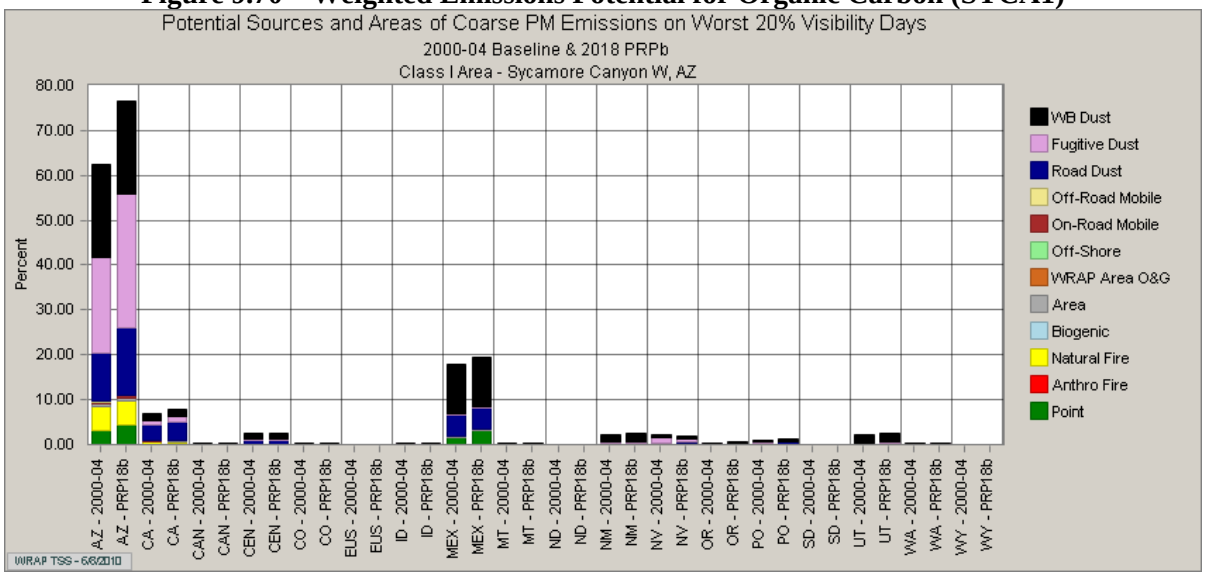
Figure 9.69 – Weighted Emissions Potential for Organic Carbon (SYCA1)



Coarse PM

Arizona has the greatest likelihood to contribute to fine PM (Figure 9.70). The primary source categories are windblown dust, fugitive dust, and road dust. Projections show that the potential of fine soil emissions from Arizona will increase by 2018. Mexico also has the potential to contribute to fine soil at Superstition Wilderness. Contributing sources types include windblown dust and road dust.

Figure 9.70 – Weighted Emissions Potential for Organic Carbon (SYCA1)



(page intentionally blank)

CHAPTER 10: BEST AVAILABLE RETROFIT TECHNOLOGY EVALUATION

10.1 Background and History

Title 40 CFR §§ 51.300 through 309 (the "regional haze rules") implement §§ 169A and 169B of the Clean Air Act and require States to submit state implementation plans (SIPs) to address regional haze visibility impairment in the 156 Class I areas. These SIPs are intended to be the first in a series of actions that will become long term regional haze strategies to demonstrate reasonable further progress toward the goal that Congress set. One of the tools provided to the States to address reasonable further progress is called Best Available Retrofit Technology (BART).

The BART process consists of three steps: 1) determining BART eligibility; 2) determining if a source is "subject to BART" by conducting modeling of Class I visibility impacts; and 3) conducting an analysis of BART controls (retrofitting) for those sources subject to BART that contribute to regional haze.

The regional haze rules use the term "BART-eligible source" to describe the sources that are potentially subject to this program. BART-eligible sources are those sources that have the potential to emit 250 tons or more of a visibility-impairing air pollutant; were constructed between August 7, 1962 and August 7, 1977, and whose operations fall within one or more of the 26 specifically listed source categories. Once a facility has been determined to be BART-eligible, air dispersion modeling tools are used to determine if that facility causes or contributes to regional haze. If a state determines that the facility "emits any air pollutant which may reasonably be anticipated to cause or contribute to any impairment of visibility in any such area," then the facility is deemed to be subject-to-BART. The visibility impairing pollutants addressed by facilities subject-to-BART include emissions of oxides of nitrogen (NO_X), sulfur dioxide (SO_2) and particulate matter (PM). The term "particulate matter" includes particles with an aerodynamic diameter that is less than 10 microns (µm), and particles with an aerodynamic diameter that is less than 2.5 µm.

There have been several challenges to the provisions of the Regional Haze Rule and the methodologies prescribed or accepted by EPA. In 1999, EPA explained in its preamble to the rules that the BART requirements demonstrated Congress' intent to focus attention directly on the problem of pollution from a specific set of sources which, as determined by a State, emit any air pollutant which may reasonably be anticipated to cause or contribute to any impairment of visibility in a Class I area.

Specifically, EPA concluded that if a potentially-subject-to-BART source was located within an area upwind from a downwind Class I area, that source "may reasonably be anticipated to cause or contribute" to visibility impairment in the Class I area. The regional haze rules address visibility impairment resulting from emissions from a multitude of sources that are located across a wide geographic area. The problem of regional haze is caused in large part by the long-range transport of emissions from multiple sources. Therefore, EPA had also concluded that when weighing the factors set forth in the statute for determining BART, a state should consider the collective impact of BART sources on visibility. In particular, when considering the degree of visibility improvement that could reasonably be anticipated to result from the use air pollution control technology, EPA explained that the state should consider the degree of improvement in visibility that would result from the cumulative impact of applying controls to all sources subject-to-BART. EPA then proposed that the states should use this analysis to determine the appropriate BART emission limitations for specific sources.

In American Corn Growers v. EPA, in addition to other challenges to the rules, industry petitioners challenged EPA's interpretations that any source with any potential impacts in any Class I area should be subject-to-BART, and that BART should be applied after considering the collective impacts of BART

sources on Class I areas. In 2002, the court concluded that the BART provisions in the 1999 regional haze rule were inconsistent with the provision in the Clean Air Act, as the Act gave the "states broad authority over BART determinations." 291 F.3d at 8.

With respect to the test for determining whether a source is subject-to-BART, the court held that the method that EPA had prescribed for determining which eligible sources are subject-to-BART illegally constrained the authority Congress had conferred to the States. Although the court did not decide whether EPA's proposed general collective contribution approach to determining BART was inconsistent with the Clean Air Act, the court did state that "[i]f the [regional haze rule] contained some kind of a mechanism by which a state could exempt a BART-eligible source on the basis of an individual contribution determination, then perhaps the plain meaning of the Act would not be violated. But the [regional haze rule] contains no such mechanism." Id, at 12.

With respect to EPA's interpretation that the Clean Air Act required the States to consider the degree of improvement in visibility that would result from the cumulative impact of applying controls in determining BART, the court also found that EPA was inconsistent with the language of the Act. 291 F.3d at 8. Based on its review of the statute, the court concluded that the five statutory factors in section 169A(g)(2) "were meant to be considered together by the states." Id. At 8.

On July 6, 2005, EPA took action to address the court's vacatur of the requirement in the regional haze rule requiring States to assess visibility impacts on a cumulative basis in determining which sources are subject-to-BART. Because this requirement was found only in the preamble to the 1999 regional haze rule, EPA concluded that no changes to the regulations were required. Instead, this issue was ultimately addressed by the BART guidelines, which provided States with different techniques and methods for determining which BART-eligible sources "may reasonably be anticipated to cause or contribute to any impairment of visibility in any mandatory Class I Federal area."

The July 6, 2005, amendments to the rules also required states to consider the degree of visibility improvement resulting from a source's installation and operation of retrofit technology, along with the other statutory factors set out in Clean Air Act § 169A(g)(2), when making a BART determination. This was accomplished by listing the visibility improvement factor with the other statutory BART determination factors in 40 CFR 51.308(e)(91)(A), so that states are now required to consider all five factors, including visibility impacts, on an individual source basis when making each source's BART determination.

10.2 BART Eligibility Determination

On June 15, 2005, EPA published final regulatory text and guidelines for implementing BART, including methodologies that are to be used to establish whether or not emissions units at a facility are truly BART-eligible. According to the language of the guidelines, there are three steps for determining which emissions units at a facility are considered to be BART-eligible. Those three steps are summarized as follows:

Step 1: Determine whether the plant contain emissions units in one or more of the 26 source categories:
- a. If no, then emissions units are not BART-eligible.
- b. If yes, proceed to Step 2.

Step 2: Identify the start-up dates of emissions units identified in Step 1. Determine whether the emissions units had begun operation after August 7, 1962 and were in existence on August 7, 1977:
- a. If no, then emissions units are not BART-eligible.

b. If yes, proceed to Step 3.

Step 3: Compare the potential emissions from all emissions units identified in Steps 1 and 2. Determine whether the combined potential emissions of visibility impairing pollutants from these emissions units are greater than 250 tons per year:

a. If no, then emissions units are not BART-eligible.
b. If yes, then emissions units are BART-eligible.

10.3 Potentially Subject-to-BART

After determining BART-eligibility, a state must then determine whether the air pollution emission unit is "potentially-subject-to-BART". EPA finalized several options that allowed states flexibility when making the determination of whether a source "emits any pollutants which may reasonably be anticipated to cause or contribute to any visibility impairment."

Option 1: All BART-eligible sources are Subject-to-BART

EPA provided states with the discretion to consider all BART-eligible sources within a state to be "reasonably anticipated to cause or contribute" to some degree of visibility impairment in a Class I area. EPA held that this option is consistent with the American Corn Growers court's decision, as it would be an impermissible constraint of State authority for the EPA to force states to conduct individualized analyses in order to determine that a BART eligible source "emits any air pollutant which may reasonably anticipated to cause or contribute to any impairment of visibility in any [Class I] area."

Option 2: All BART-Eligible Sources Do Not Cause or Contribute to Regional Haze

EPA also provided states with the option of performing an analysis to show that the full group of BART-eligible sources in a state may not, as a whole, be reasonably anticipated to cause or contribute to any visibility impairment in Class I areas. Although the option was provided, EPA did also state that it anticipated that in most, if not all, states BART-eligible-sources are likely to cause or contribute to some level of visibility impairment in at least one Class I area.

Option 3: Case-by-Case BART Analysis

The final option that was provided to states was to consider the individual contributions of a BART-eligible source to determine whether the facility is subject-to-BART. Specifically, EPA allowed states to choose to undertake an analysis of each BART-eligible source in a state in considering whether each such source "emit[s] any air pollutant which may reasonably be anticipated to cause or contribute to any impairment of visibility in any [Class I] area." Alternatively, states may choose to presume that all BART-eligible sources within a state meet this applicability test, but provide sources with the ability to demonstrate on a case-by-case basis that this is not the case.

When considering the options provided by EPA, ADEQ determined that the third option is the most consistent with the American Corn Growers case, as this option provides a rebuttable method for the evaluation of the visibility impact from a single source. If the air dispersion modeling analysis shows that a facility causes or contributes to Regional Haze, then it is required to address BART. A state is also provided with flexibility under this option, as it may exempt from BART any source that is not reasonably anticipated to cause or contribute to visibility degradation in a Class I area.

Appendix H of the April 4, 2005, draft Stationary Sources Joint Forum (SSJF) report that identified potentially BART-eligible sources in the WRAP Region specifically recognized a list of sources under the jurisdiction of ADEQ, the Maricopa Air Quality Department (MCAQD), the Pima County Department of Environmental Quality (PDEQ) and the Pinal County Air Quality Control District (PCAQCD). Using this list as a basis, ADEQ concluded that 14 distinct sources comprised of 42 separate emissions units in Arizona were "potentially-BART-eligible". On June 9, 2006, ADEQ provided potential emissions information along with stack parameters for each potentially-BART-eligible facility to the WRAP's Regional Modeling Center, which performed a CALPUFF modeling analysis to determine the predicted visibility impairment apportioned to each facility.

On June 7, 2007, the WRAP's Regional Modeling Center provided ADEQ with the results of the CALPUFF modeling analysis. Based upon the CALPUFF modeling results, ADEQ determined that if a "potentially-BART-eligible" source's twenty-second highest (98th percentile) visibility impact across the three years of modeling was greater than 0.5 deciviews (dv) in any Class I area less than 300 kilometers away, the facility would be considered to contribute to impairment of visibility in that Class I area. Similarly, if the "potentially-BART-eligible" source's impact was found to be greater than 1.0 dv in any Class I area less than 300 kilometers away, the facility would be considered to cause impairment of visibility in that Class I area. In every case where a "potentially-BART-eligible" source was found to have emissions that contributed to, or caused, impairment of visibility in a Class I area, ADEQ determined that the facility was "potentially-subject-to-BART." In some cases where a facility's contributions to impairment of visibility in a Class I area were within 20% of 0.5 dv, ADEQ requested that the source provide further information demonstrating that the facility was not "potentially-subject-to-BART." As a result, eight BART-eligible facilities were determined to be potentially-subject-to-BART, and one facility was recommended for further evaluation.

On July 13, 2007, the eight sources that were potentially-subject-to-BART and the source that was recommended for further evaluation were provided with a set of three options: (i) demonstrate that the facility is not BART-eligible; (ii) demonstrate that while the facility is BART-eligible, it is not potentially-subject-to-BART as the facility does not cause or contribute to regional haze; or (iii) agree that the facility is potentially-subject-to-BART and conduct a BART analysis for the facility.

10.4 Subject-to-BART Determination

Once the "universe" of potentially-BART-eligible sources has been set, a state must make a determination about which of these sources are truly subject-to-BART. In order for a source to be subject-to-BART, a state must conclude that emissions of visibility impairing pollution from a BART-eligible source may reasonably be anticipated to cause or contribute to any visibility impairment in a mandatory Class I area.

ADEQ's process only resulted in the determination that certain facilities are potentially-subject-to-BART. The cause for this intermediate step was that ADEQ was unable to access emissions and stack parameter information that is recommended by the EPA BART guidelines for analyzing a facility. Instead, ADEQ relied on information that was publicly available through the Title V permit applications for each of the facilities. Each of the facilities found to be potentially-subject-to-BART was provided with the opportunity to conduct a modeling analysis using emissions estimates that are reflective of steady-state operating conditions during periods of high capacity utilization. In other words, in accordance with the EPA July 6, 2005, BART guidelines, facilities were provided with the option of using of an emissions rate based on the maximum actual emissions over a 24-hour period for the most recent five year periods as an appropriate gauge of a source's potential impact. EPA explained that this would ensure that peak emission conditions are reflected, but would not overestimate a source's potential impact on any given day.

In its analysis of potentially BART-eligible sources, ADEQ identified one facility that appeared to be BART-eligible but deferred sending a letter to that facility, as representatives of the facility were already engaged in dialogue regarding the facility's BART eligibility. Ultimately, the facility chose to demonstrate that it was never BART-eligible.

Arizona Sources That Chose to Demonstrate "Not BART-Eligible":

- TEP Irvington Generating Station

Of the nine facilities that received ADEQ's July 13, 2007, letter, five facilities provided documentation that argued that while the facility was BART-eligible, it was not potentially-subject-to-BART. Those five facilities are as follows:

Arizona Sources That Chose to Demonstrate Not "Potentially-Subject-to-BART":

- Arizona Portland Cement Company
- APS West Phoenix
- ASARCO Hayden Smelter
- Chemical Lime Nelson Lime Plant
- Freeport McMoRan Miami Smelter

Of the facilities that received ADEQ's July 13, 2007, letter, four responded that the facilities were indeed subject-to-BART and provided a BART-analysis for the BART-eligible equipment. Those four facilities are as follows:

Arizona Sources that Agreed To Be Subject-to-BART:

- Catalyst Paper
- AEPCO
- APS Cholla Power Plant
- SRP Coronado Generating Station

10.5 The BART Determination Process

Clean Air Act § 169A(g)(7) directs states to consider five factors in making BART determinations. The regional haze rule codified these factors in 40 CFR § 51.308(e)(1)(ii)(B), which directs states to identify the "best system of continuous emissions control technology" taking into account "the technology available, the costs of compliance, the energy and non-air quality environmental impacts of compliance, any pollution control equipment in use at the source, and the remaining useful life of the source."

The visibility BART regulations define BART as meaning "…an emission limitation based on the degree of reduction achievable through the application of the best system of continuous emission reduction for each pollutant which is emitted by … [a BART-eligible source]. The emission limitation must be 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 requirement in use or in existence at the source, the remaining useful life of the source, and the degree of improvement in visibility which may reasonably be anticipated to result from the use of such technology."

In its guidance, EPA was clear that each state must determine the appropriate level of BART control for each source that is determined to be subject-to-BART. In making a BART determination, a state must consider the following factors:

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

ADEQ concluded that the concept of BART is similar to the concept of Best Available Control Technology (BACT). Both control technology requirements are based upon similar concepts, including the fact that both are conducted on a case-by-case basis, and both may constitute the application of production processes or available methods, systems and techniques to reduce air pollution emissions. The most significant difference between the two appears to be that BART must accommodate issues associated with retrofitting existing equipment with new air pollution controls that were not included in the initial design of the facility. Since the concepts between the two technology requirements are reasonably similar, ADEQ has determined that it is reasonable method for conducting a BART analysis is following the BACT methodology, taking specific care to address all five of the BART factors.

The framework that ADEQ used for making a BART analysis will follow a similar format, and comprises the following seven key steps:

1. Identify the existing control technologies in use at the source (BART factor 3);
2. Identify all available retrofit control technologies with practical potential for application to the specific emission unit for the regulated pollutant under evaluation;
3. Eliminate all technically infeasible control technologies;
4. Evaluate control effectiveness of remaining technologies;
5. Evaluate energy and non-air quality environmental impacts and document results (BART factors 1, 2 and 4); and
6. Evaluate visibility impacts (BART factor 5).
7. Select BART

Materials considered by the applicant and by ADEQ in identifying and evaluating available control options include the following:

- Entries in the RACT/BACT/LAER Clearinghouse (RBLC) maintained by EPA, is the most comprehensive and up-to-date listing of control technology determinations available;
- Information provided by pollution control equipment vendors;
- Information provided by industry representatives; and
- Information provided by other Regional Planning Organizations and state permitting authorities.

10.5.1 Summary of Arizona's Seven-Step Process

Step 1: Identify the Existing Control Technologies in Use at the Source

This step is in addition to the five steps that are recommended in EPA's BART guidelines (40 CFR Part 51, Appendix Y). Of the four facilities that have agreed that they are "potentially-subject-to-BART", two are already in a process of designing or installing new air pollution control devices on emissions units that are "potentially-subject-to-BART". Since the installation of these controls was not required by BART, ADEQ determined that it was appropriate to include a step that described the existing control technologies that provide the baseline against which BART will be judged.

Step 2: Identify All Available Retrofit Control Options

This step is functionally equivalent to Step 1 in EPA's BART guidelines.

At the outset of any BART analysis, EPA's guidelines suggest that states should consider all control options that have potential application to the emissions unit, regardless of technical feasibility. This includes having an understanding of other required controls, including those technologies that are required under BACT or Lowest Achievable Emissions Rate (LAER) determinations, pollution prevention practices, the use of other add-on controls, and upgrades to existing air pollution controls that are already in place. As with BACT and LAER determinations, control alternatives can also take into account technology transfer of controls that have been applied to similar source categories. Unlike some permitting authorities' BACT and LAER procedures, however, BART does not contain a requirement to redesign the source when considering available control alternatives. For example, an existing pulverized-coal-fired electricity generating facility should not be required to consider integrated gasification coal combustion during the BART process, as BART focuses on technologies that can be retrofitted to the existing equipment.

In BACT and LAER determinations, any New Source Performance Standard (NSPS) or National Emissions Standard for Hazardous Air Pollutants (NESHAP) that exists for a source category is considered to the "floor" level of control, meaning that any proposed emission rate or control technology that is less stringent than the NSPS or NESHAP is not acceptable. Because BART involves retrofitting technology to existing emissions units that are not undergoing a major modification, it is possible, albeit unlikely, that an NSPS or NESHAP for a source category might not be the "floor" control for BART. Regardless, where a NSPS or NESHAP exists for a source category, EPA has directed States to include a level of control equivalent to the NSPS or NESHAP as one of the control options to be considered.

For some emissions units that are subject-to-BART controls, the actual control measures or devices that comprise BART may already be in place. In such instances, the BART analysis should consider improvements to the existing controls or emissions limitations for those emissions units, and should not be limited to consideration of only the control devices themselves.

Finally, in some cases, if a state determines that a BART source already has controls in place which are the most stringent controls available, then it may not be necessary to comprehensively complete each following step of the BART analysis. EPA's guidance states that as long as the most stringent controls are made federally enforceable for the purposes of implementing BART for that source, a state may skip the remaining analyses, including the visibility analyses. Likewise, if a source commits to the most stringent level of BART control at the outset, then EPA's guidance suggests that there is no need to complete the remaining steps of the BART process.

Step 3: Eliminate All Technically Infeasible Control Options

This step is functionally equivalent to Step 2 in EPA's BART guidelines. In this step, states are to evaluate the technical feasibility of the control options that were identified in Step 1. EPA's guidance generally considers a control option to be technically feasible if the controls have either: (1) been installed and operated successfully under similar conditions for the type of source under review, or (2) are available and could be applicable to the source under review. EPA's guidance states that a technology should be considered to be available if the source owner may obtain the control device through commercial channels, or the control is otherwise available within the common sense meaning of the term. Similarly, EPA considers an available control technology to be "applicable" if the control can be

reasonably installed and operated on the source type that is under review. If a technology is considered to be both available and applicable, a state should consider the technology to be technically feasible.

If a technology is determined to be technically infeasible, then the state should provide documentation that demonstrates that the control is technically infeasible. EPA's guidance suggests that documentation that would be considered acceptable includes an explanation, based on physical, chemical, or engineering principles, as to why the control is technically infeasible and a discussion regarding why technical difficulties would preclude the successful use of the control option on the emissions unit under review.

Step 4: Evaluate Control Effectiveness of Remaining Technologies

This step is functionally equivalent to Step 3 in EPA's BART guidelines. EPA's guidelines state that there are two key issues that must be addressed in this step:

(1) States should ensure that the degree of control is expressed using a metric that ensures an "apples to apples" comparison of emissions performance levels among the options; and
(2) States should give appropriate treatment and consideration of control techniques that can operate over a wide range of emission performance levels.

When choosing an appropriate metric, EPA recommends selecting a metric that properly allows for the comparison of an inherently lower polluting process with a process that can only be addressed through the application of additional pollution controls. As a result, EPA has suggested that it is generally most effective to express emissions performance as an average steady state emissions level per unit of product produced or processed (i.e., pounds per million BTU, or pounds per ton of cement produced).

Step 5: Evaluate the Energy and Non-Air Quality Environmental Impacts and Document Results

This step is functionally equivalent to Step 4 in EPA's BART guidelines. After identifying the available and technically feasible control technology options, states are expected to analyze the following when making a BART determination:

- Costs of Compliance
- Energy Impacts
- Non-air Quality Environmental Impacts
- Remaining Useful Life

Each state is responsible for presenting an evaluation of each impact along with appropriate supporting information. States should discuss and, where possible, quantify both beneficial and adverse impacts. In general, the analysis should focus on the direct impact of the control alternatives.

<u>Costs of Compliance</u>

In the regional haze rules and its BART guidance document, EPA has stated that states have flexibility in how costs are calculated. EPA has expressed its position that the Control Cost Manual provides a good reference tool for cost calculations, but also provided some flexibility in this matter. If there are elements or sources that are not addressed by the Control Cost Manual, or if there are additional cost methods that were not considered in the BART guidance document, EPA determined that these methods could serve as useful supplemental information.

EPA's guidance also explains that states should consider both the average and incremental annualized costs of a control, as both provide information that is helpful when making a control determination. EPA took great care to explain, however, that these kinds of calculations can be misused, and that both numbers should be reviewed carefully.

In its guidance, EPA provided an example where a state may be faced with choosing between two available control options. The first control option (Option A) achieves a good level of control for a reasonable cost. The second control (Option B) achieves a slightly greater emissions reduction at a significantly increased cost. In this scenario, EPA explained that if only the average costs for Options A and B were considered, the overall costs associated with Options and B would be considered reasonable. EPA stated that while this may seem sufficient, a state should continue to look at the cost associated with a small increase in pollution control for a significantly greater price. EPA called this cost the "incremental cost" and explained that it can be determined through the following equation:

$$\frac{[CostOptionA - CostOptionB]}{[TotalAnnualEmissionsOptionA - TotalAnnualEmissionsOptionB]}$$

EPA explained that by considering this incremental cost, a state may determine that the incremental cost per unit of pollution removed that is associated with Option B may be greater than the benefit of requiring the control. As a result, even though the average cost associated with both controls might be reasonable, the incremental cost may make one option more desirable than the other.

As stated earlier, ADEQ sees the BART determination process as being substantially similar to the BACT processes. While BACT has components that address visibility, the principal cost decisions are generally charged only to the pollutant that is being reduced. Visibility impacts, on the other hand, are quantified and considered as an environmental impact, rather than an economic impact. As a result, the most useful cost metric for comparing control technologies under BACT and LAER ends up being dollars-per-ton-of-pollutant-removed (dollars per ton).

Although the BART determination process is substantially similar to methodologies that are used to establish BACT and LAER, the entire purpose behind BART is to support Congress' goal of reducing visibility impairment in Class I areas. In addition, BART differs from BACT and LAER in that the environmental impacts of the selected control can only address issues that are not related to air quality. As a result, ADEQ has determined that in addition to a dollar per ton metric, the BART determination process should also provide lesser consideration to a dollar-per-deciview-improvement metric.

Energy Impacts

In its guidance, EPA suggests that states should also examine the energy requirements of the control technology to determine whether the use of that technology will result in energy penalties or benefits. For instance, if a control technology is required to remediate an emissions stream that is rich in volatile organic compounds, a facility might benefit by using this combustion process to reduce energy costs. Conversely, a facility that installs a wet scrubber may suffer an energy penalty due to the increased power necessary to overcome the increased air flow resistance through the scrubber.

It should be noted that unless there is ample justification, only direct energy benefits or penalties should be considered in this analysis. Indirect energy costs should not be considered unless there is something unusual or significant enough to warrant further consideration. It is appropriate for energy impact analyses to consider the local availability (or scarcity) of specific fuels, as well as the potential differences between locally or regionally available coals.

It is also important to note that adverse energy impacts are not enough, in and of themselves, to disqualify a technology from consideration. If such penalties or benefits exist, however, it is appropriate to document these and include them in this section so that the results of all of the analyses required in this Step can be considered as a whole.

Non-Air Quality Environmental Impacts

This portion of the analysis is to focus on impacts to environmental media other than air quality. Examples of common environmental impacts include hazardous waste generation, hazardous waste discharges, and discharges of polluted water from a control device.

All non-air quality environmental impacts should be reviewed using site-specific circumstances when possible. Should a state propose to adopt the most stringent BART option then it is not necessary to perform this analysis of environmental impacts for the entire list of technologies that were ranked in the previous Step. In general, the analysis only needs to address those control alternatives with any significant or unusual environmental impacts that have the potential to affect the selection of a control alternative, or to eliminate a more stringent control technology.

In general, states should identify and document any direct or indirect, significant or unusual environmental impacts that are associated with a specific control alternative. For example, a wet scrubber will release effluent that has the potential to affect water or land use. Other examples might include disposal of spent catalyst, or contaminated carbon from a filtration device. Such types of environmental impacts could become even more important with the potential for sensitive site-specific receptors, or when comparing control technologies that have similar or marginal air quality improvements but result in substantial environmental impacts.

Remaining Useful Life

The remaining useful life of a source should be considered in the evaluation of the different controls, as it has the potential to impact the overall cost analysis. If the remaining useful life represents a relatively short period of time, then the annualized costs associated with the application of a control technology will increase significantly. EPA explained in its guidelines that the remaining useful life is the difference between the date that controls will be put into place and the date that the facility permanently stops operations.

If the remaining useful life of the facility affects the BART determination, then this date should be placed into a federally or state-enforceable restriction that prevent further operation of that facility after that date. If a source wants to have the flexibility to continue operating after the date upon which operations are expected to cease, then the BART analysis may account for the option, but it must maintain consistency with the statutory requirement to install BART within 5 years. In addition, if the remaining useful life changes the BART decision as a result of adverse cost impacts, then the BART determination should identify the more stringent level of control that would be required as BART if there was no assumption that reduced the remaining useful life of the facility.

Step 6: Evaluate Visibility Impacts

This step is functionally equivalent to Step 5 in EPA's BART guidelines. Once a state has determined that its source or sources are subject-to-BART, a visibility improvement determination for the source(s) must be conducted as part of the BART determination. States have the flexibility in setting absolute thresholds, target levels of improvement, or de minimis levels for visibility improvement since the

deciview improvement must be weighed among the five factors. States are also free to determine the weight and significance to be assigned to each factor. For example, a 0.3 dv improvement may merit a stronger weighting in one case versus another. As a result, EPA does not recommend a "bright line" analysis to be used across all facilities that are subject-to-BART.

EPA's guidelines recommend the use of CALPUFF or another appropriate dispersion model to determine the visibility improvement expected at a Class I area from the potential BART control technology applied to the source. Modeling should be conducted for NOx emissions, direct PM emissions (PM2.5 or PM10), and SO2 emissions. If the source is making the visibility determination, States should review and approve or disapprove the source's analysis before making the expected improvement determination.

Arizona instituted a portion of this process by asking sources for a modeling protocol for each of the BART analyses that were submitted. Each source was then asked to run its model at pre-control and post-control emission rates using the accepted methodology in the protocol. Sources used the 24-hour average actual emissions rate from the highest emitting day of the meteorological period modeled, and calculated the model results for each receptor as the change in deciviews compared against natural visibility conditions. Post-control emissions rates were then calculated as a percentage of pre-control emissions rates.

Step 7: Select BART

This step is in addition to the five steps that are recommended in EPA's BART guidelines. States have discretion to determine the order in which they should evaluate control options for BART. EPA's guidance states that whatever the order, states should always address the five factors. In addition, states should provide a justification for whatever control option is selected. ADEQ has determined that the contents of the TSD will provide the necessary explanations.

10.6 Arizona Sources that Chose to Demonstrate "Not BART-Eligible"

<u>TEP – Irvington Generating Station</u>

On June 9, 2006, ADEQ sent a letter to the Western Regional Air Partnership's (WRAP's) Regional Modeling Center (RMC) requesting assistance in performing a CALPUFF modeling analysis for all BART-eligible sources. In the letter and supporting attachments, ADEQ identified Steam Unit I4 at Tucson Electric Power Company's (TEP's) Irvington Generating Station as potentially-BART-eligible emissions unit. The attachment to the letter went on to describe Unit I3 as also potentially-BART-eligible, as the emissions unit appeared to have been in existence in 1961, and the "in-service" date for the unit was not well documented in the files that ADEQ had reviewed.

On January 2, 2007, TEP submitted a letter to ADEQ providing information about the BART-eligibility of both Units I3 and I4. The letter explained that the issues to which it was specifically responding were:

- For Unit I3 – the date the unit began "operation"; and
- For Unit I4 – whether the coal conversion project effectively moved its "in existence" date to later than August 7, 1977.

Regarding Unit I3, TEP noted that in order for an emissions unit to be considered BART-eligible, the unit had to be "in existence" on August 7, 1977, but not "in operation" before August 7, 1962. According to the letter, Unit I3 commenced commercial operation on June 26, 1962. As documentation, TEP provided a work log from June 29, 1962, which indicates that "…Unit [I3] was placed in commercial operation on

Tuesday, June 26, 1962." After reviewing this documentation, ADEQ agrees that Unit I3 was "in operation" prior to August 7, 1962, and is, therefore, not BART-eligible.

Regarding Unit I4, TEP stated that during the 1980s, Unit I4 was converted to burn coal in accordance with a prohibition order that was issued pursuant to Section 301(c) of the Power Plant and Industrial Fuel Use Act of 1978. The Final Prohibition Order became effective on September 21, 1981, as noted in Federal Register Vol. 46, p. 37960. In its January 2, 2007, letter, TEP stated that compliance with the Final Prohibition Order required TEP to reconstruct Unit I4. According to 40 CFR 51.301, Reconstruction is defined as follows:

Reconstruction will be presumed to have taken place where the fixed capital cost of the new component exceeds 50 percent of the fixed capital cost of a comparable entirely new source. Any final decision as to whether reconstruction has occurred must be made in accordance with the provisions of § 60.15(f)(1) through (3) of this title.

TEP stated that because Unit I4 was reconstructed after August 7, 1977, the Unit was not "in existence" before August 7, 1977, and, therefore, must be considered "not BART-eligible".

In an electronic mail that was sent to a representative of TEP on May 15, 2007, ADEQ requested that TEP provide additional documentation that demonstrated that Unit I4 was reconstructed in the 1980s. On July 3, 2007, TEP submitted a supplemental letter to ADEQ, with the documentation that ADEQ had requested.

According to the July 3, 2007, the total cost for the Unit I4 coal conversion was reported in the 1987 FERC Form No. 1 to be approximately $125 million dollars, including the Unit I4 portion of the facilities that are shared by Units I3 and I4 (i.e., coal handling facility, water treatment, ash storage and disposal, etc.). In January of 1988, Unit I4 was sold in a leaseback arrangement for $152 million, which TEP argues approximates the fair market value for the Unit. TEP stated that because Unit I4 was essentially in new condition following the coal conversion, it is reasonable to conclude that the construction of a comparable new unit would not be significantly greater than $152 million. Based upon this information, TEP stated that the coal conversion cost was significantly greater than 50% of the fixed capital cost of a comparable, entirely new unit. As a result, TEP concluded that Unit I4 was reconstructed in the 1980s, effectively changing the "in existence" date to after August 7, 1977. As a result, TEP concluded that Unit I4 was "not BART-eligible".

After reviewing the information that was provided by TEP, including the relevant portions of the December 31, 1987, FERC Form No. 1 Annual Report of Major Electric Utilities, Licensees and Others, TEP's 1987 Annual Report, and a work sheet entitled "Estimated Cost of Irvington Unit 4 Coal Conversion", ADEQ concurs that the cost of modifying TEP Irvington's Unit I4 is greater than 50 percent of the fixed capital cost of a comparable, entirely new source, and that Unit I4 was reconstructed in the 1980s.

In Federal Register, Vol. 70, No. 128, Wednesday, July 6, 2005, pages 39110-39112, EPA discusses Step 2 in determining whether a facility is BART-eligible. According to the background statement in the guidance:

"Step 2 also addresses the treatment of 'reconstruction' and 'modifications.' Under the definition of BART-eligible facility, sources which were in operation before 1962 but reconstructed during the 1962 to 1977 time period are treated as new sources as of the time of reconstruction."

The footnote attached to this statement goes on to state:

"However, sources reconstructed after 1977, which reconstruction had gone through NSR/PSD permitting, are not BART-eligible."

At the time of TEP's 1987 reconstruction of Unit I4, reconstruction of most units at the Irvington Generating Station would have normally triggered the New Source Review (NSR) or Prevention of Significant Deterioration (PSD) permitting process. As TEP points out in its correspondence, however, TEP only commenced the reconstruction as a result of the an order that was issued pursuant to Section 301(c) of the Power Plant and Industrial Fuel Use Act of 1978. Arizona's PSD rule (Arizona Administrative Code, Title 9, Article 3, Rule 304 or A.A.C. R9-3-304) was approved into the State Implementation Plan in 1983. According to the PSD rule, all "major modifications" were required to obtain a PSD permit prior to construction and operation of the facility. The definitions that support this rule were found in A.A.C. R9-3-101. According to R9-3-101(91)[1] a major modification is defined as follows:

"Major modification" means any physical change in or change in the method of operation of a major stationary source that would result in a significant net emissions increase of any pollutant subject to regulation under this Chapter.
a. …
b. For the purposes of this definition the following shall not be considered a physical change or change in the method of operation:
i. …
ii. Use of an alternative fuel or raw material by reason of an order under Sections 2 (a) and (b) of the Energy Supply and Environmental Coordination Act of 1974 (or any superseding legislation) or by reason of a natural gas curtailment plan pursuant to the Federal Power Act;
iii. …
iv. …
v. …
vi. …
vii. …"

Pursuant to A.A.C. R9-3-101(90)(b)(ii), TEP's reconstruction of Unit I4 did not constitute a major modification at the time that the reconstruction occurred, and therefore Arizona's PSD rule did not apply. TEP's January 2, 2007, letter states that "TEP believes that PSD is immaterial to BART eligibility, as Reconstruction under the RHR makes no mention of PSD or any of its provisions. In fact, no where in its rules[footnote omitted] governing BART eligibility, does it state that being subject to PSD is a condition of Reconstruction under the RHR."

ADEQ has reviewed 40 CFR Part 51 Appendix Y, Section II.A.2 and has determined that EPA has addressed this issue:

"What is a 'reconstructed source?"

1. Under a number of CAA programs, an existing source which is completely or substantially rebuilt is treated as a new source. Such 'reconstructed' sources are treated as new sources as of the time of the reconstruction. Consistent with this overall approach to reconstruction, the definition of BART-eligible facility (reflected in detail in the definition of 'existing stationary facility') includes consideration of

1 http://yosemite.epa.gov/R9/r9sips.nsf/AgencyProvision/ABAB0C337F5775248825698C0064E741/$file/az+deq+r9-3-101.pdf?OpenElement

sources that were in operation before August 7, 1962, but were reconstructed during the August 7, 1962 to August 7, 1977 time period.
2. …
3. …
4. The 'in-operation' and 'in existence' tests apply to reconstructed sources. If an emissions unit was reconstructed and began actual operation before August 7, 1962, it is not BART-eligible. Similarly, any emissions unit for which a reconstruction 'commenced' after August 7, 1977, is not BART-eligible." (emphasis added)

ADEQ has determined that EPA's guidance does not specifically address situations where a facility was reconstructed after August 7, 1977, but was exempted from PSD review at the time that reconstruction occurred. ADEQ concludes, however, that the plain reading of EPA's guidance is most appropriate, and has determined that it is appropriate to treat reconstructed sources as new sources as of the time of the reconstruction. As a result, ADEQ concurs that the reconstructed Unit I4 at TEP's Irvington Generating Station was not "in existence" prior to August 7, 1977. Therefore, ADEQ has determined that there are no BART-eligible emissions units at TEP's Irvington Generating Station.

10.7 Arizona Sources that Chose to Demonstrate Not "Potentially-Subject-to-BART"

Arizona Portland Cement Company

On June 13, 2007, ADEQ sent a letter to Arizona Portland Cement Company (APCC) indicating that Kiln 4 was "potentially-subject-to-BART" for NO_X and PM emissions. ADEQ based the letter on its analysis of the facility as described in a June 9, 2006, letter to the Western Governor's Association; and its review of the February 28, 2002, Amended Application for a Class I Permit, the 2005 Significant Revision Application, and observations from performance testing results which indicated that Kiln 4 had the following potential NO_X and PM emissions:

Table 10.1 - Kiln 4 Emissions

Emissions Unit	NO_X emissions (lb/hr)	PM emissions (lb/hr)
Kiln 4	540.10	11.39

According to the letter, the WRAP's Regional Modeling Center conducted an air dispersion modeling analysis using CALPUFF which demonstrated that the maximum 98th percentile three-year average total impact from the facility was 0.40 dv. These visibility impacts were expected to occur in both the Saguaro National Monument and the Galiuro Wilderness area.

On September 10, 2007, APCC submitted a letter to ADEQ stating that it agreed that Kiln 4 was the only emissions unit that was in operation at the facility that was BART-eligible. The letter went on to state that because the 98th percentile three-year average total impact from this emissions unit was 0.40 dv, concluded that Kiln 4 does not "cause" or "contribute to" visibility impairment in any Class I area.

When weighing APCC's response, ADEQ also gave consideration to additional extenuating circumstances regarding Kiln 4. In 1998, APCC obtained a significant permit revision from ADEQ, allowing the company to modify portions of Kiln 4 in an effort to increase the amount of clinker that the company could produce while taking limitations designed to ensure that there was not a significant net emissions increase as a result of the project. After completing Phase I of the changes to Kiln 4, APCC determined that it was not realizing the additional clinker production projected to occur as a result of the

modification. In 2002 and 2003, APCC approached ADEQ with a new application for a permit revision, requesting the authority to construct a new Kiln 5 rather than finalizing the modifications to Kiln 4.

In 2003, during its review of a proposed Title V permit that would have provided APCC with the flexibility to choose between three operating scenarios, including the construction of Kiln 5, EPA identified an error in APCC's fugitive dust emissions calculations. According to EPA's calculations, the modifications that were completed in 1998 should have gone through New Source Review. As a result, EPA issued a Notice of Violation to APCC, alleging that the company avoided New Source Review when completing modifications to Kiln 4 in 1998. EPA also objected to the issuance of the proposed Title V permit, but later lifted its objection after ADEQ removed the alternative operating scenarios that would have allowed for further modification of the facility. A consent decree is being finalized between APCC and EPA to resolve the issue.

In 2008, ADEQ issued a new permit to APCC which would have allowed the facility to stop operations at all four existing kilns and construct and operate a new Kiln 6. The 18 month construction window ended in June 2010 and APCC has since reapplied for a permit for the Kiln 6 expansion.

Based upon the consideration of the history of this facility, and the maximum 98th percentile three-year average impact from all pollutants is less than 0.5. dv, ADEQ concurs that APCC is not subject-to-BART.

APS West Phoenix

On June 13, 2007, ADEQ sent a letter to the Arizona Power Service Company's West Phoenix Generating Station indicating that three emissions units, Combined Cycle Units 1 through 3, were "potentially-subject-to-BART" for NO_X emissions. ADEQ based the letter on its analysis of the facility as described in a June 9, 2006, letter to the Western Governor's Association; and its review of the July 2000 Title V Operating Permit Application, and February 24, 2006 Significant Revision Application which showed that the facility had potential NO_X emissions as follows:

Table 10.2 – APS West Phoenix NO_X Emissions

Emissions Unit	NO_X emissions (lb/hr)	NO_X emissions (tons/year)
Combined Cycle Unit 1 (NG)[a]	255.80	1,120
Combined Cycle Unit 2 (NG)[a]	255.80	1,120
Combined Cycle Unit 3 (SR app)[c]	405.10	1,774
Combined Cycle Unit 1 (oil)[b]	763.00	3,342
Combined Cycle Unit 2 (oil)[b]	763.00	3,342
Combined Cycle Unit 3 (SR app)[c]	405.10	1,774

a. NG indicated potential emissions while burning natural gas.
b. Oil indicates potential emissions while burning oil.
c. SR app means that the potential emission were to be limited as proposed in a significant permit revision application that was submitted on February 24, 2006.

On July 30, 2007, APS West Phoenix provided documentation to ADEQ demonstrating that the facility had accepted federally enforceable conditions in Maricopa County Air Quality Permit Number V95-006 that placed limits on emissions of air pollutants from the facility. Specifically, the permit states in Table 1 that the "Allowable Combined Emissions for CC3, CC4, CC5, the CC4 and CC5 Cooling Towers, and the

Clayton Boiler Emissions Units" for NOx was 405.1 tons per year. The same permit also limits the short term NO_X emissions for Combined Cycle Unit 3 to no more than 34.3 pounds per hour.

On September 6, 2007, APS West Phoenix submitted a letter to ADEQ identifying errors in the underlying assumptions that were the basis of ADEQ's June 13, 2007, letter. Specifically, the facility identified the following issues:

- The data used as the pound per hour emission rate for Combined Cycle Unit 3 were actually tons per year emissions limitations for multiple emissions units, rather than a pound per hour emission rate for that same unit;
- Combined Cycle Unit 3 is equipped with a Selective Catalytic Reduction (SCR) unit;
- Combine Cycle Unit 3's stack height was assumed to be 54 feet, whereas the actual stack height for the unit is 82 feet; and
- The air dispersion modeling analysis used West Phoenix emissions rates associated with fuel oil combustion. MCAQD prohibits the combustion of fuel oil except during periods of natural gas curtailments, and should not have been considered as a normal operating scenario.

APS West Phoenix stated that it would fix each of these assumptions, and resubmit an air dispersion modeling analysis that was performed by the WRAP's Regional Modeling Center with the adjusted values.

On October 7, 2007, APS West Phoenix submitted a second letter to ADEQ. In that letter, APS West Phoenix explained that it agreed with ADEQ's assessment that the Combined Cycle Units CC1, CC2 and CC3 were BART-eligible. APS West Phoenix stated, however, that after correcting the air dispersion modeling analysis using the assumptions identified above, the 98th percentile visibility impacts that ADEQ had predicted in the Superstition Wilderness and the Mazatzal Wilderness areas dropped from 0.69 dv and 0.64 dv, to 0.24 dv and 0.31 dv respectively.

Based on the revised air dispersion modeling analysis that was submitted on October 7, 2007, APS West Phoenix stated that it did not cause or contribute to regional haze in a Class I area, and therefore was not subject-to-BART. Based upon its review of the information that has been submitted, and a review of the conditions in Maricopa County Air Quality Permit V95-006, ADEQ concurs that this facility is not subject-to-BART.

ASARCO Hayden Smelter

On June 13, 2007, ADEQ sent a letter to the ASARCO Hayden Smelter indicating that Converters 1 through 5, and Anode Furnaces 1 through 3 were "potentially-subject-to-BART" for SO_2 and PM emissions. ADEQ based the letter on its analysis of the facility as described in a June 9, 2006, letter to the Western Governor's Association; and its review of the 1994 Application for a Class I Permit which showed that the facility had potential SO2 and PM emissions as follows:

Table 10.3 – ADEQ Modeled Emissions for ASARCO Hayden

Emissions Unit	SO_2 emissions (lb/hr)	PM emissions (lb/hr)
Acid Plant Main Stack (Converters 1-5, Anode Furnace 1-3)	114,000	115.83
Annulus Main Stack (bypass for main stack)	114,000	115.83
Flash Furnaces and Converter Fugitives	2,991	230.00

In Attachment 3 to the June 13, 2007, letter, ADEQ also identified the equipment that, according to Title V Permit 1000042, was potentially BART-eligible. That equipment included the following:

- Converters (5) – constructed in 1969
- Anode furnaces (1-3) – constructed in 1971

Finally, ADEQ's analysis revealed that in 2004, the actual emissions of PM_{10} from the facility was 157.3 tons per year. Because ADEQ was uncertain whether this number was representative of overall emissions of PM_{10} from the ASARCO Hayden Smelter through the years, the potential emission rate information for both SOx and PM was submitted to the WRAP's Regional Modeling Center. Based upon the information that ADEQ submitted, the WRAP's Regional Modeling Center provided ADEQ with the following modeled impacts:

Table 10.4 – WRAP Modeled Impact from ASARCO Hayden

Class I Area	98th % 3 Yr Avg. PM_{10} Impact (dv)	98th % 3 Yr Avg. SO_2 Impact (dv)
Galiuro Wilderness	0.53	2.23
Superstition Wilderness	0.41	2.39
Sierra Ancha Wilderness	0.13	1.46
Saguaro NM	0.23	1.64
Mazatzal Wilderness	0.09	1.22
Mount Baldy Wilderness	0.04	0.76
Pine Mountain Wilderness	0.05	0.93
Chiricahua NM	0.13	1.39
Gila Wilderness	0.05	0.78
Petrified Forrest NP	0.04	0.78
Sycamore Canyon	0.03	0.70

As a result, ADEQ determined that the facility was BART-eligible for PM_{10} and SO_2 emissions.

On October 1, 2007, ASARCO LLC submitted a letter to ADEQ stating that the company has already installed BART-equivalent controls on the necessary emissions units, and that further control was not necessary.

In its review of ADEQ's analysis, ASARCO pointed out that errors were made in ADEQ's identification of the BART-eligible source. According to their own research, ASARCO determined that the BART-eligible emissions units at their facility were as follows:

- Converters (3)
  - Three converters were in operation prior to 1962;
  - One converter was enlarged from 13 x 32 feet to 13 x 35 feet in 1965
  - Converters #1 and #4 were added in 1968.
- Anode Furnaces #1 and #2 – Constructed in 1972
  - Anode Furnace #0 was constructed in 2001

As a result, ASARCO went on to state that it concluded that only two or three of the converters were considered to be BART-eligible. ASARCO stated that because the air dispersion modeling analysis was performed based upon the use of the potential to emit from the entire facility, the predicted impacts from the facility were overstated. Instead, ASARCO stated that the following emissions should have been modeled:

Table 10.5 – ASARCO Modeled Emissions for ASARCO Hayden			
Unit	**NO_x (tpy)**	**PM_{10} (tpy)**	**SO_2 (tpy)**
Total for BART-eligible Emission Units	21.4[a] 23.3[b]	61.1[a] 70.0[b]	6,903[a] 10,337[b]

a. 2 converters
b. 3 converters

ASARCO stated that "[i]f [PM] emissions from the BART-eligible units alone are modeled the visibility impact would be below the 0.5 dv threshold. Therefore, BART determination is necessary only for SO_2."

ADEQ has reviewed its documentation, and ASARCO's arguments regarding BART eligibility, and ADEQ agrees with ASARCO's assessment of its BART-eligible emissions unit, with the clarification that the converter that was modified in 1965 is considered BART-eligible.

At the time that ADEQ was assessing BART eligibility, ADEQ based its analysis on the potential emissions from the entire facility, as it was not possible for ADEQ staff to apportion emissions to the specific emissions units based upon the information that had been submitted by ASARCO. As a result, ADEQ provided all of the potential PM and SO_2 emissions to the Regional Modeling Center, understanding that ASARCO would have the expertise necessary to apportion emissions to each emissions unit that was BART-eligible.

ASARCO's October 1, 2007, letter, however, lacked documentation that demonstrated how ASARCO apportioned the emissions to the BART-eligible equipment. ADEQ's analysis of the table only revealed that the apportionment of emissions to the emissions units is not linear, making it too difficult for ADEQ to replicate the submitted calculations. ADEQ, however, is in the process of reviewing ASARCO's application for renewing its existing Title V permit. As part of its review, ADEQ's staff has estimated the potential emissions from the emissions units at the facility. ADEQ's calculations reveal that the potential to emit PM_{10} from the entire primary copper smelter process is 213 tons per year. As noted above, only three converters and two anode furnaces are considered to be BART-eligible emissions units at the facility. Each of these emissions units is located within the primary copper smelting process. Since non-BART-eligible emissions units contribute to the total potential emissions of 213 tons per year, ADEQ concluded that the BART-eligible equipment at the ASARCO Hayden Primary Copper Smelter is not capable of emitting more than 250 tons per year of PM10. As a result, ADEQ determined that the emissions units at the ASARCO smelter are not BART-eligible for PM10 emissions.

With respect to SO_2 emissions, ASARCO stated the following:

> "During the deliberations of the Market Trading forum [sic] of the Western Regional Air Partnership (WRAP), all parties involved including ADEQ and the U. S. Environmental Protection Agency (EPA), agreed that the controls and emissions limitation for primary copper smelters already met BART for SO_2."

ADEQ understands that there may have been, at one time, a general principle to which U.S. EPA, ADEQ, and perhaps other parties agreed regarding the controls and emissions limitation for primary copper

smelters. According to ADEQ's interpretation of the Regional Haze Rules, and its application of EPA's BART guidelines, however, general principles are not enough to exempt a facility from a BART analysis. Instead, ADEQ has determined that it is necessary to evaluate ASARCO's facility for the potential applicability of BART.

Chemical Lime Company-Nelson Lime Plant

On June 13, 2007, ADEQ sent a letter to Chemical Lime Company's (CLC's) Nelson lime plant indicating that Kilns 1 and 2 were "potentially-subject-to-BART" for NOx and SO2 emissions. ADEQ based the letter on its analysis of the facility as described in a June 9, 2006, letter to the Western Governor's Association; and its review of the November 30, 2001, Amended Application for a Class I permit, as well as air quality control permit number 36425 which showed that the facility had potential NOx and SO2 emissions as follows:

Table 10.6 – ADEQ Modeled Emissions for CLC Nelson		
Emissions Unit	**SO_2 emissions (lb/hr)**	**NO_X emissions (lb/hr)**
Kiln 1	215.59	122.14
Kiln 2	484.27	182.78

Using these emissions rates, and modeling information about the facility from the sources identified above, the WRAP's Regional Modeling Center provided ADEQ with the following modeled impacts:

Table 10.7 – WRAP Modeled Impact from CLC Nelson			
Class I Area	**98th % 3 Yr Avg. NOx Impact (dv)**	**98th % 3 Yr Avg. SO2 Impact (dv)**	**98th % 3 Yr Avg. Total Impact (dv)**
Grand Canyon NP	0.38	0.32	0.74
Sycamore Canyon WA	0.06	0.13	0.18
Zion NP	0.10	0.11	0.20
Pine Mountain Wilderness	0.03	0.08	0.10
Mazatzal Wilderness	0.03	0.08	0.11
Bryce Canyon NP	0.05	0.07	0.11
Joshua Tree NM	0.03	0.12	0.14
Sierra Ancha Wilderness	0.02	0.06	0.07
Superstition Wilderness	0.02	0.07	0.08

On September 21, 2007, CLC submitted a letter to ADEQ along with a new modeling analysis indicating that "…the 3-year average of the 8th highest visibility change is less than 0.5 dv in all Class I areas." Based upon its review of the new modeling analysis, Chemical Lime concluded that the Nelson facility did not cause or contribute to visibility impairment in any Class I area, and that the emissions units were, therefore, not subject-to-BART.

According to the documentation submitted in support of the new modeling analysis, Chemical Lime estimated its emission rates of NO_X, SO_2 and PM for the BART applicability modeling analysis using the maximum production rates achieved by each kiln during the meteorological period that was modeled (a method which can result in the over prediction of actual impacts on an annual basis), and from using

representative emissions factors that were derived from source testing performed at the Nelson facility. The emission rates that CLC modeled are as follows:

Table 10.8 – CLC Modeled Emissions for CLC Nelson		
Emissions Unit	**SO_2 Emissions (lb/hr)**	**NO_X Emissions (lb/hr)**
Kiln 1	117.8	95.23
Kiln 2	375.5	99.20

According to ADEQ's review of the modeling analysis, none of the other fixed parameters (i.e., elevation, stack height, stack diameter, exhaust gas velocity, and exit temperature) were significantly modified in CLC's analysis. The only difference noted was that the elevation of the facility used by ADEQ was 1,570.7 meters above sea level, whereas the company reported the elevation to be 1,570.3 meters above sea level. Because the difference between the two parameters was less than half of a meter (approximately 1.5 feet) ADEQ determined that the change was not significant.

The resulting modeling impacts from the screening assessment performed by CLC, as documented in the September 21, 2007, submission and a May 28, 2009, electronic mail to ADEQ, were as follows:

Table 10.9 – Modeled Impact from CLC Nelson			
Class I Area	**98th % 3 Yr Avg. NOx Impact (dv)**	**98th % 3 YR Avg. SO2 Impact (dv)**	**98th % 3 Yr Avg. Total Impact (dv)**
Grand Canyon NP	0.291	0.205	0.498
Sycamore Canyon WA	0.015	0.107	0.123
Zion NP	0.054	0.081	0.136
Pine Mountain Wilderness	0.003	0.069	0.072
Mazatzal Wilderness	0.017	0.056	0.073
Bryce Canyon NP	0.026	0.048	0.074
Joshua Tree NM	0.014	0.093	0.108
Sierra Ancha Wilderness	0.010	0.039	0.049
Superstition Wilderness	0.009	0.045	0.054

As can be seen from the table above, the company's modeling analysis showed that the 98th percentile, three-year average total impact from the plant was predicted to be less than 0.5 dv for every Class I area within 300 kilometers of the facility. The company also recognized, however, that the predicted impacts within the Grand Canyon were marginally below 0.5 dv. As a result, the company stated that "[a]lthough the maximum visibility change obtained in the screening modeling analysis is not equal to or greater than the 0.5 dv contribution threshold, a refined analysis was performed in which light extinction in the Grand Canyon National Park was calculated using the CALPOST-IMPROVE implementation of the revised light extinction algorithm…" Based upon the refined analysis, the 98th percentile (8th highest) Visibility Change in the Grand Canyon was calculated to be as follows (Table 10.10):

Table 10.10 – Modeled Impact from CLC Nelson at the Grand Canyon NP				
Class I Area	98th Percentile (8th highest) Visibility Change (dv)			
	2001	2002	2003	Average
Grand Canyon NP	0.417	0.379	0.585	0.460

Based upon its refined visibility change analysis, CLC determined that the visibility change attributable to the Nelson facility is below 0.5 dv, and it concluded that the facility does not significantly contribute to visibility impairment within the Grand Canyon National Park. As a result, CLC determined that the results of the analysis indicated that the 3-year average of the 8th highest visibility change was less than 0.5 dv in all Class I areas within 300 km of the facility, and concluded that its Nelson facility was not-subject-to-BART.

Based upon the consideration of the analysis performed for this facility, CLC's conservative approach for estimating emissions impacts during the meteorological period, and the maximum 98th percentile three-year average impact from all pollutants is less than 0.5 dv, ADEQ concurs that the Chemical Lime Company's Nelson Lime Plant is not subject-to-BART.

Freeport McMoRan Miami Smelter

On June 13, 2007, ADEQ sent a letter to Freeport McMoRan Miami Inc (FMMI) indicating that the Miami Smelter Converters 1 through 5; the Remelt Vessel and the Acid Plant were "potentially-subject-to-BART" for SO2 and PM emissions. ADEQ based the letter on its analysis of the facility as described in a June 9, 2006, letter to the Western Governor's Association; and its review of the Air Quality Permit Number 1000046, and the application for Air Quality Permit Number 1000046 which showed that the facility had potential SO2 and PM emissions as follows:

10.11 – ADEQ Modeled Emissions from FMMI		
Emissions Unit	SO_2 emissions (lb/hr)	PM emissions (lb/hr)
Acid Plant Tailgas Stack (Converters 1-5)	820.0	20.40
Vent Fume Stack (Electric Furnace Stack)	312.0	56.30
Shaft Furnace Stack	0.030	4.110
Smelter Fugitives	1288	48.55
Rod Plant Fugitives	0.000	0.100

On July 17, 2007, FMMI responded stating that "although, we do not disagree with the results that the Miami facility is subject-to-BART, because the visibility impact was greater than 0.5 dv at the Superstition Wilderness area, we would like to point out some corrections in the emissions points and emissions used in the modeling." According to the letter, FMMI disputed the stack height, diameter and velocity values that were used for the Vent Fume Stack and the emissions release point and temperature for fugitive emissions from the smelter that ADEQ provided to the WRAP's RMC in its June 9, 2006, letter. FMMI also reported that the Rod Plant shaft furnace should not have been included as part of the smelter, and the acid plant preheater was installed in 1991 as part of the company's ISA modification.

On August 3, 2007, FMMI provided another letter to ADEQ, presenting several bases for streamlining the BART review for the FMMI Smelter. According to the letter, FMMI stated that it believed that only the following emissions units at the facility constituted the "source subject-to-BART":

- The electric furnace (installed in1974);
- The four Hoboken Converters (Converters # 2-5) (installed in 1974); and
- The remelt/mold pouring vessel (installed approximately 1974).

FMMI then provided ADEQ with information regarding the five steps that EPA proposed in its BART guidance, but indicated that EPA provided the option for streamlining the review. According to FMMI's letter, EPA's guidance at 40 CFR Part 51, Appendix Y, § IV(C) states:

> "For VOC and PM sources subject to MACT standards, States may streamline the analysis by including a discussion of the MACT controls and whether any major new technologies have been developed subsequent to the MACT standards."

FMMI's letter goes on to provide a "streamlined review" of emissions from relevant emissions units at the FMMI smelter, and justification for the Rod Plant Shaft Furnace being separated from the BART-eligible source, as this furnace is not part of a listed source category.

After verbal discussions with ADEQ staff regarding the August 3, 2007, letter, FMMI submitted a final letter regarding the matter to ADEQ on November 29, 2007. In this letter, FMMI provided additional information to supplement the August 3, 2007, letter. In the letter, FMMI provides additional citations for the streamlined BART reviews for SO2 and PM emissions at the Miami Smelter.

After reviewing the information that was submitted by FMMI, ADEQ agrees it is necessary to evaluate FMMI's facility for the potential applicability of BART through its process for conducting a BART analysis.

10.8 Arizona Sources that Required a BART Analysis

Pursuant to the discussion in the previous Section, the following six facilities were identified as having to conduct a BART analyses. Due to the case-by-case nature of the BART analyses, ADEQ has included specific sections in this technical support documents for each of these facilities. A brief summary of the circumstances leading to ADEQ's subject-to-BART determinations are as follows:

Catalyst Paper (Snowflake) Inc. (CPSI) formerly Abitibi Consolidated

On June 13, 2007, ADEQ sent a letter to Abitibi Consolidated indicating that Power Boiler 2, a coal-fired boiler at the paper and pulp mill was "potentially-subject-to-BART" for SO_2 and NO_X emissions. ADEQ based the letter on its analysis of the facility as described in a June 9, 2006, letter to the Western Governor's Association, and its review of the Title V Permit Application –Amended Version submitted in March 2000 which showed that the facility had potential NO_X and SO_2 emissions as follows:

Table 10.12 – ADEQ Modeled Emissions for CPSI

Emissions Unit	NO_X emissions (lb/hr)	SO_2 emissions (lb/hr)
Power Boiler 2	555.00	915.00

On October 23, 2007, Abitibi Consolidated provided a BART analyses to ADEQ. ADEQ's analysis and BART determination for CPSI can be found in Appendix D of this document.

Arizona Electric Power Cooperative, Inc. – Apache Generating Station

On June 13, 2007, ADEQ sent a letter to Arizona Electric Power Cooperative Inc.'s (AEPCO's) Apache Generating Station indicating that Steam Units 1 through 3 were "potentially-subject-to-BART" for NO_X and SO_2 emissions. ADEQ based the letter on its analysis of the facility as described in a June 9, 2006, letter to the Western Governor's Association; and its review of the Air Quality Permit Number 35043, and the January 6, 2005, application for Class I Permit Renewal, which showed that the facility had potential NO_X and SO_2 emissions as follows:

Table 10.13 – ADEQ Modeled Emissions from AEPCO		
Emissions Unit	**NO_X emissions (lb/hr)**	**SO_2 emissions (lb/hr)**
Steam Unit #1	264.90	0.57
Steam Unit #2	576.47	1.24
Steam Unit #3	576.47	1.24

In July of 2007, AEPCO scheduled a meeting with ADEQ to discuss its concurrence that the facility was subject-to-BART. In the meeting, AEPCO indicated that the information that was provided to the WRAP's RMC was based upon Steam Units #2 and #3 burning natural gas, rather than coal. AEPCO discussed a proposed modeling protocol with ADEQ, and explained that when modeling its baseline conditions, AEPCO would use the emission rates associated with burning coal at the facility.

On January 2, 2008, AEPCO provided its BART analysis to ADEQ. ADEQ's analysis and BART determination for AEPCO's can be found in Section XI of this document.

APS Cholla Power Plant

On June 13, 2007, ADEQ sent a letter to Arizona Public Service's (APS's) Cholla Generating Station indicating that Steam Units 1 through 4 were "potentially-subject-to-BART" for NO_X, PM, and SO_2 emissions. ADEQ based the letter on its analysis of the facility as described in a June 9, 2006, letter to the Western Governor's Association, and its review of the application for Air Quality Permit Number 46353:

Table 10.14 – ADEQ Modeled Emissions from APS Cholla			
Emissions Unit	**NO_X emissions (lb/hr)**	**PM emissions (lb/hr)**	**SO_2 emissions (lb/hr)**
Unit #1	279.40	38.10	304.8
Unit #2	646.40	293.80	705.10
Unit #3	644.40	87.90	351.50
Unit #4	1,086.80	384.10	3,414.40

In August of 2007, representatives of APS's Cholla Generating Station met with representatives of ADEQ to discuss some outstanding questions that the company had regarding ADEQ's analysis. During the course of that meeting, APS provided a copy of Arizona Public Service Company Correspondence that was sent to Gus Hansen, Supt. at Cholla S.E.S. entitled "Operating Notes For May 1962". According to information provided by this document, "[o]n Tuesday, May 1, 1962, unit [#1] placed into commercial operation." As a result, APS argued that Unit #1 was "in operation" prior to August 7, 1962, and therefore was not BART-eligible. After reviewing this documentation, ADEQ concurs that Unit #1 was

never BART-eligible. On September 13, 2007, APS provided a letter to ADEQ providing a schedule for the submission of a modeling protocol and conducting a BART analysis with the goal of providing the final BART analysis on December 14, 2007. In December of 2007, ADEQ received the BART analysis. ADEQ's analysis and BART determination for the APS Cholla Power Plant can be found in Appendix D.

ASARCO Hayden Smelter

ADEQ has determined that a BART analysis regarding SO_2 emissions from this facility must be completed. ADEQ's review and determination based upon its own analysis of the facts and the information that ASARCO had provided can be found in Appendix D.

Freeport-McMoRan Miami Smelter

ADEQ has determined that a BART analysis regarding PM and SO_2 emissions from this facility must be completed. ADEQ's review and determination based upon its own analysis of the facts and the information that Freeport-McMoRan Miami Inc. had provided can be found in Appendix D.

SRP Coronado Generating Station

On June 13, 2007, ADEQ sent a letter to Salt River Project's (SRP's) Coronado Generating Station indicating that Units 1 and 2 were "potentially-subject-to-BART" for PM, SO_2 and NO_X emissions. ADEQ based the letter on its analysis of the facility as described in a June 9, 2006, letter to the Western Governor's Association, and its review of the August 21, 2003 Application for Class I Permit Renewal which showed that the facility had potential NO_X, PM, and SO_2 emissions as follows:

Table 10.15 – ADEQ Modeled Emissions for SRP Coronado

Emissions Unit	NO_X emissions (lb/hr)	PM emissions (lb/hr)	SO_2 emissions (lb/hr)
Unit #1	3,303	472	3,775
Unit #2	3,303	472	3,775

On August 22, 2007, representatives of SRP's Coronado Generating Station met with ADEQ to discuss issues that were unique to the Coronado Generating Station, including a potential settlement with EPA regarding alleged New Source Review violations that would address NOx and SO2 emissions. In addition, the company provided a proposed response to ADEQ's request for a BART analysis.

In February 2008, SRP provided its BART analysis to ADEQ. On August 12, 2008, EPA announced a "…major Clean Air Act (CAA) New Source Review (NSR) settlement agreement with [SRP]…" EPA explained that "[u]nder the settlement, SRP will spend over $400 million between now and June 2014, to install state-of-the-art pollution control technology for the reduction of sulfur dioxide (SO2) and nitrogen oxides (NO_X)."

ADEQ's analysis and BART determination for the SRP Coronado Generating Station can be found in Appendix D.

CHAPTER 11: REASONABLE PROGRESS GOAL DEMONSTRATION

11.1 Reasonable Progress Requirements

40 CFR 51.308(d)(1) requires that for each Class I area, the state must establish goals (expressed in deciviews) that provide for reasonable progress towards achieving natural visibility conditions in 2018 and to 2064. The reasonable progress goals (RPGs) must provide for improvement in visibility for the most-impaired (20% worst visibility) days over the period of the SIP and ensure no degradation in visibility for the least-impaired (20% best visibility) days over the same period.

In establishing RPGs, the state must estimate the 2018 URP at each Class I area. The state must consider the URP and the emission reductions needed to achieve it for the period covered by the plan. If the state ultimately establishes a RPG that provides for a slower rate of visibility improvement than would be required to meet natural conditions by 2064, the state must demonstrate how the URP is not reasonable at this time and that the state's goal is reasonable given current conditions, based on the four-factors. In addition, the state must provide to the public an assessment of the number of years it would take to achieve natural conditions if improvement continues at the rate selected by the state.

Four factors must be considered when establishing the RPGs: 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 potentially affected sources. The state must also include a demonstration showing how factors were taken into consideration in selecting the goals.

11.2 The Process for Determining Reasonable Progress

The following steps were followed in setting the RPGs for each Arizona Class I area:

1. Compare Baseline to Natural Conditions

For each Class I area, identify baseline (2000-2004) visibility and natural conditions in 2064 for the 20% worst and best days. See Chapter 6.

2. Identify the Uniform Rate of Progress

For each Class I area, calculate the URP glide path from baseline to 2064, including the 2018 planning milestone for the 20% worst days. Show the URP glide path in both total deciview and by pollutant in deciview. Next, identify the improvement needed by 2018 and 2064, respectively. See Chapter 6.

3. Identify the Contributing Pollutants

For each Class I area, identify the pollutant species that are contributing to visibility impairment on the current (baseline) 20% worst and 20% best days. See Chapter 7.

4. Identify the Major Emission Sources within the State and Trends

Using the WRAP Emission Inventory for 2002 and 2018, describe statewide emissions by source category and pollutant, and identify projected emission trends from current (2002) to the 2018 planning milestone. See Chapter 8.

5. Analyze the Larger Sources Categories Contributing to Impairment

For each Class I area, determine the relative contribution of anthropogenic and nonanthropogenic sources in Arizona and neighboring states to the 20% worst and 20% best days using monitoring data, source apportionment and modeling results. Compare these results to baseline (2000-2004) to 2018 on-the-books emissions reductions expected. Review these results by pollutant. See Chapter 9.

6. Document the Emission Reductions from BART

Describe the results of the BART process and identify the emissions reductions that will be achieved from BART and other measures. See Chapter 10.

7. Identify the Projected Visibility Change in 2018 from "on-the-books" Controls and BART

For each Class I area, determine the visibility improvement expected in 2018 from on-the-books controls and BART using the WRAP CMAQ modeling results for the 20% worst and 20% best days. Identify the extent of visibility improvement related to the 2018 URP milestone in total deciview and in extinction by pollutant. See Chapter 9.

8. Identify Sources or Source Categories that are Major Contributors and Conduct the Four-Factor Analysis

As a result of the analysis under step 5, for each Class I area, determine key pollutant species and source categories that have the greatest affect on visibility in Arizona Class I areas. Analyze using the four-factor analysis. See Chapter 11.

9. Describe the Results of the Four-Factor Analysis

Section 11.3 describes the results of the four-factor analysis.

10. Set the Reasonable Progress Goals (RPG) Based on Steps 7, 8, and 9

Set the RPG for each Class I area in deciview, based on the improvement in 2018 for the 20% worst and best days, from on-the-books controls, BART, and the results of the four-factor analysis on major source categories. See Section 11.4.

11. Compare RPG to the 2018 URP Milestone. Provide an Affirmative Demonstration that Reasonable progress is being made based pollutant trends, Emission Reductions, and Improvements Expected under the Long-Term-Strategy.

For each Class I area, compare the RPG developed in Step 10 to the 2018 URP milestone. Provide an affirmative demonstration that reasonable progress is being made based on pollutant treads, emissions reductions from major anthropogenic source categories, and on-the-books controls. Describe the results of the four-factor analysis in step 9 above, and how future actions identified in the Long-Term Strategy are expected to improve visibility in the next 10 years to the 2018 milestone and beyond.

11.3 Summary of the Four-Factor Analysis

Section 308(d)(1)(i)(A) of the Regional Haze Rule requires that states consider the following factors and demonstrate how they were taken into consideration in selecting the reasonable progress goals:

- costs of compliance
- time necessary for compliance
- energy and non-air quality environmental impacts of compliance, and
- remaining useful life of any potentially affected sources.

In conducting this four-factor analysis, EPA guidance indicates that states have "considerable flexibility" in how these factors are taken into consideration, in terms of what sources or source categories should be included in the analysis, and what additional control measures are reasonable.

11.3.1 Rationale and Scope of the Four-Factor Analysis

The state considered certain source categories in applying the four factors. The following rationale was used for the four-factor analysis:

1. Focus on 20% worst visibility days.

Since the Regional Haze Rule primarily focuses on demonstrating reasonable progress for the 20% worst days, the four-factor analysis in this section addresses only the worst days. It is a reasonable assumption that emission reductions benefiting the worst days also benefits the best days. The CMAQ modeling projections in Chapter 9 and reasonable progress demonstration in this chapter both indicated that the 20% best days are maintained for most of the Class I areas in Arizona.

2. Focus on anthropogenic sources.

Since the purpose of this analysis is to evaluate certain sources or source categories for potential control, the four-factor analysis in the section addresses only anthropogenic sources, on the assumption that the focus should be on sources that are "controllable". Although nonanthropogenic sources such as wildfire and dust are major contributors to regional haze, ADEQ has determined this analysis is not applicable to these sources. In considering which anthropogenic sources or source categories to apply the statutory factors, ADEQ considered point, area, mobile, and fire (controlled burning).

For mobile sources, there are major emissions reductions projected by 2018 based on numerous "on-the-books" federal and state regulations, as described in detail in Section 11.4 and in Section 12.5 as part of on-going implementation under the LTS. There are also significant visibility improvements projected by 2018 due to these reductions, as Chapter 9 PSAT results indicate. Based on the above findings, ADEQ does not believe applying the four-factor analysis to mobile sources is necessary.

For fire sources, forestry and agricultural burning are large anthropogenic sources. as described in detail in Section 12, both of these activities are controlled under state-run smoke management programs that meet all of the requirements for an Enhanced Smoke Management Program (ESMP), and as such represent an advanced level of smoke management. Both of these activities are also addressed under the Arizona Visibility Program. In Section 12, ADEQ has identified future efforts to evaluate new methods of protecting Class I areas from forestry burning. Based on current controls and future efforts, ADEQ did not believe applying the four-factor analysis to forestry and agricultural burning was needed.

As a result of the above consideration, ADEQ elected to focus the four-factor analysis on point and area sources only. Additional details are provided in the following sections.

3. Focus on SO_2 and NO_X pollutants.

Although there are six visibility impairing pollutants, SO_2 and NO_X (sulfate and nitrate) are typically associated with anthropogenic sources. As noted in Chapter 8, sulfates and nitrates are about three times more effective at impairing visibility than $PM_{2.5}$. Since a large component of particulate (both fine and course is associated with nonanthropogenic sources, such as wildfire and natural windblown dust, this pollutant was not included in the analysis.

11.3.2 Identification of Point and Area Sources for the Four-Factor Analysis

ADEQ maintains the focus on point and area sources of SO_2 and NO_X for applying the four-factor analysis is consistent with EPA guidance, in terms of flexibility to consider which major source categories are "reasonable" to evaluate for the first planning period of the regional haze plan.

As described in Chapter 8 and 9, it is important to note that there are reductions projected in 2018 in SO_2 and NO_X emissions and effects from point and area sources. This trend was a consideration in the four-factor analysis, in terms of what source categories ADEQ considered for this analysis. Large reductions in SO_2 and NO_X were also used as supporting evidence in the demonstration that the reasonable progress goals selected were "reasonable".

The first step in the four-factor analysis is to identify the sulfate and nitrate contribution within Arizona. Table 11.1 shows the modeled sulfate and nitrate effects on the 20% worst days in 2018, based on PSAT modeling results, at each Class I area in Arizona. This table shows that the range of the Arizona portion on the worst days is from 6-24% for sulfate, and 7-54% for nitrate. The 2018 modeled concentration is used here to show projected contribution, in order to assess what further emission reductions would be beneficial in achieving reasonable progress.

Table 11.1 – Arizona Share of Modeled Sulfate and Nitrate in 2018 on 20% Worst Days

Arizona Class I Area	Sulfate			Nitrate		
	2018 Total Sulfate (ug/m^3)	2018 Arizona Sulfate (ug/m^3)	2018 Arizona Sulfate Share (%)	2018 Total Nitrate (ug/m^3)	2018 Arizona Nitrate (ug/m^3)	2018 Arizona Nitrate Share (%)
Chiricahua NM, Chiricahua W, Galiuro W	0.92	0.06	6.52%	0.14	0.01	7.14%
Grand Canyon NP	0.62	0.06	9.68%	0.17	0.06	35.29%
Mazatzal W, Pine Mountain W	0.82	0.09	10.98%	0.28	0.13	46.43%
Mount Baldy W	0.77	0.14	18.18%	0.13	0.05	38.46%
Petrified NP	0.80	0.19	23.75%	0.12	0.01	8.33%
Saguaro NP – West Unit	1.0	0.13	13.00%	0.45	0.22	48.89%
Saguaro NP – East Unit	1.2	0.17	14.17%	0.28	0.15	53.57%
Sierra Ancha W	0.91	0.12	13.19%	0.11	0.04	36.36%
Superstition W	0.93	0.16	17.20%	0.38	0.20	52.63%
Sycamore Canyon W	0.58	0.05	8.62%	0.26	0.11	42.31%

The next step in the analysis is to identify the larger point and area source categories within the state. Table 11.2 shows the sulfate and nitrate point and area categories in Arizona, based on their projected emissions in 2018, as identified in Chapter 8 (the PRP18b emission inventory). These categories are external combustion boilers, industrial processes, internal combustion engines, stationary fuel combustion, and waste disposal. The table shows the tons per year of each pollutant, as the extent of the contribution. Excluded from these source categories are sources evaluated under BART.

Table 11.2 – 2018 Projected Emissions from Arizona's Largest Source Categories

Pollutant	Type	Source Category	Extent of Contribution (tons per year)
SO_2	Point	External Combustion Boilers	15,871
	Point	Internal Combustion Engines	185
	Point	Industrial Processes	41,118
	Area	Stationary Source Fuel Combustion	3,127
	Area	Waste Disposal, Treatment, and Recovery	272
NO_X	Point	External Combustion Boilers	48,062
	Point	Internal Combustion Engines	11,068
	Point	Industrial Processes	9,510
	Area	Stationary Source Fuel Combustion	10,190
	Area	Waste Disposal, Treatment, and Recovery	2,357

11.3.3 Non-BART Sources

In its analysis of non-BART sources, ADEQ included all sources that had actual emissions over 40 tons per year of NO_X and SO_2. In analyzing the inventory of sources, ADEQ determined that the evaluation could be meaningfully conducted by categorizing the inventory based on the significant emission units involved. The table below summarizes the categories that were considered:

Table 11.3 - Non-BART Source Categories

Source Type	Number of Facilities
Internal Combustion Engines and Turbines	31
Boilers	7
Asphalt Plants	3
Lime Plants	2
Portland Cement Plants	2
Primary Copper Smelters	2
Nitric Acid Plants	1

It should be noted that the first two categories, internal combustion engines and turbines and boilers, cover a large number of equipment both in the subsequent categories and at facilities not listed above. For example, many asphalt plants use internal combustion engines as a power source.

Emission sources subject-to-BART were not included since source-specific determinations were made for those sources. However, non-BART emission units at facilities that were identified as subject to BART were included in the evaluation. In this section, significant source categories are evaluated. Visibility impacts from these source categories were not estimated.

1. Internal Combustion Engines/Combustion Turbines

This category includes commercial and institutional sources, electric generation, industrial engines, and engine testing. The primary sources are engines burning natural gas, which include natural gas-fired reciprocating internal combustion engines and natural gas-fired turbines, and engines burning diesel fuel. Generally speaking, low-emission combustion, steam injection, selective catalytic reduction, and selective non-catalytic reduction are considered potentially-viable NO_X control strategies. It should be noted that most of these engines are fueled by fuel oil or natural gas. Emissions of SO_2 from the burning of natural gas are expected to be negligible. At this time, fuel oil combusted in these units is expected to have very low sulfur in it. In many cases, it amounts to 15 ppm of sulfur. Consequently, the SO_2 emissions resulting from these units are expected to be minimal.

In the Department's evaluation of this category, it was determined that a significant number of engines are portable in how they operate. Since these emission units are portable, it is difficult to perform a site-specific analysis addressing visibility impacts for these units. Portable equipment can stay at one site for as little as week before moving to another site. Additionally, many of the engines considered are not used as process-support engines but solely for backup purposes when commercial power supply is interrupted. In that regard, it can reasonably be presumed that the actual emissions from emergency backup engines will be minimal (typically emergency engines are run for one hour each week to check the operability of the engine).

There are multiple state and federal regulations that apply to this source category. These regulations are technology-based requirements that stipulate emission limitations and operational restrictions to ensure that emissions of NO_X and SO_2 are minimized.

The following list identifies potentially applicable federal requirements:

- 40 CFR 60 Subpart IIII (Standards of Performance for Reciprocating Internal Combustion Engines)
- 40 CFR 60 Subpart JJJJ (Standards of Performance for Spark Ignition Engines)
- 40 CFR 60 Subpart GG (Standards of Performance for Stationary Gas Turbines)
- 40 CFR 60 Subpart KKKK (Standards of Performance for New Stationary Gas Turbines)
- 40 CFR 63 Subpart ZZZZ (National Emission Standards for Internal Combustion Engines)
- 40 CFR 63 Subpart YYYY (National Emission Standards for Combustion Turbines)

In addition, for older engines and turbines, Arizona Administrative Code R18-2-719 (Standards of Performance for Existing Stationary Rotating Machinery) applies.

As part of this assessment, the Department reviewed the information in the report titled "Supplementary Information for Four Factor Analyses by WRAP States" dated May 4, 2009. In review of the document, the Department was not able to ascertain the viability of the control options for a variable range of engine and turbine vintage and size. Additionally, the cost computations for the various technology options appeared to be derived from a generic costing tool called AIRControlNet. The Department has determined that the information presented in the report cannot be meaningfully adapted for the purposes of developing a four-factor analysis. In this regard, the Department has determined that it is not possible to complete a four-factor analysis without a major investment of resources, and an exhaustive facility-by

facility review to evaluate each unit, which is beyond the scope and effort required in this first Regional Haze SIP therefore no further analysis was conducted.

2. External Combustion Boilers

This source category consists of electricity generating, industrial, and commercial boilers.

Generally speaking, low-NO_X burners, over-fire air systems, flue gas recirculation, SCR and SNCR are considered viable NO_X control strategies for this source category. Spray dry absorber flue gas desulfurization systems, and the use of low sulfur fuel are considered viable control strategies for sulfur dioxide emissions.

There are multiple state and federal regulations that apply to this source category. These regulations s are technology based standards that stipulate emission limitations and operational restrictions to ensure that emissions of NO_X and SO_2 are minimized.

The following list identifies potentially applicable federal requirements:

- 40 CFR 60 Subpart D, Da, Db, Dc (Standards of Performance for Fossil Fuel-fired Steam Generators and Electric Utility Steam Generating Units)
- 40 CFR 63 Subpart DDDDD (National Emission Standards for Hazardous Air Pollutants for Industrial, Commercial, and Institutional Boilers and Process Heaters at Major Sources proposed on June 4, 2010)
- 40 CFR 63 Subpart JJJJJJ (Area Source Boiler MACT proposed June 4, 2010)
- Additionally a comprehensive rule under 40 CFR 63 is expected for electric utilities by November 2011.

In addition, for older boilers, A.A.C. R18-2-703 and 724 (Standards of Performance for Fossil Fuel fired Steam Generators and General Fuel-burning Equipment) applies.

As part of this assessment, the Department reviewed the information in the report titled "Supplementary Information for Four Factor Analyses by WRAP States" dated May 4, 2009. In review of the document, the Department was not able to ascertain the viability of the control options for a variable range of boiler vintage and size. Additionally, the cost computations for the various technology options appeared to be derived from a generic costing tool called AIRControlNet. The Department has determined that the information presented in the report cannot be meaningfully adapted for the purposes of developing a four-factor analysis. In this regard, the Department has determined that it is not possible to complete a four-factor analysis without a major investment of resources, and an exhaustive facility-by facility review to evaluate each unit, which is beyond the scope and effort required in this first Regional Haze SIP therefore no further analysis was conducted.

3. Asphalt Plants

This source category includes facilities that produce asphaltic concrete. The main sources of NO_X and SO_2 emissions are the drum dryer and supporting internal combustion engines. The engines are addressed in Section 11.3.3.1. Many asphalt plants in Arizona are portable sources. These facilities typically only operate at a single location for a limited duration, depending on contractual obligations and product demand. Since many of these emission units are portable, it is difficult to perform a site-specific analysis addressing visibility impacts for these units.

Asphalt plants in Arizona are permitted as minor sources of emissions. Typically, each facility accepts an hourly, production, or emissions limit that reduces the emissions of NO_X and SO_2 emitted into the atmosphere. Most modern drum dryers are equipped with low-NO_X burners and other combustion technology that reduce NO_X emissions.

Cost of Compliance

In review of literature for retrofitting existing drum dryers with low- NO_X burner technology, the cost for such retrofits is estimated at about 3,000 dollars per ton of NO_X reduced.

Time Necessary for Compliance

Considering the portable nature of this source category and the low- NO_X burners typically available in most modern drum dryers, , no additional controls were identified for this source category.

Energy and Non-Air Quality Environmental Impacts of Compliance

Considering the portable nature of this source category, and the various controls already operated by modern drum dryers, no additional controls were identified for this source category and no energy or non-air quality impacts were identified.

Remaining Useful Life of Affected Sources

It is difficult to estimate the remaining life of any potentially affected source in this category. Remaining life is specific to the facility for which controls are considered.

4. Lime Plants

This source category includes facilities that produce lime. There are two lime plants that operate in Arizona: Chemical Lime Nelson and Chemical Lime Douglas.

The Nelson facility is located in Northern Arizona between Kingman and Flagstaff. Both kilns at this facility were identified as BART-eligible for NO_X and SO_2. Based on a modeling analysis performed by Chemical Lime, it was determined that the facility does not cause or contribute to visibility impairment at any nearby Class I areas. Additional details on the modeling results can be found in Section VI.D of the BART Technical Support Document (TSD) in Appendix D of this plan. As a result of the dispersion modeling, no further analysis was conducted.

Due to economic conditions, the Douglas facility has been in care and maintenance mode since January 2009, and the Department has received no indication of when the facility will resume normal operations. Due to the lack of operation and economic conditions, no further analysis was conducted as part of this first Regional Haze SIP.

5. Portland Cement Plants

There are two operating Portland cement plants in Arizona: California Portland Cement and Phoenix Cement.

The California Portland Cement plant is located 20 miles north of Tucson. The facility operates four cement kilns. Kiln 4 was identified as BART-eligible. Based on a modeling analysis performed by the company, it was determined that Kiln 4 does not cause or contribute to visibility impairment at any nearby Class I areas. Additional details on the modeling results can be found in Section VI.A of the BART TSD in Appendix D. Additionally the facility obtained a New Source Review/Prevention of Significant Deterioration (NSR/PSD) permit to construct and operate a modern, state-of-the-art kiln that would replace all 4 existing kilns. Due to economic conditions the facility was unable to commence construction on the new kiln within 18 months as required by law, but has resubmitted an application for re-approval. Due to the same economic conditions, Kilns 1-3 have been in care and maintenance mode for the last year.

The Phoenix Cement plant is located near Clarkdale. The facility operates a single kiln that commenced operation in the early 2000s. The operations are covered by a comprehensive air permit that includes facility-wide limits on NO_X and SO_2. The permit also includes limits from the federal NSPS (Subpart F) and NESHAP (Subpart LLL). The modeling analysis conducted as part of the permit that authorized construction of the modern kiln included visibility modeling to ensure that the new kiln does not appreciably diminish or impair visibility.

6. Primary Copper Smelters

This source category includes two primary copper smelters that are operated in Arizona: Freeport McMoRan's Miami Smelter and ASARCO's Hayden Smelter.

Both smelters have equipment that was identified as subject-to-BART for SO_2 (see Section VI.C and E of the BART TSD). For each facility, the double contact sulfuric acid plant was determined as BART. The emissions from equipment not subject to BART (specifically some converters and the flash furnaces) are also routed to the acid plant and therefore will be subject to the same BART limits. No additional analysis was determined to be necessary for SO_2.

These operations also emit NO_X. Freeport Miami obtained a PSD permit for the installation of the Isasmelt furnace in the early 1990s and that permit contains BACT limits for NO_X for affected emission units. In addition, the following 4-step analysis was conducted:

<u>Cost of Compliance</u>

Based upon the Department's review of primary copper smelters, no additional NO_X controls were identified as retrofit options for this source category.

<u>Time Necessary for Compliance</u>

Based upon the Department's review of primary copper smelters, no additional NO_X controls were identified as retrofit options for this source category.

<u>Energy and Non-Air Quality Environmental Impacts of Compliance</u>

Based upon the Department's review of primary copper smelters, no additional NO_X controls were identified as retrofit options for this source category.

Remaining Useful Life of Affected Sources

The remaining useful life of the primary copper smelters was not available.

7. Nitric Acid Plants

This category includes one source (Apache Nitrogen Products in Benson, Arizona) that manufactures nitric acid for sale and for use in manufacturing of fertilizer products. The main sources of NO_X emissions in this category are the nitric acid plants and internal combustion engines. The emissions from the engines are discussed in 11.3.3.1.

There are multiple state and federal regulations that will apply to nitric acid production. These standards are technology based standards that stipulate emission limitations and operational restrictions to ensure that emissions of NO_X are minimized. Emissions of SO_2 from nitric acid plants are minimal.

The following list identifies applicable federal and state requirements:

- 40 CFR 60 Subpart G (Standards of Performance for Nitric Acid Plants)
- A.A.C. R18-2-706 (Standards of Performance for Existing Nitric Acid Plants)

The facility is covered by a permit that requires the operation of NO_X controls including Selective Catalytic Reduction (SCR), absorption towers, and scrubbers to reduce NO_X emissions.

Cost of Compliance

Considering that the applicable NSPS standard has a NO_X limit, and the various controls already operated by the facility, no additional controls were identified for this source.

Time Necessary for Compliance

Considering that the applicable NSPS standard has a NO_X limit, and the various controls already operated by the facility, no additional controls were identified for this source.

Energy and Non-Air Quality Environmental Impacts of Compliance

Considering that the applicable NSPS standard has a NO_X limit, and the various controls already operated by the facility, no additional controls were identified for this source.

Remaining Useful Life of Affected Sources

The remaining useful life of the nitric acid plant was not available.

11.3.4 Conclusions from the Four-Factor Analysis

Based on the above analysis, ADEQ has concluded that it is not reasonable to require additional controls for these source categories at this time. ADEQ will be developing guidance for conducting a comprehensive review of individual non-BART stationary sources over the next five years, to identify any additional emission reductions that could improve Class I area visibility by end of this planning period covered by this submittal. This review will identify possible controls for non-BART sources and a schedule for implementation.

11.4 Determination of Reasonable Progress Goals

Under Section 308(d)(1) of the Regional Haze Rule states must "establish goals (expressed in deciviews) that provide fore reasonable progress towards achieving natural visibility conditions" for each Class I area. These reasonable progress goals (RPGs) are interim goals that must provide for incremental visibility improvement for the most impaired visibility days, and ensure no degradation for the least impaired visibility days. The RPGs for the first planning period are goals for the year 2018. Based on the steps outlined in Section 11.2, ADEQ has established RPGs for each Class I area in Arizona.

The RPGs provide for visibility improvement at all Class I areas in Arizona on 20% worst days (Table 11.3); however, the goals are less than the URP. It is important to note that the URP represents the mathematical annual average deciview necessary each year to move from the baseline condition to the natural condition for any given Class I area. This annual average decrease does not take into account existing or real world conditions and are not achievable in every instance. The RPGs presented in Table 11.11 are based on ADEQ's evaluation and consideration of the following: the results of the CMAQ modeling described in Section 9.3, which includes "on-the-books" controls and other emission inputs (see Appendix C for list of CMAQ model emission inputs), the results of the four-factor analysis described in Section 11.3.3, and the BART review described in Chapter 10.

Table 11.3 shows that for all but two monitors, there is no degradation on 20% best days. For those areas with no degradation, there is an improvement in visibility conditions in 2018 on best days. ADEQ attributes this predicted improvement to a combination of factors: the numerous "on-the-books" controls included in the CMAQ modeling and significant reductions in mobile sources emissions (as described in Section 11.4.3). The two monitors showing degradation on best days are CHIR1 and SAGU1, representing four Class I areas. Section 11.4.2 contains a discussion of the factors involved and an explanation of why the degradation is occurring.

For the 20% worst days, Table 11.3 shows that the RPGs are short of the URP goal for each Class I area in Arizona. Section 11.4.1 provides an affirmative demonstration why the RPGs for the 20% worst days are justified.

Table 11.4 – Reasonable Progress Goals for 20% Worst and Best Days for Arizona Class I Areas

Arizona Class I Area	20% Worst Days			20% Best Days	
	Baseline (dv)	2018 URP (dv)	2018 Reasonable Progress (dv)	Baseline (dv)	2018 Reasonable Progress (dv)
Chiricahua NM, Chiricahua W, Galiuro W	13.43	11.98	13.35	4.91	4.94
Grand Canyon NP	11.66	10.58	11.14	2.16	2.12
Mazatzal W, Pine Mountain W	13.35	11.79	12.76	5.40	5.17
Mount Baldy W	11.85	10.54	11.52	2.98	2.86
Petrified NP	13.21	11.64	12.85	5.02	4.73
Saguaro NP – West Unit	16.22	13.90	15.99	8.58	8.34
Saguaro NP – East Unit	14.83	12.88	14.82	6.94	7.04
Sierra Ancha W	13.67	12.02	13.17	6.16	5.88
Superstition W	14.16	12.38	13.89	6.46	6.22

Table 11.4 – Reasonable Progress Goals for 20% Worst and Best Days for Arizona Class I Areas					
Arizona Class I Area	20% Worst Days			20% Best Days	
	Baseline (dv)	2018 URP (dv)	2018 Reasonable Progress (dv)	Baseline (dv)	2018 Reasonable Progress (dv)
Sycamore Canyon W	15.25	13.25	15.00	5.58	5.49

11.4.1 Affirmative Demonstration of the RPGs for 20% Worst Days

EPA guidance indicates that "States may establish a RPG that provides for greater, lesser, or equivalent visibility improvement as that described by the glidepath." The 2018 RPGs identified in Table 11.11 for 20% worst days show an improvement in visibility; however, they are short of the 2018 URP. Under the Regional Haze Rule, a state can demonstrate reasonable progress, using the four-factor analysis in Section 11.3 and other evidence and documentation. ADEQ maintains that the RPGs presented are justified and "reasonable" based on the following:

1. Findings from the four-factor analysis. This analysis was conducted as required under Section 308 (d)(1)(i)(A). Based on the general level of this review of major source categories, ADEQ has determined it is not reasonable to control additional source categories and has identified a schedule for a more in-depth evaluation of individual sources and additional control measures as part of the long-term strategy (LTS) in Chapter 12 of this plan. This evaluation will be completed by the next SIP submittal in 2016 and will contain a timetable for installation of controls for subject sources, if applicable.

2. Evidence that natural sources affect ability to meet the 2018 URP. The analysis of emissions data, source apportionment, and modeling results in Chapter 8 and 9 of this plan supports the finding that contribution from natural or nonanthropogenic sources, natural wildfire and windblown dust, and the pollutants associated with these sources (OC, EC, coarse PM, and fine soil) is one reason for not achieving the 2018 URP for Class I areas in Arizona. The CMAQ modeling results in Chapter 9 show considerably less reduction by 2018 in these pollutants, in contrast to significant reductions in SO_2 and NO_X, which are commonly associated with anthropogenic sources.

3. Reductions in anthropogenic sources equal to or greater than 2018 URP as a means of showing "reasonable progress." Given the correlation of SO_2 and NO_X emissions to anthropogenic sources, trends in these pollutants by 2018 can be factored into the determination of reasonable progress, in contrast to the contribution of nonanthropogenic sources. The analysis in Section 11.4.3 below shows reductions in SO_2 and NO_X by 2018. In Chapter 6, each 2018 URP for the Class I areas shows the total reduction in deciview from baseline to the 2018 URP is approximately 20%. The tables in Section 11.4.2 show that 2018 WEP emission projections for NO_X and SO_2 range between 17% and 20% reduction, while projected CMAQ modeling shows reductions between 8% and 19% for SO_2 and 9% and 36% for NO_X by 2018. The combination of these improvements due to emission reductions from anthropogenic sources adds to the demonstration of reasonable progress.

4. Major reductions in mobile source emissions. As the largest anthropogenic source category for NO_X, mobile sources show a considerable reduction in emissions by 2018. Although these reductions are primarily achieved through federal regulations already "on-the-books", ADEQ

maintains that this further supports the demonstration of reasonable progress. ADEQ expects future improvements by 2018 based on additional EPA standards that will require higher fuel efficiency for vehicles in 2017 – 2025.

ADEQ expects that changes proposed by EPA to the primary NAAQS and other regulatory changes being considered by EPA will result in enforceable reductions that will likely contribute to visibility improvements by 2018.

11.4.2 Degradation on 20% Best Days at CHIR1 and SAGU1

Section 308(d)(1) of the Regional Haze Rule requires that states ensure no degradation in visibility for the least impaired days. Visibility projections however, show degradation at two IMPROVE monitors, CHIR1 and SAGU1. As shown in Table 11.3, the degradation at CHIR1 and SAGU1 amounts to 0.03 dv and 0.1 dv, respectively, above the projected visibility conditions on best days in 2018. According to established literature, the change in deciview that is perceptible to the human eye is 0.5 dv. Even though the amount of degradation is very small, ADEQ agrees that it needs to be addressed. The primary pollutants contributing to visibility impairment on best days at CHIR1 and SAGU1 are sulfate, organic carbon, and coarse mass. It is important to note that coarse mass deciview is not modeled for 2018 due to model performance issues.

Sulfate

PSAT modeling of sulfate at CHIR1 on best days in 2018 indicates that the Outside Domain and Mexico contribute 43% and 23.1% towards sulfate concentrations, respectively. Arizona sources are projected to contribute 15.1%. At SAGU1, the Outside Domain and Mexico are also the highest contributors at 47% and 17.9%, respectively. Arizona sources are projected to contribute 13.7% towards sulfate in 2018 on best days at SAGU1. Emissions of SO_2 from point sources in Mexico are projected to increase by approximately 150,000 tpy by 2018. CMAQ modeling projections show that SO_2 will have the highest light extinction on best day at both CHIR1 and SAGU1. Given that Arizona's source contributions are expected to remain the same or be reduced in 2018 and emissions increases occur in regions outside of Arizona's control, no further action was deemed reasonable.

Organic Carbon

On best days, WEP analysis for 2018 shows that Arizona sources of primary organic aerosol (POA) emissions have a total potential of 77% to contribute at CHIR1 and a 95% potential to contribute at SAGU1. The primary anthropogenic source of POA emissions are area sources. The potential for area sources within Arizona to contribute to POA emissions is projected to be 7.6% and 9.5% at CHIR1 and SAGU1 in 2018, respectively, which is an increase of 2% and SAGU1 and 1.8% at CHIR1. WEP analysis also shows that the potential for sources of natural fire to impact visibility on best days is approximately 62% and 76% at CHIR1 and SAGU1, respectively, which is a much larger potential than from area sources. Given that impacts from natural fire outweigh the impact form other sources and since natural fire is difficult to predict and control, Arizona has no means to mitigate the projected visibility increase.

Coarse PM

The primary components of coarse PM are road dust, fugitive dust, and windblown dust. The potential for coarse PM from Arizona sources of road dust and fugitive dust in 2018 is projected to be 6% (increase of 1%) and 17% (increase of 7%), respectively, at CHIR1 on best days. The potential for Arizona sources

of windblown dust to contribute to coarse PM at CHIR1 in 2018 is about 8%. It should be noted that sources of windblown dust from New Mexico have a 43% potential to contribute to coarse PM on best days at CHIR1. At SAGU1, the potential for coarse PM from Arizona sources of road dust and fugitive dust is about 20% (increase of 7%) and 89% (increase of 52%), respectively. The impact of windblown dust from Arizona sources to coarse PM at SAGU1 is about 10%. The potential to contribute to windblown dust from sources in Mexico is projected to be 11% in 2018.

Source apportionment analysis shows that global and international contribution has a significant affect on visibility on best days at CHIR1 and SAGU1. It is reasonable to assert that the increase in SO_2 from Mexico coupled with the contribution from the Outside Domain is a significant reason why there is degradation in visibility on best days at these monitors. Another factor contributing to degradation is the impact of natural sources of organic carbon, which is approximately 6 times the contribution from area sources of organic carbon at CHIR1 and SAGU1. While the contribution from natural sources is large, ADEQ recognizes that the anthropogenic contribution of area sources must be addressed. The WEP analysis shows that the contribution to coarse PM at CHIR1 from Arizona sources of road dust and fugitive dust is high; however, it also shows that windblown dust from New Mexico has a greater potential to contribute to visibility impairment. It is reasonable to assert that the contribution from New Mexico has a greater affect on visibility than that from Arizona.

All of the factors mentioned above are likely the primary reasons why there is a slight but imperceptible predicted degradation in visibility at CHIR1 and SAGU1. ADEQ acknowledges the anthropogenic contribution from Arizona sources and will further address these emissions from anthropogenic sources in the next planning period. Changes being considered by EPA regarding the primary standards may reduce the contribution from anthropogenic sources and have a collateral benefit to the secondary visibility standard. ADEQ believes that these changes will further reduce the impact of visibility impairing pollutants in addition other control measures implemented by ADEQ.

11.4.3 20% Reduction in Emissions from Anthropogenic Sources

Chapter 6 shows the URP glidepath for the Class I areas in Arizona. The improvement needed from the 2000-2004 baseline to the 2018 URP for the 20% worst visibility days is approximately 20% in total deciview. None of the Class I areas in Arizona are projected to meet the 2018 URP. This can be attributed mostly to nonanthropogenic sources, such as natural wildfire (OC) and windblown dust (coarse mass and fine soil). ADEQ believes that in determining "reasonable" progress, it is important to distinguish between anthropogenic (controllable) versus nonanthropogenic (uncontrollable) emission sources. The results of the WEP apportionment and the CMAQ regional modeling in Chapter 9 show that in looking at individual pollutants, there are significant projected reductions in SO_2 and NO_X by 2018, which represent mostly anthropogenic sources.

Table 11.4 shows the projected emission reductions in SO_2 and NO_X in comparison to the other pollutants, based on the WEP results described in Chapter 9. The WEP results were used in order to compare the impact of all pollutants. The WEP analysis does not take into account chemical reactions of SO_2 and NO_X, but it is a useful screening tool for identifying the potential contribution of pollutant species to regional haze formation.

Sulfate, nitrate, and elemental carbon show decreasing potential to contribute to visibility impairment on worst days. The decreasing potential can be attributed to mobile source reductions described in Section 11.4.3 and BART. Arizona also has many different air quality control programs and regulations which are expected to contribute to overall emissions reductions. There is however, increasing potential for sulfate to affect visibility at CHIR1 and TONT1. At CHIR1, this is primarily due to an increase in the

potential for sulfate from point sources outside of Arizona's control. At TONT1, there is a slight increase in sulfate from point sources.

Table 11.5 - WEP Projected Potential Contributions of Individual Pollutants by 2018 URP as an Indicator of Reasonable Progress							
Monitor	**Arizona Class I Areas**	**20% Worst Days Baseline to 2018 Change in Anthropogenic Upwind Weighted Emissions Potential (percent potential to contribute)**					
		SO_2	**NO_X**	**OC**	**EC**	**PM Fine**	**PM Coarse**
CHIR1	Chiricahua NM, Chiricahua W, Galiuro W	11	-25	12	-28	36	29
GRCA2	Grand Canyon NP	-38	-43	-1	-39	17	21
IKBA1	Mazatzal W, Pine Mountain W	-21	-52	14	-47	36	35
BALD1	Mount Baldy W	-22	-35	9	-34	46	36
PEFO1	Petrified Forest NP	-51	-32	9	-38	28	27
SAWE1	Saguaro NP – West Unit	-17	-41	23	-39	60	80
SAGU1	Saguaro NP – East Unit	-25	-40	19	-39	71	97
SIAN1	Sierra Ancha W	-11	-49	14	-45	35	36
TONT1	Superstition W	9	-50	19	-46	43	41
SYCA1	Sycamore Canyon W	-38	-36	8	-36	27	31

Tables 11.5 and 11.6 show projected sulfate and nitrate reductions, respectively, for worst days. The projections are based on CMAQ modeling results and are broken down by Class I area and pollutant. Results show the reduction in light extinction for each pollutant. Reductions in light extinction from sulfate ranges between 8% and 19%. The reduction in extinction due to nitrate ranges from 5% to 26%.

Table 11.6 – CMAQ Projected Reduction in Sulfate by 2018 as an Indicator of Reasonable Progress					
Monitor	**Arizona Class I Areas**	**20% Worst Days Baseline to 2018 Change in Sulfate Light Extinction**			
		2000-2004 Baseline (Mm-1)	**2018 URP (Mm-1)**	**2018 Projected Visibility (Mm-1)**	**Total % Change by 2018**
CHIR1	Chiricahua NM, Chiricahua W, Galiuro W	8.13	5.98	7.36	-9%

Table 11.6 – CMAQ Projected Reduction in Sulfate by 2018 as an Indicator of Reasonable Progress					
Monitor	Arizona Class I Areas	20% Worst Days Baseline to 2018 Change in Sulfate Light Extinction			
		2000-2004 Baseline (Mm-1)	2018 URP (Mm-1)	2018 Projected Visibility (Mm-1)	Total % Change by 2018
GRCA2	Grand Canyon NP	5.36	4.11	4.38	-18%
IKBA1	Mazatzal W, Pine Mountain W	6.51	4.89	5.36	-18%
BALD1	Mount Baldy W	6.2	4.67	5.35	-14%
PEFO1	Petrified Forest NP	6.65	4.98	5.61	-16%
SAWE1	Saguaro NP – West Unit	7.75	5.71	7.14	-8%
SAGU1	Saguaro NP – East Unit	7.42	5.48	5.13	-11%
SIAN1	Sierra Ancha W	6.41	4.82	5.59	-13%
TONT1	Superstition W	7.19	5.33	6.24	-13%
SYCA1	Sycamore Canyon W	4.99	3.82	4.02	-19%

Table 11.7 – CMAQ Projected Reduction in Nitrate by 2018 as an Indicator of Reasonable Progress					
Monitor	Arizona Class I Areas	20% Worst Days Baseline to 2018 Change in Nitrate Light Extinction			
		2000-2004 Baseline (Mm-1)	2018 URP (Mm-1)	2018 Projected Visibility (Mm-1)	Total % Change by 2018
CHIR1	Chiricahua NM, Chiricahua W, Galiuro W	1.35	1.18	1.15	-15%
GRCA2	Grand Canyon NP	2.19	1.83	1.99	-9%
IKBA1	Mazatzal W, Pine Mountain W	3.51	2.8	2.6	-26%
BALD1	Mount Baldy W	1.12	1.01	1.05	-6%
PEFO1	Petrified Forest NP	1.84	1.53	1.47	-20%
SAWE1	Saguaro NP – West Unit	6.02	4.64	4.54	-25%
SAGU1	Saguaro NP – East Unit	5.77	4.46	5.13	-11%
SIAN1	Sierra Ancha W	2.14	1.76	1.36	-36%
TONT1	Superstition W	3.05	2.45	2.9	-5%
SYCA1	Sycamore Canyon W	2.03	1.69	1.82	-10%

11.4.4 Major Reductions in Mobile Sources Emissions by 2018

As the largest anthropogenic source category, ADEQ believes that the trend in mobile source emission reductions from 2002 to 2018 is another factor in support of the demonstration of reasonable progress. As shown by the emission inventory information in Chapter 8, mobile sources annual emissions show a

decrease from 2002 (plan02d) to 2018 (prp18b) and represent the largest emissions reductions of any single source category. This can be seen in the statewide emission in Section 8.1 and the regional level emission in Section 8.2. The greatest reduction is in NO_X emissions, followed by volatile organic compounds (VOCs), and to a lesser extent SO_2. Table 11.7 shows these reductions in ton per year (tpy) and percent reduction at the statewide level, from the baseline 2002 to the projections for 2018.

Table 11.8 – Mobile Source Emission Reductions in Arizona from 2002 to 2018			
Source Category	**SO_2**	**NO_X**	**VOC**
On-Road Mobile	-1,953 (72%)	-124,501 (70%)	-57,552 (52%)
Off-Road Mobile	-3,677 (87%)	-23,165 (35%)	-20,868 (37%)

The mobile source emission inventory was based on the WRAP Mobile Source Emission Inventories Update. This report estimated all on-road and off-road mobile source emissions for the WRAP region for the 2002 base year and projections to 2008, 2013, and 2018. It also included emissions from aircraft, locomotives, marine shipping, and road dust. The contractor who conducted the project surveyed state and local air quality planning agencies to obtain the most up-to-date mobile source activity data and control program information. On-road mobile source emissions were estimated with EPA's MOBILE6.2 model. Emissions for most off-road mobile sources were estimated with EPA's Draft NONROAD2004 model. Locomotive emissions were estimated based on locomotive fuel consumption; aircraft emission were based on aircraft landing and takeoffs and FAA EDMS emission factors commercial marine emissions were estimated using a variety of activity data sources and EPA emission factors. For further information, see http://www.wrapair.org/forums/ef/UMSI/index.html.

The mobile source emission reductions are based on numerous "on-the-books" federal mobile source regulations that include the following:

For on-road mobile sources:

- Tier 1 light-duty vehicle standards
- National Low Emission Vehicle (NLEV) standards
- Tier 2 light-duty vehicle standards, with low sulfur gasoline
- Heavy-duty vehicle standards, with low sulfur diesel

For non-road mobile sources and equipment:

- Emission standards for new non-road spark-ignition engines below 25 horsepower
- Phase 2 emission standards for new spark ignition hand-held engines below 25 horsepower
- Phase 2 emission standards for new spark-ignition non-handheld engines below 25 horsepower
- Emission standards for new gasoline spark-ignition marine engines
- Tier 1 and 2 emission standards for new nonroad compression-ignition engines below 50 horsepower including recreational marine engines
- Tier 2 and Tier 3 standards for new nonroad compression-ignition engines of 50 horsepower and greater not including recreation marine engines greater than 50 horsepower
- Tier 4 emission standards for new nonroad compression-ignition engines above 50 horsepower and reduced nonroad diesel fuel sulfur levels

In 2004, EPA adopted the Tier 4 rule for Nonroad Diesel Engines and Fuel, which took effect in 2008. These rules are expected to have major visibility benefits. Nationally, these rules are estimated to reduce emissions in 2030 from nonroad engines, locomotive engines, and marine engines by 95% for $PM_{2.5}$, 90% for NO_X, and 99% for SO_2.

The visibility benefits that are projected for 2018 from these reductions can be found in Chapter 9, under the PSAT source apportionment results for sulfate and nitrate, on 20% worst days.

The extent of the mobile source emission reductions and the visibility improvements that are projected are significant factors in determining that the RPGs identified in this represent reasonable progress. It should be noted that the trend in emission reductions may likely be greater than expected. Increasing gasoline prices commonly reduce the annual vehicle miles traveled, which will lead to increased reductions in NO_X emissions. Reductions to the primary National Ambient Air Quality Standards (NAAQS) for ozone and SO_2 will also have the secondary benefit of improving visibility as a result of emissions reductions.

11.4.5 Additional Emission Reductions Expected by 2018 due to the Long-Term Strategy

Under the Long-Term Strategy (LTS) described in Chapter 12, additional emission reductions that will result in visibility improvements are expected by 2018. Although these new strategies have yet to be implemented, it is reasonable to expect that these visibility improvements will occur and provide greater progress toward the 2018 URP than the RPGs estimated in this submittal. The key elements of the LTS include an evaluation and possible controls for non-BART sources, new smoke management improvements for prescribed burning, review and possible revision of state open burning regulations, and expected benefits associated with the revised $PM_{2.5}$ NAAQS.

11.4.6 Long-Term Strategy "Next Steps" in Analyzing Major Source Categories

As described in the LTS in Chapter 12, ADEQ will take the results of the four-factor analyses for source categories and will conduct further evaluation and analysis of these source categories to determine what additional control are appropriate to achieve further reasonable progress. It is expected this evaluation will be incorporated into the work described in Section 12.6.1 of the LTS that will develop criteria and guidance for evaluating all non-BART sources. Results from this evaluation will be reported in the required 2013 plan update.

11.5 Years to Reach Natural Conditions Based on Reasonable Progress Goals

The Regional Haze Rule allows states to set reasonable progress goals for a slower rate of progress than the URP. Section 308(d)(1)(B)(ii) also requires states to provide an assessment of the number of years it will take to reach natural conditions based on the reasonable progress goals set by a state. Table 11.8 provides this information for Arizona's Class I areas.

Table 11.9 – Years to Meet Natural Conditions (NC) Based on Reasonable Progress Goals

Arizona Class I Area	Baseline (dv)	2018 RPG (dv)	Annual Rate of Progress Based on RPG (dv)	Natural Conditions (dv)	Improvement Needed to Reach NC (dv)	Years to Meet NC
Chiricahua NM, Chiricahua W, Galiuro W	13.43	13.35	0.006	7.2	6.23	1,038

Table 11.9 – Years to Meet Natural Conditions (NC) Based on Reasonable Progress Goals						
Arizona Class I Area	**Baseline (dv)**	**2018 RPG (dv)**	**Annual Rate of Progress Based on RPG (dv)**	**Natural Conditions (dv)**	**Improvement Needed to Reach NC (dv)**	**Years to Meet NC**
Grand Canyon NP	11.66	11.14	0.037	7.04	4.62	125
Mazatzal W, Pine Mountain W	13.35	12.76	0.042	6.68	6.67	159
Mount Baldy W	11.85	11.52	0.024	6.24	5.61	234
Petrified NP	13.21	12.85	0.026	6.49	6.72	258
Saguaro NP – West Unit	16.22	15.99	0.016	6.24	9.98	624
Saguaro NP – East Unit	14.83	14.82	0.001	6.46	8.37	8,370
Sierra Ancha W	13.67	13.17	0.036	6.59	7.08	197
Superstition W	14.16	13.89	0.019	6.54	7.62	401
Sycamore Canyon W	15.25	15.00	0.018	6.65	8.6	478

(page intentionally blank)

CHAPTER 12: LONG-TERM STRATEGY (LTS)

12.1 Overview of the LTS

The Regional Haze Rule requires states to submit a 10-15 year long-term strategy (LTS) to address regional haze visibility impairment in each Class I areas in the state, and for each Class I area outside the state which may be affected by emissions from the state. The LTS must include enforceable measures necessary to achieve reasonable progress goals, and identify all anthropogenic sources of visibility impairment considered by the state in developing the LTS. Where the state contributes to Class I visibility impairment in other states it must consult with those states and develop coordinated emission management strategies, and demonstrate it has included all measures necessary to obtain its share of the emission reductions. If the state has participated in a regional planning process, the state must include measures needed to achieve its obligations agreed upon through that process.

As required in Section 51.308(d)(3)(v) of the Regional Haze Rule, the state must consider, at a minimum, the following factors: (1) emission reductions due to ongoing air pollution control programs; (2) measures to mitigate the impacts of construction activities; (3) emission limitations and schedules for compliance; (4) source retirement and replacement schedules; (5) smoke management techniques for agricultural and forestry burning; (6) the enforceability of emission limitations and control measures; and (7) the anticipated net effect on visibility due to projected changes in point, area and mobile source emissions over the period of the long-term strategy.

12.2 Overview of the LTS Development Process

As described in Chapter 5, Section 5.1, Arizona is a participant in the WRAP, which was a major source of technical and policy assistance for western states in developing regional strategies for reducing haze. The following is a partial list of the primary WRAP systems relied upon the ADEQ and other western states in developing the LTS. For a complete list, see the WRAP Web site (archived) at http://www.wrapair.org

- **Technical Support System (TSS)** – http://vista.cira.colostate.edu/tss/ - this is a project that provides a single, one-stop shop for access, visualization, analysis, and retrieval of the technical data and regional analytical results prepared by the WRAP Forums and Workgroups in support of regional haze planning in the West. The TSS specifically summarizes and consolidates information about air quality monitoring, meteorological and receptor modeling data analyses, emissions inventories and model, and gridded air quality /visibility regional modeling simulations. For more information on the TSS, see Appendix C.

- **Regional Modeling Center (RMC)** – http://pah,cert.ucr.edu/aqm/308/ - this modeling project conducted by the RMC provides regional scale, three-dimensional regulatory air quality model that simulate the emission, chemical transformations, and transport of criteria pollutants and fine particulate matter. The modeling also provides the effects on visibility in Class I areas in the WRAP region and across North America.

- **Visibility Information Exchange Web System (VIEWS)** – http://views.cira.colostate.edu/web/ - this system provides ongoing access to IMPROVE and other visibility monitoring data, research results, and special studies related to the Regional Haze Rule. Downloads of the IMPROVE data, custom displays of spatial, chemical, and temporal patterns, as well as information about applying monitoring data for regional haze planning are available.

- **Causes of Haze Assessment Project (CoHA)** – http://www.coha.dri.edu/ - this project provides detailed analyses of IMPROVE and meteorological monitoring data in the WRAP region. includes multi-year back trajectory wind plots for each monitored Class I area, trajectory regression analyses' results used in the Phase I Attribution of Haze (AoH) project, and extensive descriptive information about the monitoring data and each Class I area.

- **Emission Data Management System (EDMS)** – http://www.wrapedms.org/ - this project entail an emission inventory and web-based Geographic Information System (GIS) application that provides a consistent, complete, and regional approach to emission data tracking to meet the requirements for SIP and TIP development, periodic progress reviews, and data updates. The EDMS serves as a central regional emission inventory database for all types of emission, and uses associated software to facilitate the data collection efforts for regional modeling, emission tracking, and associated data analyses.

12.3 Summary of all Anthropogenic Sources of Visibility Impairment Considered in Developing the LTS

Section 51.308(d)(3)(iv) of the Regional Haze Rule requires the identification of "all anthropogenic sources of visibility impairment considered by the state when developing its long-term strategy." Chapter 8 of this plan describes state and regional emission, including projections of emission reduction from anthropogenic sources from 2002 to 2018. Chapter 9 of this plan provides source apportionment results, including projected reductions from anthropogenic sources during the same period. Together, these two chapters show the major anthropogenic sources affecting regional haze in Arizona and in the West. Section 11.3 in Chapter 11 describes the major anthropogenic source categories evaluated through the four-factor analysis.

12.4 Summary of Interstate Transport and Contribution

Sections 51.308(d)(3)(i) and (ii) of the Regional Haze Rule requires that the LTS address the contribution of interstate transport of haze pollutants between states. Chapter 8 of this plan showed regional emissions by state, while Chapter 9 identified interstate transport of pollutants and larger source categories based on source apportionment results. ADEQ has analyzed the PSAT and WEP source apportionment findings, focusing on the 20% worst days for primarily impacts from SO_2 and NO_X, typically associated with point, area, and mobile anthropogenic sources. Other pollutants such as OC, EC, PM fine and coarse, were reviewed as well, however, these were assumed to be associated with natural fire and dust sources, and not evaluated any further.

ADEQ consulted with neighboring states as part of this review, and discussed the need for coordinated strategies to address interstate transport. Based on this consultation, no significant contributions were identified that supported developing new interstate strategies. Both Arizona and neighboring states agreed that the implementation of BART and other existing measures in state regional haze plans were sufficient to address the relatively minor contributions discussed below. This interstate consultation is an on-going process and commitment between states. See Chapter 13 for further information.

12.4.1 Other State Class I Areas Affected by Arizona Emissions

ADEQ reviewed PSAT and WEP source apportionment information on the WRAP TSS website, focusing on the 20% worst day impacts in Class I areas in neighboring states. The tables listed in this section provide the percent of Arizona contribution only, not all neighboring states. Appendix B, Section 2, contains tables showing the concentration and percent contribution for the highest contributors for the Class I areas listed in this section.

Colorado

There are four Class I areas in Colorado that have a potential to be affected by Arizona: Great Sand Dunes National Monument (GRSA1), Mesa Verde National Park (MEVE1), Black Canyon of the Gunnison National Park (WEMI1), La Garita Wilderness (WEMI1), and Weminuche Wilderness (WEMI1).

The percent contribution from Arizona sources to sulfate at the Class I areas listed above are about 10% or less for both the base case and 2018 projections. Contribution is higher at the area that are closer to Arizona, MEVE1 and WEMI1. At each of the Class I areas listed, contribution from Arizona to sulfate is projected to increase, mostly from point sources and a smaller amount from natural fire/biogenic.

Overall, the contribution to nitrate from Arizona sources is low. The percent contribution from Arizona sources is projected to decrease or remain the same by 2018 (Table 12.1).

Table 12.1 – Percent Contribution from Arizona at Colorado Class I Areas (PSAT Analysis)

Class I Area	SO_4		NO_3	
	2002 Base Case	2018 Projections	2002 Base Case	2018 Projections
GRSA1	5	6	6	6
MEVE1	9	10	13	10
WEMI1	7	9	15	10
WHRI1	5	7	0	0

Table 12.2 shows the WEP analysis for the potential percent contribution from sources in Arizona to contribute to OC, EC, and fine PM. For OC and EC, the primary source category is natural fire. Fine and coarse PM are dominated by road dust, fugitive dust, and windblown dust from all states and regions. The highest potential for Arizona sources to contribute these pollutants is found at MEVE1.

12.2 – Potential Percent Contribution from Arizona at Colorado Class I Areas (WEP Analysis)

Class I Area	POA (organic carbon)		Elemental Carbon		Fine PM		Coarse PM	
	2002 Base Case	2018 Projection	2002 Base Case	2018 Projection	2002 Base Case	2018 Projection	2002 Base Case	2018 Projection
MEVE1	24	25	23	19	16	18	14	17
WEMI1	16	17	16	13	16	19	14	17
GRSA1	15	16	13	11	6	8	6	7
WHRI1	6	6	6	4	8	9	7	9

New Mexico

There are six Class I areas in New Mexico that have the potential to be affected by sulfate from Arizona: Bandelier National Monument (BAND1), San Pedro Parks Wilderness (SAPE1), Pecos Wilderness, Bosque del Apache National Wildlife Reserve (BOAP1), and Gila Wilderness (GICL1).

Sulfate concentrations are low, approximately 0.06 $\mu g/m^3$ or less for the baseline period and 2018 projections. The projected contribution from Arizona sources at the Class I areas listed is 10% or less (Table 12.3). Modeling shows that contribution to sulfate from point sources in Arizona will increase by 2018.

The impact from Arizona sources of nitrate is lower than sulfate, with concentrations below 0.02 $\mu g/m^3$ at the Class I areas listed above. PSAT modeling shows that percent contribution to nitrate concentrations will either stay the same or decrease by 2018.

12.3 – Percent Contribution from Arizona at New Mexico Class I Areas (PSAT Analysis)				
Class I Area	**SO_4**		**NO_3**	
	2002 Base Case	**2018 Projections**	**2002 Base Case**	**2018 Projections**
BAND1	7	9	10	9
BOAP1	6	7	9	8
GICL1	7	8	23	20
SAPE1	9	10	13	13

Table 12.4 shows the WEP for OC, EC, fine PM, and coarse PM. For OC and EC, the potential contribution from Arizona is below 31% for the base case. The 2018 projections show a slight increase in OC and a small decrease in EC. The WEP analysis shows that the potential for Arizona sources to contribute to fine PM will increases slightly in 2018. Fine PM from Arizona is approximately half the contribution from New Mexico.

12.4 – Percent Contribution from Arizona at New Mexico Class I Areas (WEP Analysis)								
Class I Area	**POA (organic carbon)**		**Elemental Carbon**		**Fine PM**		**Coarse PM**	
	2002 Base Case	**2018 Projection**	**2002 Base Case**	**2018 Projection**	**2002 Base Case**	**2018 Projection**	**2002 Base Case**	**2018 Projection**
GICL1	31	32	31	27	16	21	16	19
BOAP1	37	38	31	26	10	13	11	11
SAPE1	29	30	27	22	13	16	7	10
BAND1	18	19	16	14	7	10	7	8

Utah

There are five Class I areas in Southern Utah that have the potential to be affected by haze pollutants from Arizona: Zion National Park (ZION1), Bryce Canyon National Park (BRCA1), Capitol Reef National Park (CAPI1), Canyonlands National Park (CANY1), and Arches National Park (CANY1).

Based on PSAT results, the projected contribution to sulfate from Arizona is 4% or below at each Class I area listed. The greatest contribution is from point sources, which was between approximately 7% and 10% for the baseline period at each Class I area listed (Appendix B). The potential for sulfate to affect these Class I areas increases slightly in 2018. The potential for sulfate from Arizona sources to affect visibility at Bryce Canyon is higher than at other Class I areas in Utah. While the concentration of sulfate is relatively low, approximately 0.015 for the baseline period and 2018 projections (prp18b). Sulfate emissions from Arizona are projected to decrease by 2018; however, modeling shows that sulfate concentrations are increasing from point sources in Arizona (Appendix B). PSAT results show that nitrate concentrations are relatively low, between 0.005 and 0.03 $\mu g/m^3$ for the baseline and 2018 projections (prp18b) for these areas in Utah.

12.5 – Percent Contribution from Arizona at Utah Class I Areas (PSAT Analysis)				
Class I Area	**SO_4**		**NO_3**	
	2002 Base Case	**2018 Projections**	**2002 Base Case**	**2018 Projections**
BRCA1	2.5	3.0	4.7	4.1
CANY1	4.0	5.4	6.3	8.1
CAPI1	2.9	3.9	4.4	5.9
ZION1	2.9	3.4	3.3	3.8

The WEP analysis shows the potential for contribution from sources of OC and EC in Arizona at Class I areas in Utah are between five and 10 percent for both the baseline and 2018 projections. For fine PM, the potential contribution from Arizona increases slightly, between 10 and 24 percent at Zion, Capitol Reef, Canyonlands, and Arches. Potential contribution from fine PM is higher at Bryce Canyon, between 28 and 32 percent for the baseline and 2018 projections (prp18b), respectively.

12.6 – Percent Contribution from Arizona at Utah Class I Areas (WEP Analysis)								
Class I Area	**POA (organic carbon)**		**Elemental Carbon**		**Fine PM**		**Coarse PM**	
	2002 Base Case	**2018 Projection**	**2002 Base Case**	**2018 Projection**	**2002 Base Case**	**2018 Projection**	**2002 Base Case**	**2018 Projection**
ZION1	5	5	6	5	22	24	23	25
BRCA1	10	10	11	8	28	31	22	24
CAPI1	9	10	9	8	20	21	13	15
CANY1	5	5	6	5	13	15	11	12

12.4.2 Interstate and International/Global Contribution to Arizona Class I Areas

This section provides a description of the contribution to regional haze from neighboring states, which includes California, Nevada, Utah, Colorado, and New Mexico. New Mexico has a higher potential to affect Class I areas in eastern Arizona, whereas Nevada, Utah, and Colorado are more likely to affect northern Class I areas. California has a higher potential to contribute to Class I areas located in western and northern Arizona. Please note the outside domain category in PSAT modeling is not differentiated and specific source types are not identified. The following section describes other states' contribution at Arizona's Class I areas. The tables in this section show the contribution on worst days, except as noted.

Chiricahua NM, Chiricahua W, and Galiuro W

Three Class I areas are represented by the IMPROVE monitor, CHIR1, which is located west of Chiricahua NM. These areas are Chiricahua National Monument, Chiricahua Wilderness, and Galiuro Wilderness. The monitor is representative of meteorological and geographical conditions at all three areas. Tables 12.7 and 12.8 show the top six contributors to sulfate at CHIR1 for the baseline and 2018 projections. PSAT modeling shows the outside domain is the highest contributor to sulfate concentrations. The second highest contributors are Mexico and the eastern regions, followed by the central region. Source types contributing to sulfate are primarily point, area, and mobile. Arizona sources are projected to contribute to approximately 6.9% of sulfate in 2018.

Table 12.7 – Interstate & International Contribution to Sulfate at CHIR1 (2002 Base)

State or Region	Nat. Fires & Bio.	Anthro Fires	Mobile	Area	Point	Outside Domain	Total (μ/m^3)	% Contribution
OD						0.265	0.265	26.4%
EUS	0	0	0.006	0.011	0.176		0.193	19.2%
MEX	0	0	0.004	0.023	0.166		0.193	19.2%
CEN	0	0	0.008	0.019	0.119		0.146	14.5%
PO	0	0	0.001	0.054	0.019		0.074	7.4%
AZ	0.01	0	0.008	0.003	0.031		0.052	5.2%

Table 12.8 – Interstate & International Contribution to Sulfate at CHIR1 (2018 Projections)

State or Region	Nat. Fires & Bio.	Anthro Fires	Mobile	Area	Point	Outside Domain	Total (μ/m^3)	% Contribution
OD						0.279	0.279	30.3%
MEX	0	0	0.005	0.025	0.192		0.222	24.1%
CEN	0	0	0.001	0.02	0.093		0.114	12.4%
EUS	0	0	0.002	0.011	0.078		0.091	9.9%
PO	0	0	0.001	0.054	0.02		0.075	8.1%
AZ	0.012	0	0.005	0.004	0.043		0.064	6.9%

Tables 12.9 and 12.10 show the five highest contributors to nitrate concentrations and CHIR1. PSAT modeling shows the outside domain is the highest contributor to nitrate, approximately 26% over the baseline and increasing to 29.4% in 2018. Modeling shows that California is the second highest contributor to nitrate, about 17.6%. Contributions to nitrate from California sources are higher than those from Arizona for both the baseline and 2018 projections. These emissions will likely be addressed in California's evaluation of non-BART sources in addition to federal regulations regarding emissions from mobile sources. New Mexico contributes a low amount of nitrate, approximately 0.012 $\mu g/m^3$ for baseline and 2018 projections, or 5.4% and 7.4%, respectively.

Table 12.9 – Interstate & International Contribution to Nitrate at CHIR1 (2002 Base)

State or Region	Nat. Fires & Bio.	Anthro Fires	Mobile	Area	Point	Outside Domain	Total	% Contribution
CA	0.001	0	0.034	0.005	0.004		0.044	26.3%
OD						0.038	0.038	22.8%

Table 12.9 – Interstate & International Contribution to Nitrate at CHIR1 (2002 Base)								
State or Region	Nat. Fires & Bio.	Anthro Fires	Mobile	Area	Point	Outside Domain	Total	% Contribution
AZ	0.002	0	0.018	0.001	0.005		0.026	15.6%
NM	0.001	0	0.006	0.002	0.004		0.013	7.8%
MEX	0.002	0	0.004	0.001	0.002		0.009	5.4%

Table 12.10 – Interstate & International Contribution to Nitrate at CHIR1 (2018 Projections)								
State or Region	Nat. Fires & Bio.	Anthro Fires	Mobile	Area	Point	Outside Domain	Total	% Contribution
OD						0.04	0.04	29.4%
CA	0.001	0	0.014	0.005	0.004		0.024	17.6%
AZ	0.002	0	0.007	0.001	0.007		0.017	12.5%
NM	0.001	0	0.003	0.005	0.004		0.013	9.6%
MEX	0.002	0	0.004	0.001	0.003		0.01	7.4%

The WEP analysis shows that the potential contribution to OC, EC, and fine PM from other states is below 10 percent (See Section 9.4.1). New Mexico has the potential to contribute close to 32 percent of fine PM, which are mostly from sources of windblown dust.

Given that CHIR1 is one of two monitors showing degradation on best days, the following tables show the highest contributors to sulfate and nitrate on best days. Tables 12.11 and 12.12 show the highest contributors to sulfate concentrations. For the baseline and 2018 projections, the highest contributors are the outside domain and Mexico. Arizona sources contribute about 14% and 15% to nitrate concentrations for the baseline and 2018 projections, respectively.

12.11 – Interstate & International Contribution to Sulfate at CHIR1 on Best Days (2002 Base)								
State or Region	Nat. Fires & Bio.	Anthro Fires	Mobile	Area	Point	Outside Domain	Total	% Contribution
OD						0.26	0.26	42.4%
MEX	0	0	0.003	0.022	0.114		0.139	22.7%
AZ	0.003	0	0.01	0.005	0.069		0.087	14.2%
PO	0	0	0	0.024	0.012		0.036	5.9%

Table 12.12 – Interstate & International Contribution to Sulfate at CHIR1 on Best Days (2018 Projections)								
State or Region	Nat. Fires & Bio.	Anthro Fires	Mobile	Area	Point	Outside Domain	Total	% Contribution
OD						0.259	0.259	43.0%
MEX	0	0	0.003	0.022	0.114		0.139	23.1%
AZ	0.003	0	0.005	0.006	0.077		0.091	15.1%
PO	0	0	0	0.024	0.012		0.036	6.0%

Tables 12.13 and 12.14 show the contribution to nitrate concentrations at CHIR1 on best days. For both the baseline and 2018 projections, Arizona sources are the highest contributors to nitrate. Arizona sources contribute 35.8% for the baseline and is projected to decrease to 32.7% in 2018. Modeling shows that California sources contribute about 14% to nitrate concentration, making them the third highest contributor. Projections for 2018 show that those contributions will fall to approximately 10%. Sources of NO_X in New Mexico are projected to be the third highest contributor to nitrate in 2018 (Table 12.8).

Table 12.13 – Interstate & International Contribution to Nitrate at CHIR1 on Best Days (2002 Base)

State or Region	Nat. Fires & Bio.	Anthro Fires	Mobile	Area	Point	Outside Domain	Total	% Contribution
AZ	0.014	0	0.107	0.004	0.037		0.162	35.8%
OD						0.089	0.089	19.6%
CA	0.002	0	0.05	0.006	0.006		0.064	14.1%
NM	0.004	0	0.02	0.006	0.015		0.045	9.9%
UT	0	0	0.008	0.001	0.017		0.026	5.7%
MEX	0.005	0	0.011	0.002	0.005		0.023	5.1%

Table 12.14 – Interstate & International Contribution to Nitrate at CHIR1 on Best Days (2018 Projections)

State or Region	Nat. Fires & Bio.	Anthro Fires	Mobile	Area	Point	Outside Domain	Total	% Contribution
AZ	0.015	0	0.052	0.006	0.064		0.137	32.7%
OD						0.107	0.107	25.5%
NM	0.004	0	0.011	0.015	0.016		0.046	11.0%
CA	0.002	0	0.024	0.008	0.008		0.042	10.0%
MEX	0.005	0	0.01	0.003	0.006		0.024	5.7%
UT	0	0	0.005	0.001	0.013		0.019	4.5%

Grand Canyon NP

PSAT modeling shows that the top three contributors to sulfate at GRCA2 are the outside domain, Pacific offshore, and Mexico (Table 12.15), or about 60 to 65% of sulfate concentrations for the baseline and 2018 projections, respectively. Pacific offshore emissions are mainly from area sources with about one-fourth from point sources. Mexico is the third highest contributor to sulfate (approximately 0.07 $\mu g/m^3$ for the baseline and 2018 projections), which is mostly from point sources. For the baseline, Arizona and California sources are the sixth highest contributors to sulfate. Arizona contributions increase slightly to 9.4% in 2018, up from 8.6% for the baseline. Nevada sources contribute to sulfate concentrations, but at low levels.

Table 12.15 – Interstate & International Contribution to Sulfate at GRCA2 (2002 Base)

State or Region	Nat. Fires & Bio.	Anthro Fires	Mobile	Area	Point	Outside Domain	Total	% Contribution
OD						0.238	0.238	36.1%

Table 12.15 – Interstate & International Contribution to Sulfate at GRCA2 (2002 Base)								
State or Region	Nat. Fires & Bio.	Anthro Fires	Mobile	Area	Point	Outside Domain	Total	% Contribution
PO	0	0	0.001	0.064	0.025		0.09	13.7%
MEX	0	0	0.002	0.013	0.055		0.07	10.6%
AZ	0.018	0	0.01	0.002	0.027		0.057	8.6%
CA	0.013	0	0.009	0.008	0.027		0.057	8.6%
NV	0.001	0	0.001	0.005	0.033		0.04	6.1%

Table 12.16 – Interstate & International Contribution to Sulfate at GRCA2 (2018 Projections)								
State or Region	Nat. Fires & Bio.	Anthro Fires	Mobile	Area	Point	Outside Domain	Total	% Contribution
OD						0.24	0.24	39.0%
PO	0	0	0.001	0.064	0.026		0.091	14.8%
MEX	0	0	0.002	0.013	0.055		0.07	11.4%
AZ	0.018	0	0.007	0.003	0.03		0.058	9.4%
CA	0.013	0	0.006	0.008	0.027		0.054	8.8%
NV	0.001	0	0.001	0.005	0.01		0.017	2.8%

Arizona and California are the top two contributors to nitrate concentrations at GRCA2. Nitrate concentrations from sources in Arizona and California are projected to decrease by 2018 (Tables 12.17 and 12.18)

Table 12.17 – Interstate & International Contribution to Nitrate at GRCA2 (2002 Base)								
State or Region	Nat. Fires & Bio.	Anthro Fires	Mobile	Area	Point	Outside Domain	Total	% Contribution
AZ	0.006	0	0.079	0.003	0.008		0.096	41.7%
CA	0.003	0.001	0.052	0.007	0.006		0.069	30.0%
OD						0.033	0.033	14.3%
PO	0	0	0.006	0.008	0.001		0.015	6.5%

Table 12.18 – Interstate & International Contribution to Nitrate at GRCA2 (2018 Projections)								
State or Region	Nat. Fires & Bio.	Anthro Fires	Mobile	Area	Point	Outside Domain	Total	% Contribution
AZ	0.006	0	0.032	0.005	0.013		0.056	34.1%
CA	0.003	0	0.024	0.008	0.007		0.042	25.6%
OD						0.04	0.04	24.4%
PO	0	0	0.003	0.01	0.001		0.014	8.5%

The WEP analysis shows that the potential for sources in California to contribute OC and EC is about 27%, which is projected to decrease to 20 percent in 2018 (See Section 9.4.2). These emissions are mostly from sources of natural fire. Mexico and California have a 15% potential to contribute fine PM from dust and area sources, which increase slightly in 2018.

Mazatzal W and Pine Mountain W

PSAT modeling shows the outside domain is the highest contributor to sulfate concentrations followed by Mexico, which contributes approximately 0.15 µg/m^3 for the baseline and 2018 projections (Tables 12.19 and 12.20). Sulfate from Mexico is mostly from point sources, with a smaller amount from area sources. Pacific offshore has the third highest sulfate concentrations at IKBA1. Arizona is the fourth highest contributor to nitrate for both the baseline and 2018 projections. The fifth and sixth highest contributors to sulfate concentrations are California and CENRAP, respectively. Sulfate from California sources are mainly from point and natural fire/biogenic. The primary source types from CENRAP are point and area sources, both types show decreasing concentrations by 2018.

Table 12.19 – Interstate & International Contribution to Sulfate at IKBA1 (2002 Base)

State or Region	Nat. Fires & Bio.	Anthro Fires	Mobile	Area	Point	Outside Domain	Total	% Contribution
OD						0.266	0.266	30.5%
MEX	0	0	0.004	0.023	0.123		0.15	17.2%
PO	0	0	0.002	0.078	0.035		0.115	13.2%
AZ	0.005	0	0.019	0.007	0.053		0.084	9.6%
CEN	0	0	0.004	0.007	0.049		0.06	6.9%
CA	0.014	0	0.009	0.008	0.026		0.057	6.5%

Table 12.20 – Interstate & International Contribution to Sulfate at IKBA1 (2018 Projections)

State or Region	Nat. Fires & Bio.	Anthro Fires	Mobile	Area	Point	Outside Domain	Total	% Contribution
OD						0.267	0.267	32.6%
MEX	0	0	0.004	0.023	0.123		0.15	18.3%
PO	0	0	0.001	0.078	0.036		0.115	14.1%
AZ	0.005	0	0.011	0.009	0.062		0.087	10.6%
CA	0.013	0	0.005	0.008	0.026		0.052	6.4%
CEN	0	0	0	0.008	0.037		0.045	5.5%

Tables 12.21 and 12.22 show the contributions to nitrate at IKBA1 for the baseline and 2018 projections. California is the second highest contributor of nitrate at IKBA1 over the baseline (Table 12.21). Contributions from California sources are projected to decrease in 2018 (Table 12.22). PSAT modeling shows that the outside domain will be the second highest contributor to nitrate in 2018, approximately 20%.

Table 12.21 – Interstate & International Contribution to Nitrate at IKBA1 (2002 Base)

State or Region	Nat. Fires & Bio.	Anthro Fires	Mobile	Area	Point	Outside Domain	Total	% Contribution
AZ	0.011	0	0.158	0.007	0.024		0.2	54.2%
CA	0.003	0.001	0.048	0.006	0.005		0.063	17.1%
OD						0.048	0.048	13.0%
PO	0	0	0.006	0.011	0.001		0.018	4.9%

Table 12.21 – Interstate & International Contribution to Nitrate at IKBA1 (2002 Base)								
State or Region	Nat. Fires & Bio.	Anthro Fires	Mobile	Area	Point	Outside Domain	Total	% Contribution
NM	0	0	0.002	0.001	0.007		0.01	2.7%

Table 12.22 – Interstate & International Contribution to Nitrate at IKBA1 (2018 Projections)								
State or Region	Nat. Fires & Bio.	Anthro Fires	Mobile	Area	Point	Outside Domain	Total	% Contribution
AZ	0.012	0	0.069	0.012	0.036		0.129	46.4%
OD						0.056	0.056	20.1%
CA	0.003	0	0.022	0.007	0.007		0.039	14.0%
PO	0	0	0.003	0.013	0.001		0.017	6.1%
NM	0	0	0.001	0.004	0.007		0.012	4.3%

The WEP analysis shows that Mexico also has the potential to contribute to fine soil at Mazatzal and Pine Mountain and the primary contributors are point and windblown dust (See Section 9.4.3). Mexico has a small potential, less than 20%, to contribute to coarse mass.

Mount Baldy W

Tables 12.23 and 12.24 show the highest contributions to sulfate at BALD1. The outside domain (26.2%), Mexico (20%), and Arizona (17.3%) are the three highest contributors to sulfate concentrations. Modeling shows that overall concentrations from Arizona sources will decrease by 2018.

Table 12.23 – Interstate & International Contribution to Sulfate at BALD1 (2002 Base)								
State or Region	Nat. Fires & Bio.	Anthro Fires	Mobile	Area	Point	Outside Domain	Total	% Contribution
OD						0.215	0.215	26.2%
MEX	0	0	0.004	0.019	0.141		0.164	20.0%
AZ	0.027	0.001	0.012	0.004	0.098		0.142	17.3%
PO	0	0	0.001	0.049	0.019		0.069	8.4%
CEN	0	0	0.004	0.009	0.052		0.065	7.9%
CA	0.011	0	0.005	0.005	0.016		0.037	4.5%

Table 12.24 – Interstate & International Contribution to Sulfate at BALD1 (2018 Projections)								
State or Region	Nat. Fires & Bio.	Anthro Fires	Mobile	Area	Point	Outside Domain	Total	% Contribution
OD						0.218	0.218	28.1%
MEX	0	0	0.004	0.02	0.146		0.17	21.9%
AZ	0.029	0.001	0.006	0.006	0.097		0.139	17.9%
PO	0	0	0.001	0.049	0.02		0.07	9.0%
CEN	0	0	0	0.009	0.04		0.049	6.3%
CA	0.011	0	0.003	0.005	0.016		0.035	4.5%

Tables 12.25 and 12.26 show the contributions to nitrate at BALD1. The outside domain (20.3%) and New Mexico (12.5%) are the second and third highest contributors to nitrate, respectively, for both the baseline and 2018 projections.

Table 12..25 – Interstate & International Contribution to Nitrate at BALD1 (2002 Base)								
State or Region	Nat. Fires & Bio.	Anthro Fires	Mobile	Area	Point	Outside Domain	Total	% Contribution
AZ	0.009	0	0.022	0.001	0.02		0.052	40.6%
OD						0.026	0.026	20.3%
NM	0.001	0	0.004	0.002	0.009		0.016	12.5%
CA	0.001	0	0.011	0.002	0.001		0.015	11.7%
UT	0	0	0.002	0	0.003		0.005	3.9%

Table 12.26 – Interstate & International Contribution to Nitrate at BALD1 (2018 Projections)								
State or Region	Nat. Fires & Bio.	Anthro Fires	Mobile	Area	Point	Outside Domain	Total	% Contribution
AZ	0.011	0.001	0.011	0.001	0.023		0.047	38.2%
OD						0.03	0.03	24.4%
NM	0.001	0	0.002	0.005	0.008		0.016	13.0%
CA	0.001	0	0.005	0.002	0.002		0.01	8.1%
UT	0	0	0.001	0.001	0.002		0.004	3.3%

The WEP analysis shows that sources outside of Arizona have less than five percent potential to contribute to OC and EC at Mount Baldy (See Section 9.4.4). Mexican sources have approximately 20 percent potential to contribute to fine and coarse PM. There is a small potential, about 10%, for fine and coarse PM from New Mexico to contribute to visibility impairment.

Petrified Forest NP

Tables 12.27 and 12.28 show that the highest contributor to sulfate at PEFO1 is the outside domain (27%) for both the baseline and 2018 projections. Mexico (13.5%) and Pacific offshore (10%) are the third and fourth highest contributors, respectively, for the baseline and 2018 projections. The dominant source type contributing to sulfate from Mexico are point sources. Modeling shows the contribution from the outside domain, Arizona, Mexico, and Pacific offshore will not change significantly from the baseline to 2018.

Table 12.27 – Interstate & International Contribution to Sulfate at PEFO1 (2002 Base)								
State or Region	Nat. Fires & Bio.	Anthro Fires	Mobile	Area	Point	Outside Domain	Total	% Contribution
OD						0.224	0.224	27.0%
AZ	0.01	0	0.015	0.004	0.157		0.186	22.4%
MEX	0	0	0.003	0.016	0.093		0.112	13.5%
PO	0	0	0.001	0.058	0.024		0.083	10.0%
CA	0.012	0	0.008	0.007	0.023		0.05	6.0%
CEN	0	0	0.002	0.005	0.031		0.038	4.6%

Table 12.28 – Interstate & International Contribution to Sulfate at PEFO1 (2018 Projections)								
State or Region	Nat. Fires & Bio.	Anthro Fires	Mobile	Area	Point	Outside Domain	Total	% Contribution
OD						0.224	0.224	28.4%
AZ	0.01	0	0.008	0.006	0.171		0.195	24.7%
MEX	0	0	0.003	0.016	0.093		0.112	14.2%
PO	0	0	0.001	0.058	0.025		0.084	10.6%
CA	0.011	0	0.004	0.007	0.023		0.045	5.7%
CEN	0	0	0	0.005	0.023		0.028	3.5%

New Mexico is the second highest contributor to nitrate at PEFO1, both for the baseline and 2018 projections (Tables 12.29 and 12.30). Concentrations are slightly more than 0.02 $\mu g/m^3$ for the baseline and 2018 projections, or approximately 18% to 20% of the total sulfate, respectively.

Table 12.29 – Interstate & International Contribution to Nitrate at PEFO1 (2002 Base)								
State or Region	Nat. Fires & Bio.	Anthro Fires	Mobile	Area	Point	Outside Domain	Total	% Contribution
AZ	0.003	0	0.033	0.001	0.023		0.06	48.8%
NM	0	0	0.006	0.002	0.014		0.022	17.9%
OD						0.016	0.016	13.0%
CA	0.001	0	0.008	0.001	0.001		0.011	8.9%
UT	0	0	0.001	0	0.006		0.007	5.7%

Table 12.30 – Interstate & International Contribution to Nitrate at PEFO1 (2018 Projections)								
State or Region	Nat. Fires & Bio.	Anthro Fires	Mobile	Area	Point	Outside Domain	Total	% Contribution
AZ	0.005	0	0.017	0.002	0.032		0.056	47.9%
NM	0	0	0.003	0.007	0.014		0.024	20.5%
OD						0.018	0.018	15.4%
CA	0.001	0	0.004	0.002	0.001		0.008	6.8%
UT	0	0	0.001	0	0.002		0.003	2.6%

The WEP analysis shows that California and New Mexico have a less than 10% potential to contribute to OC and EC (See Section 9.4.5). For sources of fine and coarse PM outside of Arizona, Mexico has less than 20% potential to contribute.

Saguaro NP (West and East Unit)

West Unit

Tables 12.31 and 12.32 show that the outside domain and Mexico are the highest contributors to sulfate at SAWE1. Contributions from the outside domain and Mexico account for 47% to 52% of the sulfate at SAWE1 for both the baseline and 2018 projections.

Table 12.31 – Interstate & International Contribution to Sulfate at SAWE1 (2002 Base)								
State or Region	Nat. Fires & Bio.	Anthro Fires	Mobile	Area	Point	Outside Domain	Total	% Contribution
OD						0.291	0.291	27.0%
MEX	0	0	0.005	0.028	0.185		0.218	20.2%
AZ	0.003	0	0.023	0.013	0.078		0.117	10.9%
CEN	0	0	0.006	0.015	0.084		0.105	9.7%
EUS	0	0	0.003	0.006	0.095		0.104	9.7%
PO	0	0	0.001	0.076	0.022		0.099	9.2%

Table 12.32 – Interstate & International Contribution to Sulfate at SAWE1 (2018 Projections)								
State or Region	Nat. Fires & Bio.	Anthro Fires	Mobile	Area	Point	Outside Domain	Total	% Contribution
OD						0.291	0.291	29.3%
MEX	0	0	0.005	0.028	0.186		0.219	22.0%
AZ	0.003	0	0.014	0.017	0.095		0.129	13.0%
PO	0	0	0.001	0.075	0.023		0.099	10.0%
CEN	0	0	0.001	0.015	0.066		0.082	8.2%
EUS	0	0	0.001	0.006	0.042		0.049	4.9%

For the baseline period, California is the second highest contributor to nitrate at SAWE1, accounting for 16.5% of total nitrate (Table 12.33). Modeling shows that California's contribution will decrease to 13% in 2018 (Table 12.34). The outside domain is projected to contribute close to 16% of nitrate concentration in 2018.

Table 12.33 – Interstate & International Contribution to Nitrate at SAWE1 (2002 Base)								
State or Region	Nat. Fires & Bio.	Anthro Fires	Mobile	Area	Point	Outside Domain	Total	% Contribution
AZ	0.013	0	0.219	0.011	0.043		0.286	54.8%
CA	0.003	0	0.067	0.008	0.008		0.086	16.5%
OD						0.055	0.055	10.5%
PO	0	0	0.006	0.016	0.001		0.023	4.4%
MEX	0.004	0	0.009	0.002	0.003		0.018	3.4%

Table 12.34 – Interstate & International Contribution to Nitrate at SAWE1 (2018 Projections)								
State or Region	Nat. Fires & Bio.	Anthro Fires	Mobile	Area	Point	Outside Domain	Total	% Contribution
AZ	0.015	0	0.105	0.019	0.082		0.221	49.6%
OD						0.07	0.07	15.7%
CA	0.004	0	0.033	0.01	0.011		0.058	13.0%
PO	0	0	0.003	0.02	0.001		0.024	5.4%
MEX	0.004	0	0.01	0.002	0.003		0.019	4.3%

The WEP analysis shows that sources outside of Arizona have a less than 5% potential to contribute to OC and EC (See Section 9.4.6). Mexico is the only source outside of Arizona having the potential to contribute to fine and coarse PM, which is about 20%.

East Unit

Similar to the West Unit (SAWE1), most of the sulfate concentrations at SAGU1 are from the outside domain and Mexico (Tables 12.35 and 12.36). Modeling shows that the percent contribution will increase by 2018.

Table 12.35 – Interstate & International Contribution to Sulfate at SAGU1 (2002 Base)

State or Region	Nat. Fires & Bio.	Anthro Fires	Mobile	Area	Point	Outside Domain	Total	% Contribution
OD						0.291	0.291	27.0%
MEX	0	0	0.005	0.028	0.185		0.218	20.2%
AZ	0.003	0	0.023	0.013	0.078		0.117	10.9%
CEN	0	0	0.006	0.015	0.084		0.105	9.7%
EUS	0	0	0.003	0.006	0.095		0.104	9.7%
PO	0	0	0.001	0.076	0.022		0.099	9.2%

Table 12.36 – Interstate & International Contribution to Sulfate at SAGU1 (2018 Projections)

State or Region	Nat. Fires & Bio.	Anthro Fires	Mobile	Area	Point	Outside Domain	Total	% Contribution
OD						0.291	0.291	29.3%
MEX	0	0	0.005	0.028	0.186		0.219	22.0%
AZ	0.003	0	0.014	0.017	0.095		0.129	13.0%
PO	0	0	0.001	0.075	0.023		0.099	10.0%
CEN	0	0	0.001	0.015	0.066		0.082	8.2%
EUS	0	0	0.001	0.006	0.042		0.049	4.9%

California sources contribute to approximately 16% and 13% of the nitrate concentrations at SAGU1 over the baseline and 2018 projections, respectively (Tables 12.37 and 12.38). PSAT modeling shows that nitrate should decrease by 2018.

Table 12.37 – Interstate & International Contribution to Nitrate at SAGU1 (2002 Base)

State or Region	Nat. Fires & Bio.	Anthro Fires	Mobile	Area	Point	Outside Domain	Total	% Contribution
AZ	0.013	0	0.219	0.011	0.043		0.286	54.8%
CA	0.003	0	0.067	0.008	0.008		0.086	16.5%
OD						0.055	0.055	10.5%
PO	0	0	0.006	0.016	0.001		0.023	4.4%
MEX	0.004	0	0.009	0.002	0.003		0.018	3.4%

Table 12.38 – Interstate & International Contribution to Nitrate at SAGU1 (2018 Projections)								
State or Region	Nat. Fires & Bio.	Anthro Fires	Mobile	Area	Point	Outside Domain	Total	% Contribution
AZ	0.015	0	0.105	0.019	0.082		0.221	49.6%
OD						0.07	0.07	15.7%
CA	0.004	0	0.033	0.01	0.011		0.058	13.0%
PO	0	0	0.003	0.02	0.001		0.024	5.4%
MEX	0.004	0	0.01	0.002	0.003		0.019	4.3%

The WEP analysis shows that the potential for OC and EC contribution at Saguaro East (SAGU1) is similar to the West Unit (SAWE1). Sources outside of Arizona have a less than 5% potential to contribute to OC and EC (See Section 9.4.7). Mexico is the only source outside of Arizona having the potential to contribute to fine and coarse PM, which is about 20%.

Given that SAGU1 is one of two monitors showing degradation on best days, the following tables show the highest contributors to sulfate and nitrate. The outside domain is the primary contributor to sulfate for both the baseline and 2018 projections on best days (Tables 12.39 and 12.40). On best days, Arizona sources contribute 13.1% to sulfate for the baseline and are projected to contribute 13.7% of total sulfate in 2018.

Table 12.39 – Interstate & International Contribution to Sulfate at SAGU1 on Best Days (2002 Base)								
State or Region	Nat. Fires & Bio.	Anthro Fires	Mobile	Area	Point	Outside Domain	Total	% Contribution
OD						0.272	0.272	46.7%
MEX	0	0	0.002	0.016	0.08		0.098	16.8%
AZ	0.002	0	0.019	0.011	0.044		0.076	13.1%
PO	0	0	0	0.034	0.014		0.048	8.2%
NM	0	0	0.001	0.002	0.013		0.016	2.7%
CEN	0	0	0.001	0.004	0.011		0.016	2.7%

Table 12.40 – Interstate & International Contribution to Sulfate at SAGU1 on Best Days (2018 Projections)								
State or Region	Nat. Fires & Bio.	Anthro Fires	Mobile	Area	Point	Outside Domain	Total	% Contribution
OD						0.278	0.278	47.0%
MEX	0	0	0.002	0.016	0.088		0.106	17.9%
AZ	0.003	0	0.013	0.014	0.051		0.081	13.7%
PO	0	0	0	0.034	0.014		0.048	8.1%
NM	0	0	0	0.003	0.012		0.015	2.5%
CEN	0	0	0	0.004	0.009		0.013	2.2%

Interstate and international contribution to nitrate concentrations at SAGU1 on best days is primarily from the outside domain and California. Contribution to nitrate from Arizona sources is 40.8% for the baseline and is projected to decrease to 35.3% in 2018 (Tables 12.41 and 12.42).

Table 12.41 – Interstate & International Contribution to Nitrate at SAGU1 on Best Days (2002 Base)								
State or Region	**Nat. Fires & Bio.**	**Anthro Fires**	**Mobile**	**Area**	**Point**	**Outside Domain**	**Total**	**% Contribution**
AZ	0.011	0	0.099	0.005	0.029		0.144	40.8%
OD						0.068	0.068	19.3%
CA	0.001	0	0.035	0.005	0.004		0.045	12.7%
NM	0.002	0	0.014	0.004	0.007		0.027	7.7%
UT	0	0	0.008	0.001	0.012		0.021	6.0%
MEX	0.003	0	0.007	0.002	0.004		0.016	4.5%

Table 12.42 – Interstate & International Contribution to Nitrate at SAGU1 on Best Days (2018 Projections)								
State or Region	**Nat. Fires & Bio.**	**Anthro Fires**	**Mobile**	**Area**	**Point**	**Outside Domain**	**Total**	**% Contribution**
AZ	0.011	0	0.043	0.007	0.047		0.108	35.3%
OD						0.082	0.082	26.8%
CA	0.001	0	0.016	0.006	0.005		0.028	9.2%
NM	0.002	0	0.008	0.008	0.008		0.026	8.5%
MEX	0.003	0	0.007	0.002	0.004		0.016	5.2%
UT	0	0	0.004	0.001	0.01		0.015	4.9%

Sierra Ancha W

For the baseline and 2018 projections, the top three contributors to sulfate concentrations at SIAN1 are the outside domain, Mexico, and Pacific offshore. Combined, these sources account for about 32% of the sulfate and PSAT modeling shows that the combined contribution will increase to 63.5% in 2018 (Tables 12.43 and 12.44).

Table 12.43 – Interstate & International Contribution to Sulfate at SIAN1 (2002 Base)								
State or Region	**Nat. Fires & Bio.**	**Anthro Fires**	**Mobile**	**Area**	**Point**	**Outside Domain**	**Total**	**% Contribution**
OD						0.258	0.258	26.6%
MEX	0	0	0.005	0.024	0.164		0.193	19.9%
PO	0	0	0.001	0.084	0.031		0.116	12.0%
AZ	0.015	0	0.019	0.006	0.068		0.108	11.1%
CEN	0	0	0.004	0.009	0.058		0.071	7.3%
EUS	0	0	0.002	0.004	0.06		0.066	6.8%
CA	0.016	0	0.008	0.008	0.026		0.058	6.0%

Table 12.44 – Interstate & International Contribution to Sulfate at SIAN1 (2018 Projections)								
State or Region	Nat. Fires & Bio.	Anthro Fires	Mobile	Area	Point	Outside Domain	Total	% Contribution
OD						0.262	0.262	28.9%
MEX	0	0	0.005	0.025	0.166		0.196	21.6%
PO	0	0	0.001	0.084	0.033		0.118	13.0%
AZ	0.015	0	0.011	0.008	0.081		0.115	12.7%
CEN	0	0	0	0.01	0.045		0.055	6.1%
CA	0.015	0	0.005	0.007	0.025		0.052	5.7%
EUS	0	0	0.001	0.004	0.027		0.032	3.5%

California is the second highest contributor to nitrate for both the baseline and 2018 projections. Source of nitrate from California contribute about 0.08 and 0.05 $\mu g/m^3$ for the baseline period and 2018 projections, respectively (Tables 12.45 and 12.46).

Table 12.45 – Interstate & International Contribution to Nitrate at SIAN1 (2002 Base)								
State or Region	Nat. Fires & Bio.	Anthro Fires	Mobile	Area	Point	Outside Domain	Total	% Contribution
AZ	0.004	0	0.071	0.003	0.003		0.081	47.1%
CA	0.002	0	0.038	0.005	0.004		0.049	28.5%
OD						0.017	0.017	9.9%
PO	0	0	0.005	0.009	0.001		0.015	8.7%
MEX	0.001	0	0.002	0	0.001		0.004	2.3%
NV	0	0	0.002	0	0.002		0.004	2.3%

Table 12.46 – Interstate & International Contribution to Nitrate at SIAN1 (2018 Projections)								
State or Region	Nat. Fires & Bio.	Anthro Fires	Mobile	Area	Point	Outside Domain	Total	% Contribution
AZ	0.004	0	0.025	0.005	0.006		0.04	36.0%
CA	0.002	0	0.017	0.006	0.006		0.031	27.9%
OD						0.019	0.019	17.1%
PO	0	0	0.002	0.01	0.001		0.013	11.7%
MEX	0.001	0	0.002	0	0.001		0.004	3.6%
NV	0	0	0.001	0	0.003		0.004	3.6%

The WEP analysis shows that sources outside of Arizona have a minimal potential to contribute to both OC and EC (See Section 9.4.8). Looking at fine and coarse PM, Mexico has between 15% and 20% potential to contribute to emissions.

Superstition W

The outside domain has the greatest contribution to sulfate at TONT1 for the baseline and 2018 projections (Tables 12.47 and 12.48). Modeling shows that Mexico will be the second highest contributor to sulfate in 2018, about 0.17 $\mu g/m^3$.

Table 12.47 – Interstate & International Contribution to Sulfate at TONT1 (2002 Base)								
State or Region	**Nat. Fires & Bio.**	**Anthro Fires**	**Mobile**	**Area**	**Point**	**Outside Domain**	**Total**	**% Contribution**
OD						0.283	0.283	28.5%
AZ	0.034	0	0.045	0.012	0.072		0.163	16.4%
MEX	0	0	0.004	0.023	0.136		0.163	16.4%
PO	0	0	0.002	0.089	0.035		0.126	12.7%
CA	0.014	0	0.009	0.008	0.028		0.059	5.9%
CEN	0	0	0.003	0.007	0.045		0.055	5.5%

Table 12.48 – Interstate & International Contribution to Sulfate at TONT1 (2018 Projections)								
State or Region	**Nat. Fires & Bio.**	**Anthro Fires**	**Mobile**	**Area**	**Point**	**Outside Domain**	**Total**	**% Contribution**
OD						0.287	0.287	30.9%
MEX	0	0	0.004	0.024	0.138		0.166	17.9%
AZ	0.035	0	0.029	0.014	0.078		0.156	16.8%
PO	0	0	0.001	0.089	0.036		0.126	13.6%
CA	0.014	0	0.005	0.008	0.028		0.055	5.9%
CEN	0	0	0	0.007	0.033		0.04	4.3%

Tables 12.49 and 12.50 shows that the outside domain and California are the second and third highest contributors to nitrate at TONT1. This accounts for 24.7% and 28.5% of the total nitrate for the baseline and 2018 projections, respectively.

Table 12.49 – Interstate & International Contribution to Nitrate at TONT1 (2002 Base)								
State or Region	**Nat. Fires & Bio.**	**Anthro Fires**	**Mobile**	**Area**	**Point**	**Outside Domain**	**Total**	**% Contribution**
AZ	0.014	0	0.228	0.01	0.03		0.282	62.5%
CA	0.002	0.001	0.051	0.007	0.006		0.067	14.9%
OD						0.044	0.044	9.8%
PO	0	0	0.005	0.01	0.001		0.016	3.5%
NM	0.001	0	0.003	0.002	0.008		0.014	3.1%
MEX	0.002	0	0.006	0.001	0.001		0.01	2.2%

Table 12.50 – Interstate & International Contribution to Nitrate at TONT1 (2018 Projections)								
State or Region	Nat. Fires & Bio.	Anthro Fires	Mobile	Area	Point	Outside Domain	Total	% Contribution
AZ	0.017	0	0.117	0.021	0.049		0.204	54.8%
OD						0.058	0.058	15.6%
CA	0.003	0	0.027	0.009	0.009		0.048	12.9%
PO	0	0	0.003	0.014	0.001		0.018	4.8%
NM	0.001	0	0.002	0.005	0.008		0.016	4.3%
MEX	0.002	0	0.007	0.001	0.001		0.011	3.0%

The WEP analysis shows that sources outside of Arizona have less than five percent potential to contribute to OC and EC. The potential for emissions of fine and coarse PM is highest for Arizona sources, but Mexico has between 15 and 20 percent potential to contribute to emissions.

Sycamore Canyon W

Tables 12.51 and 12.52 show that the top three contributor to sulfate at SYCA1 over the baseline and 2018 projections are the outside domain, Pacific offshore, and Mexico. This accounts for 61.5% and 56.9% of the total sulfate for the baseline and in 2018, respectively.

Table 12.51 – Interstate & International Contribution to Sulfate at SYCA1 (2002 Base)								
State or Region	Nat. Fires & Bio.	Anthro Fires	Mobile	Area	Point	Outside Domain	Total	% Contribution
OD						0.218	0.218	36.8%
PO	0	0	0.001	0.054	0.026		0.081	13.7%
MEX	0	0	0.002	0.012	0.051		0.065	11.0%
CA	0.013	0	0.007	0.006	0.021		0.047	7.9%
AZ	0.006	0	0.014	0.003	0.023		0.046	7.8%
NV	0.001	0	0.001	0.004	0.028		0.034	5.7%

Table 12.52 – Interstate & International Contribution to Sulfate at SYCA1 (2018 Projections)								
State or Region	Nat. Fires & Bio.	Anthro Fires	Mobile	Area	Point	Outside Domain	Total	% Contribution
OD						0.224	0.224	39.4%
PO	0	0	0.001	0.055	0.027		0.083	14.6%
MEX	0	0	0.003	0.013	0.057		0.073	12.9%
AZ	0.006	0	0.01	0.004	0.028		0.048	8.5%
CA	0.014	0	0.005	0.006	0.021		0.046	8.1%
NV	0.001	0	0	0.004	0.009		0.014	2.5%

Tables 12.53 and 12.54 shows that the outside domain and California are the second and third highest contributors to nitrate at SYCA1. This accounts for 25.9% and 29.1% of the total nitrate in the baseline and 2018 projections, respectively.

Table 12.53 – Interstate & International Contribution to Nitrate at SYCA1 (2002 Base)								
State or Region	**Nat. Fires & Bio.**	**Anthro Fires**	**Mobile**	**Area**	**Point**	**Outside Domain**	**Total**	**% Contribution**
AZ	0.01	0	0.112	0.004	0.022		0.148	47.9%
OD						0.044	0.044	14.2%
CA	0.001	0	0.029	0.003	0.003		0.036	11.7%
UT	0.001	0	0.012	0.001	0.018		0.032	10.4%
NM	0	0	0.002	0.002	0.009		0.013	4.2%

Table 12.54 – Interstate & International Contribution to Nitrate at SYCA1 (2018 Projections)								
State or Region	**Nat. Fires & Bio.**	**Anthro Fires**	**Mobile**	**Area**	**Point**	**Outside Domain**	**Total**	**% Contribution**
AZ	0.013	0	0.051	0.007	0.037		0.108	42.0%
OD						0.051	0.051	19.8%
CA	0.002	0	0.014	0.004	0.004		0.024	9.3%
UT	0.001	0	0.006	0.002	0.014		0.023	8.9%
NM	0	0	0.001	0.006	0.009		0.016	6.2%

The WEP analysis shows that California has a small potential to contribute to both OC and EC, about 10% (See Section 9.4.9). Looking at fine and coarse PM, Mexico has a small potential to contribute (less than 20%).

12.4.3 Estimated International Contribution to Arizona Class I Areas

The Regional Haze Rule does not specifically address international transport; however, it is important to identify the contribution to visibility impairment at Class I areas in Arizona from international sources such as the outside domain and Mexico. As described in Chapter 9 and Section 12.3.2, both the PSAT and WEP results show the contribution from the outside domain and Mexico are significant. Global transport can be assumed to be most of the outside domain category. PSAT modeling does not differentiate the sources and source categories of the outside domain and are not addressed in this plan. Emissions from Pacific offshore sources are mentioned in the previous section and Chapter 9 illustrates the contribution from this category.

In terms of addressing Mexican emissions for the LTS, ADEQ does not have authority over Mexican sources and is not pursuing strategies for those emissions that contribute to visibility impairment. The pacific offshore emissions are under the purview of EPA and are therefore not addressed in this plan. The emissions will be addressed at a future date.

12.5 Summary of Interstate Consultation

In addition to evaluating interstate transport, states are required to consult with each other under Section 51.308(d)(3)(i), to develop coordinated emission management strategies. See Section 13.2 for information on state consultation.

12.6 Technical Documentation

Section 51.308(d)(3)(iii) requires documentation of the technical basis, including modeling, monitoring, and emissions information, upon which the state relied upon to determine apportionment of emission reductions needed to achieve progress goals in each Class I area. ADEQ relied on the technical information and analysis developed and provided by the WRAP. The projects and studies were conducted by contractors and WRAP staff and are presented on WRAP's Technical Support System (TSS) Web site. The following references the Chapters in this plan describing the technical information and documentation. Additional information on the TSS can be found in Appendix C of this plan.

Emissions Data

Chapter 8 describes the emission inventory information for state and regional emission. Section 8/1 summaries Arizona's emissions and Section 8.2 summarizes regional emissions for neighboring states.

Modeling Techniques

The modeling techniques used are described in Chapter 9. Section 9.1.1 describes source apportionment analysis using the PM Source Apportionment Technology (PSAT) tool, for the attribution of sulfate and nitrate sources, and the Weighted Emissions Potential (WEP) tool, for the attribution of sources of sulfate, nitrate, organic carbon, elemental carbon, fine PM, and coarse PM Section 9.1.2 describes the regional haze modeling used the Community Multi-Scale Air Quality (CMAQ) model.

Monitoring Data

Chapter 4 describes the IMPROVE monitoring network and monitoring sites in Arizona. Chapter 6 and 7 provide a summary of monitoring data, trends, and breakdown by pollutant for each of the monitor sites in Arizona.

12.7 Required Factors for the LTS

Under Section 51.308(d)(3)(v) of the Regional Haze Rule, the factors listed in the following section represent the minimum that must be considered by a state in developing the LTS. Section 12.7 identified additional measure and control being proposed by Arizona beyond those required for the LTS.

12.7.1 Emission Reductions Due to Ongoing Air Pollution Programs

This section describes ongoing program and regulations in Arizona that directly protect visibility, or can be expected to improve visibility at Class I areas in Arizona by reducing emissions in general. This summary does not attempt to estimate the actual improvements in visibility that will occur, as many of the benefits are secondary to the primary air pollution objective of these programs/rules, and consequently would be extremely difficult to quantify, due to the technical complexity and limitation in current assessment techniques.

1. Prevention of Significant Deterioration/New Source Review Rules

The two primary regulatory tools for addressing visibility impairment from industrial sources are BART and the Prevention of Significant Deterioration (PSD) New Source Review rules. The PSD rules protect

visibility in Class I areas from new industrial sources and major changes to existing sources. ADEQ's air quality rules contain requirements for visibility impact assessment and mitigation associated with emissions from new and modified major stationary sources. Specifically, A.A.C. R18-2-406(F) references the need for protection of "Air Quality Related Values" (AQRV), which are specific scenic and environmentally related resources that may be adversely affected by a change in air quality. One of these AQRVs is visibility. Protection of all AQRVs (including visibility) is the primary responsibility of the Federal Land Manager. Any new major source or major modification within 300 kilometers of a Class I area that is found through modeling to cause significant visibility impairment will not be issued an air quality permit by the Department unless the impact is mitigated. The definition of "significant" impairment for PSD is very similar to the significance level used for BART modeling. For PSD, the significance level is an increase in visibility impairment above natural background of 5% (expressed as visibility extinction). For BART, the significance level is 0.5 deciviews. In addition to R18-2-406(F) is R18-2-410, Visibility Protection. This rule allows an opportunity for a Federal Land Manager to provide information on visibility impairment for a new source or major modified source during the public process for a permit. Both of these rules are included in Appendix F of this SIP for the reader's convenience but are already part of the state's permitting program.

2. Arizona's Strategy to Address Reasonably Attributable Visibility Impairment (RAVI)

Section 169A of the CAA contains the national goal that requires states to remedy existing visibility impairment and prevent future visibility impairment in the Class I areas. Initially, states containing mandatory Class I Federal areas were required to address the specific type of air pollution coming from existing stationary sources that could be anticipated to cause or contribute to visibility impairment. This type of pollution was commonly referred to as "plume blight," or more formally, reasonably attributable visibility impairment (RAVI). On December 2, 1980, the EPA determined that there were two types of air pollution that reduced or impaired visibility (45 FR 80084). One type was described as "smoke, dust, colored gas plumes, or layered haze emitted from stacks," and the second type was "widespread, regionally homogeneous haze from a multitude of sources" (Ibid, p. 80085).

The existing stationary sources subject to Section 169A of the CAA include any reconstructed source that was not in operation prior to August 7, 1962, and was in existence on August 7, 1977, and has the potential to emit 250 tons per year of any regulated pollutant. "In existence" is interpreted by the EPA to be consistent with the term, "commence construction" found in Prevention of Serious Deterioration (PSD) regulations (40 CFR 51.165(a)(1)(xvi) and 40 CFR 52.21(b)(9)). If construction commenced after August 7, 1977, the source would be subject to the PSD/NSR (new source review) program.

The SIPs developed to address visibility impairment from sources that could be reasonably anticipated to cause or contribute to visibility impairment in Class I areas had to include four specific things: (1) a monitoring plan to assist in the determination of what type of emissions were actually occurring in and near the Class I Area; (2) a way to determine what type of technological controls (best available retrofit technology or BART) could be used at a source should that source be found to cause or contribute – be found attributable – for the air pollution; (3) a process for addressing possible visibility impairment from new sources through existing New Source Review regulations, including review of that process by the FLMs; and (4) long-term strategies for dealing with existing and any future visibility impairment from stationary sources.

SIPs for 36 states were due to EPA by December 2, 1980. Unable to comply by the deadline, Arizona along with several other states, was cited on July 12, 1985, as failing to meet the requirements of 40 CFR 51.305, monitoring, and 51.307, new source review (50 FR 28545). On November 24, 1987, Arizona was cited as failing to meet the requirements of 40 CFR 51.306, long-term strategies, and 51.302, control

strategies (i.e., BART). Failure to meet the requirements in 40 CFR 51.302, 305, 306, and 307 through a SIP meant EPA imposed a Federal Implementation Plan or FIP (52 FR 45134, November 24, 1987). Included in the 1987 FIP was FLM certification of three Class I areas in Arizona for visibility impairment: Grand Canyon National Park, Petrified Forest National Park, and Saguaro Wilderness.

On September 15, 1988, EPA published its assessment of the Class I areas certified by the FLMs that included an assessment of the three Arizona areas named in 1987 (53 FR 35956). By 1991, EPA published a final rule that revised Arizona's FIP to reflect an analysis of the visibility impairment at Grand Canyon National Park for an attributable stationary source, Navajo Generating Station (56 FR 50172).

To address RAVI, Arizona promulgated Article 16, effective December 2, 2003 (A.C.C. R18-2-1601 – 1606). Article 16 allows Arizona to comply and meet the requirements of 40 CFR 51.302 through 307. R18-2-1610 – 1613 addresses requirements for the sulfur dioxide backstop market trading program that was a strategy under Section 309. a copy of Article 16 has been included in Appendix F of this SIP for the reader's convenience. The RAVI rule continues to be an avenue available to both the state and Federal land Managers to remedy visibility impairment in addition to and beyond the strategies outline under regional haze.

Implementation of Control Strategies

Pursuant to 40 CFR 51.302, states must have a procedure in place to analyze and, if necessary, implement control strategies for RAVI, and imposition of best available retrofit technology (BART) for any eligible source whose emissions are found to cause or contribute to visibility impairment. Again, Arizona's RAVI rule can be found in Appendix F; a list of the BART-eligible sources is listed in Section 1601 of the rule.

40 CFR 51.302 also requires the state to communicate with the FLMs and provide for consultation on any matters pertaining to visibility impairment. Emails providing a draft copy of this SIP and notifying the FLMs of the public comment period, and locations and dates of public hearings for this SIP can also be found in Appendix E.

Exemptions from Controls

Pursuant to 40 CFR 51.303, any source found attributable for visibility impairment and required to install and operate BART, may request a federal exemption from BART. This federal exemption process is incorporated by reference in R18-2-1606 of Arizona's RAVI rule. At this time, no source in the State of Arizona has requested a federal exemption from BART.

Monitoring

Pursuant to 40 CFR 51.305, the State of Arizona developed a monitoring plan for the 12 Class I areas. The plan, Arizona Class I Area Visibility Monitoring Operational Plan (Monitoring Plan) includes a commitment to, "characterize long-term trends in all Arizona Class I areas as completely as possible using ambient visibility measurements, within constraints of an area's size, terrain, or logistics, for each of the 12 Class I areas in Arizona".

Arizona's Monitoring Plan was developed in cooperation of the FLMs, other related agencies and counties as well as air quality specialists in the field of monitoring, data gathering and assessment, and meteorology. The Monitoring Plan contains four objectives that serve to meeting the needs of any visibility regulations promulgated by the State of Arizona to meet RAVI. The objectives are: (1) long-

term monitoring strategy, (2) track visibility trends at Arizona Class I areas, (3) assist in identifying any reasonably attributable visibility impairment impacts, and (4) provide monitoring data if necessary for new or major modifications of categorical major sources.

The Monitoring Plan accounts for the long-standing IMPROVE monitoring program and integration with EPA's $PM_{2.5}$ monitoring guidance. IMPROVE was established in 1985 to coordinate the monitoring of national parks and wilderness areas and to ensure sound and consistent scientific methods were being employed. The IMPROVE Steering Committee established monitoring protocols for visibility measurement, particulate matter measurement, and scientific photography of the Class I areas. IMPROVE monitoring is designed to established reference information on visibility conditions and trends to aid in the development of visibility protection programs.

Long-term Strategy Requirements for RAVI

Pursuant to 40 CFR 51.306, a long-term strategy for RAVI must be established in the SIP. This strategy must cover a 10-15 year period. Arizona's RAVI rule fulfills the long-term strategy requirements for RAVI for stationary sources. Should any source be found attributable for visibility impairment and subsequently required to install and operate BART, Arizona commits to submitting a SIP revision (as required by R18-2-1605(B)), meeting the review requirements for the long-term strategies as outlined in 51.306(e), including any impact resulting from the imposition of controls or exemption from controls for BART.

3. On-going Implementation of State and Federal Mobile Source Regulations

As described in Section 11.4.3, mobile source annual emissions show a major decrease in NO_X, SO_2, and VOCs in Arizona from 2002 to 2018, and represent the greatest emission reductions of any single source category. This is likely due to the numerous "on the books" federal mobile source regulations (see list in Section 11.4.3). This trend is expected to provide significant visibility benefits.

Beginning in 2006, EPA mandated new standards for on-road (highway) diesel fuel, known as ultra-low sulfur diesel (ULSD). This regulation dropped the sulfur content of diesel fuel from 500 ppm to 15 ppm. ULSD fuel enables the use of cleaner technology diesel engines and vehicles with advanced emissions control devices, resulting in significantly lower emissions. Diesel fuel intended for locomotive, marine and non-road (farming and construction) engines and equipment is required to meet the low sulfur diesel fuel maximum specification of 500 ppm sulfur in 2007 (down from 5000 ppm). By 2010, the ULSD fuel standard of 15-ppm sulfur will apply to all non-road diesel fuel. Locomotive and marine diesel fuel will be required to meet the ULSD standard beginning in 2012, resulting in further reductions of diesel emissions. These rules not only reduce SO_2 emissions, but also NO_X and PM.

ADEQ administers a mandatory vehicle emissions testing and repair program known as Vehicle Emissions Inspection Program (VEIP) in Phoenix and Tucson to improve air quality and reduce vehicle emissions. VEIP emphasizes the importance of maintaining vehicle performance to lower emissions and extend the life of vehicles. The vehicle inspection program identifies those vehicles emitting high levels of pollutants, which have led to significant reductions in air pollution, including NO_X and VOCs.

4. On-going Implementation of Programs to meet PM_{10} NAAQS

Section 51.308(d)(3)(v)(A) requires states to consider emission reductions from ongoing pollution control programs. ADEQ looked at nonattainment and maintenance areas for PM_{10} in developing its long-term

strategy. There are 10 communities that are either currently or formerly nonattainment areas under the PM_{10} National Ambient Air Quality Standard (NAAQS). The following lists these communities by population size and their current PM_{10} designation:

- Ajo – nonattainment with maintenance plan under development
- Bullhead City - maintenance
- Douglas-Paul Spur – nonattainment with maintenance plan under development
- Hayden – nonattainment
- Miami – nonattainment with maintenance plan submitted to EPA
- Nogales – nonattainment with maintenance plan under development for Arizona emissions
- Payson – maintenance
- Phoenix – nonattainment with 5 Percent Plan
- Rillito – nonattainment with maintenance plan submitted to EPA
- Yuma – nonattainment with maintenance plan submitted to EPA

As related to regional haze, these PM_{10} nonattainment and maintenance areas have made significant reductions in PM_{10} emissions in the last 10 years by adopting similar strategies to address the primary emission sources in each community. The major contributing sources causing nonattainment in these communities are industry, mobile sources, road dust, and outdoor burning. These are the same sources that contribute to visibility impairment. As Table 12.55 shows, some of these communities are in close proximity to Arizona Class I areas.

Table 12.55 – Proximity of Nonattainment/Maintenance Areas to Arizona Class I Areas

Community	Population (est.)	Approximate Distance to Nearby Class I Area
Ajo	4,351	Saguaro NP (West) – 160 mi; Superstition W – 160 mi
Bullhead City	40,747	Grand Canyon NP – 90 mi; Sycamore Canyon W – 195 mi
Douglas-Paul Spur	36,620	Chiricahua W – 40 mi; Chiricahua NM – 60 mi; Saguaro NP (East) – 80 mi
Hayden	808	Superstition W – 25 mi; Galiuro W – 30 mi
Miami	1,765	Superstition W – 15 mi; Galiuro W – 50 mi
Nogales	20,017	Saguaro NP (East) – 65 mi; Chiricahua W – 150 mi; Chiricahua NM – 165 mi
Payson	15,547	Mazatzal W – 10 mi; Superstition W – 45 mi; Sierra Ancha W – 40 mi; Pine Mountain W – 30 mi
Phoenix	1,601,587	Superstition W – 10 mi; Sierra Ancha W – 50 mi; Mazatzal W – 45 mi; Pine Mountain W – 60 mi
Rillito	148	Saguaro NP (West) – 4 mi; Saguaro NP (East) – 22 mi; Galiuro W – 50 mi; Superstition W – 65 mi
Yuma	91,105	Saguaro NP (West) – 200 mi

ADEQ believes the ongoing PM_{10} reductions in these communities may provide significant benefits to visibility and regional haze. Many of the communities within the nonattainment areas have city or county ordinances and rules regarding the prevention of trackout onto roadways, stabilizing unpaved parking surfaces, traffic reduction, and/or stabilizing wind erodible soil. Many mining and construction operations within Arizona have permit provisions requiring covering haul trucks, controlling dust from

storage piles, and/or the use of dust suppressants or stabilizers on unpaved roadways, parking areas, and vacant lots. For areas in the state with tailing piles resulting from mining operations, A.C.C. R18-2-608 requires the tailing to be controlled during and after operations.

In the Maricopa nonattainment area, emissions from are regulated through Rule 310.01 (Maricopa County), which applies to any open area or vacant lot that is not defined as agricultural land and is not used for agricultural purposes according to Arizona Revised Statutes (A.R.S.) § 42-12151 and A.R.S. § 42-12152. Maricopa County also has regulations to restrict residential wood burning on high pollution days. Forecasters at ADEQ monitor existing conditions and if high pollution conditions occur, they issue a high pollution advisory day (HPA). At that time, a no-burn day restriction would be issued prohibiting all fireplace, woodstove and outdoor burning devices, including the use of manufactured logs. Statewide rules regulating unlawful open burning, R18-2-602, require individuals to acquire a burn permit from their local burn authority.

Yuma provides its residents with High Wind Advisories that operate much like high pollution advisories, but are solely for the control of particulate matter. The City of Nogales, Arizona is considering developing a similar program. The remaining rules under Article 6, including rules related to particulate matter from agricultural operations in both the Phoenix and Yuma areas require farmers to be aware of and implement best management practices to control particulate matter throughout the year, regardless of growing season. The Agricultural Best Management Practices Program is reviewed on a regular basis to ensure that current practices are updated and new practices are added, as necessary.

12.7.2 Measures to Mitigate the Impacts of Construction Activities

Section 51.308(d)(3)(v)(B) requires states to consider measures to mitigate the impacts of construction activities. After reviewing the current status and knowledge of construction activity in Arizona, and without conducting extensive research on the contribution of emissions from construction activities to visibility impairment at Class I areas, ADEQ believes current state regulations adequately address visibility impairment from construction activities.

Arizona currently has rules addressing impacts from construction activities. Rule 310 (Maricopa County) regulates fugitive dust emissions from traditional dust generating operations. This rule requires job sites that will disturb more than 1/10 acre (4356 ft^2) of soil to obtain a permit and develop a dust control plan with primary control measures and contingency dust control measures. Maricopa County Rule 300 that establishes opacity standards and applies to visible emissions from sources for which no source-specific opacity requirements apply. This rule requires that no person shall discharge into the ambient air from any single source of emissions any air contaminants, other than uncombined water, in excess of 20% opacity for a period aggregating more than three minutes in any 60 minute period.

12.7.3 Emission Limitation and Schedules of Compliance

As described in Chapter 10, the implementation of BART will contain emission limits and schedules of compliance for those sources either installing BART controls or taking federally enforceable permit limitations. The four-factor analysis did not identify any additional measures that were appropriate for this first Regional Haze plan. As a result, no other emission limitations or schedules of compliance are included in this plan. The evaluation of non-BART sources as part of the LTS is expected to identify additional emission reductions and improve visibility by 2018.

12.6.3 Emission Limitation and Schedules of Compliance

As described in Chapter 10, the implementation of BART will contain emission limits and schedules of compliance for those sources either installing BART controls or taking federally enforceable permit limitations. The four-factor analysis did not identify any additional measures that were appropriate for this first Regional Haze plan. As a result, no other emission limitations or schedules of compliance are included in this plan.

12.7.4 Source Retirement and Replacement Schedules

This LTS contains an evaluation of non-BART sources, described below in Section 12.7.1. This evaluation will include a review of all existing industrial sources to identify scheduled shutdowns, retirements in upcoming years, or replacement schedules, such as planned installation of new control equipment to meet other regulations or routine equipment replacement or modernization.

12.7.5 Smoke Management

Arizona's Enhanced Smoke Management Program

Adoption and certification of an Enhanced Smoke Management Program (ESMP), one of the recommendations of the *Grand Canyon Visibility Transport Commission,* enables states to meet the reasonable progress requirement for emissions from fire under Section 309 of the Regional Haze Rule. EPA's *Interim Air Quality Policy on Wildland and Prescribed Fires* allows special consideration of high concentrations of particulate matter (PM) attributed to fires subject to certified Smoke Management Programs (SMP). If a certified SMP is not implemented special consideration is not given to high concentrations of PM that cause or significantly contribute to violations of a $PM_{2.5}$ or PM_{10} National Ambient Air Quality Standard (NAAQS), visibility impairment in mandatory Class One Federal areas, or failure to achieve reasonable progress toward the national visibility goal.

The Western Regional Air Partnership (WRAP) developed a policy, *Enhanced Smoke Management Programs for Visibility,* to help states meet this requirement of the Rule. The WRAP Policy is based on EPA's *Interim Air Quality Policy on Wildland and Prescribed Fires* and the Agricultural Air Quality Task Force (AAQTF) Recommendation on Air Quality Policy on Agricultural Burning. The State of Arizona relied on these documents and subsequent revisions in adopting revised fire-related rules as the basis for an ESMP that qualifies for certification under the conditions outlined in EPA's Policy.

Under criteria identified in 40 CFR 51.309(d)(6)(i) of the Regional Haze Rule, to ensure visibility protection and to meet the designation of "enhanced," an ESMP must address efficiency, economics, law, emission reduction opportunities, land management objectives, and reduction of visibility impacts. The Program is also required to incorporate "burn authorization" and "regional coordination" elements. Arizona Administrative Code (A.A.C.) R18-2-1501-1515, *Forest and Range Management Burns* and A.A.C. R18-2-602 (Section 602), *Unlawful Open Burning*, includes the required criteria as listed in the following table. Copies of these rules are included in Appendix F. The rules stipulate that prescribed fires and open burns conducted on private land require a permit, are conducted under specific atmospheric conditions, and notify the local burn authority. Permittees are required to submit burn plans that prevent or minimize smoke emissions using emission reduction techniques (ERTs) to populated areas, Class I areas, travelled roads, airports, and areas that are non-attainment for particulate matter.

Table 12.56 – Arizona Enhanced Smoke Management Program	
Enhanced Smoke Management Plan Criteria	**Rule Citation**
Actions to Minimize Emission from Fire	R18-2-1509 R18-2-602(D)(3)(e) R18-2-1510
Evaluation of Smoke Dispersion	R18-2-1506 and 1510 R18-2-602(D)(3)(m) and (o) R18-2-602(D)(3)(d)
Alternatives to Fire	R18-2-1503(C)(8), 1503(D) and 1503(G) R18-2-602(H)*
Public Notification of Burning	R18-2-1513 R18-602(D)((3)(g)
Air Quality Monitoring	R18-2-1508 and 1511 R18-2-602(H)*
Surveillance and Enforcement	R18-2-1514 R18-2-602**
Program Evaluation	R18-2-1503 R18-2-602(H)I
Prescribed Burn Authorization	R18-2-1505 and 1508 R18-602(D)(3)(g)
Wildfire Use Authorization	R18-2-1508
Regional Coordination	R18-2-1513 and 1515 R18-2-602(H)*

* R18-2-602(H) allows the State of Arizona to examine at its annual smoke management meeting any need to address monitoring, regional coordination, or alternatives to burning as they arise in an overall discussion of program evaluation for unlawful open burning.

** Any violations under A.A.C. R18-2-602 are subject to civil penalties under Arizona Revised Statutes §49-501.

EPA's *Interim Air Quality Policy on Wildland and Prescribed Fire* contains information and discusses the tracking of fire data. The ESMP in Arizona has been tracking prescribed fire and wildfire use data since 1996. Arizona also participates in the regional tracking of fires in order to facilitate regional coordination.

Arizona's ESMP qualifies for certification because the program meets the requirements defined in EPA's *Interim Air Quality Policy on Wildland and Prescribed Fire* and the program meets the criteria for ESMPs as defined in the Regional Haze rule. On October 2, 2007, ADEQ notified EPA that it had certified the ESMP. A copy of this letter is included in Appendix F.

In addition to state regulations for open burning, rules adopted by Maricopa, Pima, and Pinal Counties either meet or exceed the stringency of ADEQ's rules.

12.7.6 Enforceability of Arizona's Measures

Section 51.308(d)(3)(v)(F) of the Regional Haze Rule requires States to ensure that emission limitations and control measures used to meet reasonable progress goals are enforceable.

All emission limitations and control measures used to meet reasonable progress goals are enforceable through Arizona Administrative Rules, in accordance with Arizona Revised Statutes §49-104 and §49-404. ADEQ has adopted the Arizona Regional Haze Plan into the Arizona Applicable SIP, which ensures that all elements in the plan are enforceable. Enforceability of future emission limitations and control measures, for which ADEQ is responsible, will be enforceable through permit conditions or SIP measures to be approved in the future by EPA.

12.8 Additional Measures in the LTS

This section of the LTS identifies new measures being considered or proposed by ADEQ for achieving reasonable progress. These reasonable progress measures will be evaluated and discussed in the next plan submittal. This evaluation will take into account any new monitoring and modeling information related to the contribution of anthropogenic sources within Arizona to visibility impairment at Class I areas, 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. If additional controls are identified as a result of these evaluations, the next plan update will include an implementation schedule for controls, necessary rulemaking, projected visibility improvements, and revised RPGs for 2018 (if applicable).

12.8.1 Future Federal Mobile Programs

A new rule, "Control of Emissions of Air Pollution from Locomotives and Marine Compression-Ignition Engines Less Than 30 Liters per Cylinder", was signed on March 14, 2008. EPA estimates that by 2030, this program will reduce annual emissions of NOx by about 800,000 tons and PM emissions by 27,000 tons. Emission reductions are expected to continue as fleet turnover is completed. These standards are intended to achieve these large reductions in emissions through the use of technologies such as "incylinder" controls, "aftertreatment", and low sulfur fuel, perhaps as early as 2011.

In June 2009, EPA announced a rule (Control of Emissions from New Marine Compression-Ignition Engines at or above 30 Liters per Cylinder) proposing more stringent exhaust emission standards for the largest marine diesel engines used for propulsion on oceangoing vessels (called Category 3 engines). The proposed engine standards are equivalent to the nitrogen oxides limits recently adopted in amendments to Annex VI to the International Convention for the Prevention of Pollution from Ships (MARPOL). The near-term standards for newly-built engines would apply beginning in 2011. Long-term standards would begin in 2016, and are based on the application of high-efficiency aftertreatment technology. By 2030, this strategy to address emissions from oceangoing vessels is expected to reduce annual emissions of NO_X in the U.S. by approximately 1.2 million tons and particulate matter emissions by about 143,000 tons. When fully implemented, the coordinated strategy is anticipated to reduce NO_X emissions by 80 percent and PM emissions by 85 percent, compared to the current limits applicable to these engines.

A proposed rule, the Renewable Fuel Standard (RFS2), was signed by EPA Administrator Jackson on May 5, 2009. This rule took effect on March 26, 2010. The rule addresses changes to the Renewable Fuel Standard program as required by the Energy Independence and Security Act of 2007 (EISA). The revised statutory requirements establish new specific volume standards for cellulosic biofuel, biomass-based diesel, advanced biofuel, and total renewable fuel that must be used in transportation fuel each year. The revised statutory requirements also include new definitions and criteria for both renewable fuels and the feedstocks used to produce them, including new greenhouse gas emission (GHG) thresholds for renewable fuels. The regulatory requirements for RFS will apply to domestic and foreign producers and importers of renewable fuel. It is estimated that annual GHG emissions from transportation will be

reduced by approximately 160 million tons, the equivalent of the removal of 24 million vehicles from the highways. In addition, 36 billion gallons of renewable fuel will displace approximately 11% of gasoline and diesel consumption in 2022. The majority of the reductions are expected to come from reduced petroleum imports.

12.8.2 Efforts to Address Offshore Shipping

As shown in the PSAT results in Chapter 9, emissions from offshore marine vessel emissions only have slight contribution to visibility in Arizona Class I areas. ADEQ has no authority to regulate offshore shipping emissions and therefore must rely upon the EPA and coastal states such as California for adoption of regulations.

EPA adopted emission standards for new marine diesel engines installed on vessels flagged or registered in the United States with displacement at or above 30 liters per cylinder. Also adopted in this rulemaking were additional standards for new engines with displacement at or above 2.5 liters per cylinder but less than 30 liters per cylinder. This rule established a deadline of April 27, 2007 for EPA to promulgate a second set of emission standards for these engines. Because much of the information necessary to develop more stringent Category 3 marine diesel engines standards has become available only recently, a new deadline for the rulemaking to consider the next tier of Category 3 marine diesel engine standards has been set for December 17, 2009. On December 7, 2007, EPA announced an advance notice of proposed rulemaking regarding the above-referenced standards, first set in 2003. The advanced notice of proposed rulemaking stated that EPA was considering standards for achieving large reductions in NO_X and PM through the use of technologies such as in-cylinder controls, aftertreatment, and low sulfur fuel, starting as early as 2011.

On July 24, 2008, the State of California adopted new strict regulations for marine vessels within 24 miles off shore. ADEQ expects that implementation of these new regulations for marine vessels will benefit visibility conditions at Class I areas in Arizona.

12.8.3 Long-Term Control Strategies for BART Facilities

Chapter 10 and Appendix D outline the BART determinations and requirements for the sources identified

12.8.4 Evaluation of Non-BART Sources

As shown in the discussion in Chapter 11, ADEQ evaluated non-BART sources for additional control, as required by the Regional Haze Rule. This evaluation was limited, in that no specific guidance was provided for identifying "significant sources", and no contribution to visibility impairment thresholds were established, aside from the EPA's *Guidance for Setting Reasonable Progress Goals Under the Regional Haze Program*. ADEQ will conduct further research to evaluate non-BART sources for possible emission controls and retrofits and provide these results in the next plan submission.

12.9 Projection of the Net Effect on Visibility

The anticipated net effect on visibility from emission reductions by point, area, and mobile sources during the period of the LTS has been estimated by the WRAP, based on monitoring, emission inventory, and modeling projections. The results of the CMAQ modeling described in Section 9.3 show anthropogenic

emission sources declining significantly across the West and in Arizona through 2018. However, overall visibility benefits of these reductions are somewhat offset by emission from natural sources such as wildfire and dust, and other uncontrollable sources. This includes international sources from Canada, Mexico, global transport of emissions (outside domain), and offshore shipping (pacific offshore) in the Pacific Ocean. Despite this, it is clear that visibility improvements will be made due to the control of BART sources, numerous on-the-books regulations such as state and federal mobile source rules, and elements contained in the LTS to address non-BART sources and fire emissions over the next five to ten years that may provide additional improvements by 2018. The WRAP has also committed to conducting final reasonable progress modeling when all BART results are complete, which may result additional progress toward the 2018 URP.

CHAPTER 13: CONSULTATION AND FUTURE COMMITMENTS

13.1 Federal Land Manager Consultation

Section 308(i) of the Regional Haze Rule requires consultation between states and FLMs related to the development and implementation of regional haze plans. States need to provide FLMs an opportunity to comment at least 60 days prior to holding a public hearing on a proposed plan or plan revision. This includes commenting on the State's assessment of visibility impairment in each Class I area, and providing recommendations on the reasonable progress goals and visibility control strategies the state has proposed. States also need to provide the FLM an opportunity to comment on the five-year progress reports and other developing programs that may contribute to Class I visibility impairment.

Section 51.308(f) of the Regional Haze Rule requires states to submit a plan revision by July 31, 2018 and every ten years thereafter.

ADEQ has provided agency contacts to the FLMs as required. In the development of this plan, the FLMs were consulted in accordance with the provisions of 51.308(i)(2). ADEQ has provided the FLMs an opportunity for consultation, in person and at least 60 days prior to holding any public hearing on the plan. The first public hearing on the plan is October 19, 2010. The Arizona Regional Haze Plan was made available to the FLMs for review and comment on September 20, 2010. The FLMs were notified by email on that date. Copies of the emails are in Appendix G.

In accordance with 40 CFR 51.308(i)(3), ADEQ has received comments regarding the plan from the FLMs. These comments on the plan were addressed by ADEQ. See Appendix G of this plan.

Section 51.308(i)(4) requires procedures for continuing consultation between the state and FLMs on the implementation of the visibility protection program. ADEQ will consult with the FLMs on the status of the following implementation items:

1. Implementation of emissions strategies identified in the plan as contributing to achieving improvement in the worst-day visibility.
2. Summary of major new source permits issued.
3. Status of State/Tribe actions to meet commitments for completing any future assessments or rulemakings on sources identified as likely contributors to visibility impairment, but not directly addressed in the most recent plan revision.
4. Any changes to the monitoring strategy or monitoring stations status that may affect tracking of reasonable progress.
5. Work underway for preparing the 5-year review and 10-year revision.
6. Items for FLMs to consider or provide support for in preparation for any visibility plan revisions (based on a 5-year review or the 10-year revision schedule under EPA's RHR).
7. Summary of topics and discussions covered in ongoing communication between the State/Tribe regarding implementation of the visibility program.

The consultation will be coordinated with the designated visibility protection program coordinators for the National Park Service, U. S. Fish and Wildlife Service and the U.S. Forest Service.

Section 51.308(g) requires states to submit a progress report to EPA every five years evaluating progress towards the reasonable progress goal established for each Class I area. The first progress report is due 5 years from submittal of this plan, and must be in the form of a SIP revision.

In accordance with Section 51.308(h), at the time of the report submission, ADEQ will also submit a determination of the adequacy of its existing Regional Haze SIP revision.

ADEQ will continue to coordinate and consult with the FLMs during the development of future progress reports and plan revisions, as well as during the implementation of programs having the potential to contribute to visibility impairment in Arizona's Class I areas.

13.2 State Consultation and Coordination

Section 51.308(d)(3)(i) of the Regional Haze Rule requires states to consult with neighboring states to develop coordinated emission strategies. This requirement applies both where emissions from a state is reasonably anticipated to contribute to visibility impairment in Class I areas outside the state, and where emissions from other states are reasonably anticipated to contribute to Class I visibility impairment inside the state.

As described in Section 12.3 the LTS, ADEQ reviewed interstate transport of haze pollutants with neighboring states, focusing on source apportionment information to identify visibility impacts in Arizona and neighboring state Class I areas. The states consulted were New Mexico, California, Utah, and Colorado. Section 13.2-1 reviews the consultation process with these states. Additional consultation with these states was through Arizona's participation in the WRAP, and the numerous committees and workgroups described in Section 4.1.2 of this plan.

Of particular note was the WRAP Implementation Work Group (IWG), which consists of state and tribal staff involved in the development of regional haze plans. The state representatives on this work group were the primary regional haze plan writers from the 14 WRAP states. This work group reviewed the major strategies associated with state and tribal regional haze plans, and addressed the issues associated with plan development and rule interpretation, including the primary coordination and consultation that took place between states, tribes, EPA, and the FLMs during the development of the Arizona Regional Haze Plan. The attached link identifies the IWG members http://www.wrapair.org/forums/iwg/members.html. Additional information on IWG work products, projects, and documents, can be found on that website as well.

13.2.1 Summary of State Consultation Process

As described above, the WRAP IWG was the primary mechanisms for state-to-state consultation. Discussions with neighboring states included the review of major contributing sources of air pollution. The focus of this review process was interstate transport of emissions, major sources believed to be contributing, and whether any mitigation measures were needed. All the states relied upon similar emission inventories, results from source apportionment studies and BART modeling, review of IMPROVE monitoring data, and existing state smoke management programs, and other information in assessing the extent to which each state contributes to visibility impairment in the other state Class I areas.

ADEQ will continue to coordinate and consult with other states as part of the implementation of the strategies contained in the Arizona Regional Haze Plan, and for future progress reports and plan revisions, as required under the federal Regional Haze Rule.

13.2.2 Consistency with Neighboring State SIPs

As described above, the Arizona Regional Haze Plan was developed with emphasis on consistency with other state plans, through consultation directly with neighboring states and in the WRAP, and the technical tools, policy documents, and other products that were used to develop all of the regional haze plans by Western States.

13.2.3 Arizona and Other State Emission Reductions Obligations

Section 51.308(d)(3)(ii) requires states to demonstrate that its regional haze plan includes all measures necessary to obtain its fair share of emission reductions needed to meet reasonable progress goals. Based on the consultation described above, no major contributions were identified that supported developing new interstate strategies, mitigation measures, or emission reduction obligations. Both Arizona and neighboring states agreed that the implementation of BART and other existing measures in state regional haze plans were sufficient, and that future consultation would address any new strategies or measures needed.

13.3 Tribal Consultation

Although not required under EPA's Regional Haze Rule, ADEQ consulted with Tribes in during the development of this plan. Similar to the state process, consultation with Tribes involved reviewing major emission sources and regional haze strategies, both through WRAP activities and direct outreach to Tribes within Arizona.

13.4 Commitment to Future 308 Plan Revisions

13.4.1 Comprehensive 10-year Plan Revision

Section 51.308(f) of the Regional Haze Rule requires states to revise their regional haze plans and submit a plan revision to EPA by July 31, 2018, and every ten years thereafter. In accordance with the requirements listed in Section 51.308(f) of the federal rule for regional haze, Arizona commits to revising and submitting this regional haze implementation plan by July 31, 2018 and every ten years thereafter.

These plan revisions must evaluate and reassess elements under 40 CFR 51.308(d), taking into account improvements in monitoring data collection and analysis, and control technologies. Elements of the future plans are summarized below.

1. Current Visibility Conditions. Determine current visibility (most recent five year period preceding the required date of the plan 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. Long Term Strategies. Determine the effectiveness of the long-term strategy for achieving the presumptive goal for the prior SIP period. If the long-term strategy or prior presumptive goal was insufficient to attain natural conditions by 2064, the state/tribe must look at additional or new control measures that may be adopted considering compliance cost, compliance time, compliance energy and non-air quality environmental impacts, and the affected source remaining useful life.

3. Reasonable Progress Goals. Affirm or revise the current reasonable progress goal based on assessment of new or updated information, improved technologies, and ongoing legislation.

4. Monitoring Strategy. Re-evaluate the adequacy of the existing monitoring strategy. Provide updated information and changes to the monitoring strategy, as well as an updated state/tribe emissions inventory.

13.4.2 Five-Year Progress Reports

Section 51.308(g) requires periodic reports evaluating progress towards the reasonable progress goals established for each mandatory Class I area. In accordance with the requirements listed in Section 51.308(g) of the federal rule for regional haze, Arizona commits to submitting a report on reasonable progress to EPA every five years following the initial submittal of the SIP. The report will be in the form of a plan revision submitted by December 2016. The reasonable progress report will evaluate the progress made towards the reasonable progress goal for each mandatory Class I area in Arizona. All requirements listed in 51.308(g) shall be addressed in the SIP revision for reasonable progress. At a minimum, the progress reports must contain the following elements:

1. Implementation status of the current SIP measures;
2. Summary of emissions reductions;
3. Assessment of most/least impaired days;
4. Analysis of emission reductions by pollutant;
5. Significant changes in anthropogenic emissions;
6. Assessment of the current SIP sufficiency to meet reasonable progress goals; and
7. Assessment of visibility monitoring strategy.

Section (d)(4)(v) requires periodic updates of the emission inventory. Arizona commits to update the inventory by the next SIP update in 2016.

13.5 Determination of Plan Adequacy

Section 51.308(h) requires a state/tribe to take one of the following actions at the same time the state/tribe is required to submit a five-year periodic progress report described in Section 13.4.2 of this plan. Depending on the findings the five-year progress report, Arizona commits to taking one of the four actions as summarized above.

1) If the state/tribe finds that no substantive SIP revisions are required to meet established visibility goals, the state/tribe must provide EPA a negative declaration saying that no implementation plan revision is needed.
2) If the state/tribe finds that the implementation plan is or may be inadequate to ensure reasonable progress due to emissions from outside the state, the state/tribe shall notify EPA and the other contributing state(s) or tribes(s) and initiate efforts through a regional planning process to develop additional strategies in addressing the SIP deficiency. The state/tribe shall identify in the next progress report the outcome of this regional planning effort, including any additional strategies that were developed to address the plans deficiencies.
3) If the state/tribe finds that the implementation plan is or may be inadequate to ensure reasonable progress due to emissions from another country, the State/Tribe shall notify EPA and provide the available supporting information.

4) If the state/tribe finds that the implementation plan is or may be inadequate to ensure reasonable progress due to emissions from with the state, the state/tribe shall develop additional strategies to address the plan deficiencies and revise the implementation plan within one year form the date that the progress report was due.

(page intentionally blank)