ADEQ
Arizona Department of Environmental Quality

# Maintenance Plan Renewal

1971 Sulfur Dioxide National Ambient Air Quality Standards

Douglas Maintenance Area

*Air Quality Division*
*November 3, 2016 Proposed*

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# Completeness Criteria (40 C.F.R. Part 51, Appendix V, § 2.0)

## Appendix V § 2.1 - Administrative Materials

### (a) A formal signed, stamped, and dated letter of submittal from the Governor or his designee, requesting EPA approval of the plan or revision thereof (hereafter "the plan"). If electing to submit a paper submission with a copy in electronic version, the submittal letter must verify that the electronic copy provided is an exact duplicate of the paper submission.

See the cover letter for this SIP submission and attached delegation of authority from Misael Cabrera, Director of ADEQ, to Timothy Franquist, Director of the ADEQ Air Quality Division, authorizing Mr. Franquist to perform any act the ADEQ Director is authorized to perform under the state air quality statutes, including the submission of SIPs to EPA.

### (b) Evidence that the State has adopted the plan in the State code or body of regulations; or issued the permit, order, consent agreement (hereafter "document") in final form. That evidence shall include the date of adoption or final issuance as well as the effective date of the plan, if different from the adoption/issuance date.

See the cover letter to this document wherein the state adopts and submits this SIP revision. This is the method of Arizona state adoption.

### (c) Evidence that the State has the necessary legal authority under State law to adopt and implement the plan.

The Arizona Department of Environmental Quality has responsibility for air pollution control and abatement, and as such, is required to adopt and "maintain a state implementation plan that provides for implementation, maintenance and enforcement of national ambient air quality standards and protection of visibility as required by the clean air act." A.R.S. § 49-404(A). ADEQ also maintains authority to issue and administer rules, adopt county rules, and to submit such rules for approval in the SIP. Copies of Arizona Revised Statutes sections 49-104, 49-106, 49-404, 49-406 and 49-425, are attached as Appendix C-II.

### (d) A copy of the actual regulation, or document submitted for approval and incorporation by reference into the plan, including indication of the changes made (such as redline/strikethrough) to the existing approved plan, where applicable. The submission shall include a copy of the official State regulation/document, signed, stamped, and dated by the appropriate State official indicating that it is fully enforceable by the State. The effective date of any regulation/document contained in the submission shall, whenever possible, be indicated in the regulation/document itself; otherwise the State should include a letter signed, stamped, and dated by the appropriate State official indicating the effective date. If the regulation/document provided by the State for approval and incorporation by reference into the plan is a copy of an existing publication, the State submission should, whenever possible, include a copy of the publication cover page and table of contents.

See this document.

### (e) Evidence that the State followed all of the procedural requirements of the State's laws and constitution in conducting and completing the adoption/issuance of the plan.

As demonstrated in the Completeness Criteria Section, Appendix V § 2.1 Sections B, C, and G, ADEQ has complied with all requirements of state law for adoption of this SIP Revision.

### (f) Evidence that public notice was given of the proposed change consistent with procedures approved by EPA, including the date of publication of such notice.

Proof that ADEQ gave notice of the SIP Revision in accordance with A.R.S. § 49-444 is attached as Appendix C-III.

### (g) Certification that public hearing(s) were held in accordance with the information provided in the public notice and the State's laws and constitution, if applicable and consistent with the public hearing requirements in 40 CFR 51.102.

The certification and other documents related to the public hearing are attached as Appendices C-IV, C-V, C-VI, and C-VII.

### (h) Compilation of public comments and the State's response thereto.

A compilation of comments received and the State's responses are attached as Appendix C-VIII.

## Appendix V § 2.2 - Technical Support

### (a) Identification of all regulated pollutants affected by the plan.

This plan includes provisions for the regulation of Sulfur Dioxide. See Section 1.1, Statement of Introduction and Purpose and Chapter 4, Control Measures.

### (b) Identification of the locations of affected sources including the EPA attainment/ nonattainment designation of the locations and the status of the attainment plan for the affected areas(s).

This maintenance plan is applicable to sources within the Douglas Sulfur Dioxide Maintenance Area. See Sections 1, 3, and 5.

### (c) Quantification of the changes in plan allowable emissions from the affected sources; estimates of changes in current actual emissions from affected sources or, where appropriate, quantification of changes in actual emissions from affected sources through calculations of the differences between certain baseline levels and allowable emissions anticipated as a result of the revision.

See Section 3, Emission Inventories and Section 5, Maintenance Demonstration.

### (d) The State's demonstration that the national ambient air quality standards, prevention of significant deterioration increments, reasonable further progress demonstration, and visibility, as applicable, are protected if the plan is approved and implemented. For all requests to redesignate an area to attainment for a national primary ambient air quality standard, under section 107 of the Act, a revision must be submitted to provide for the maintenance of the national primary ambient air quality standards for at least 10 years as required by section 175A of the Act.

See Sections 5, 6, and 7

### (e) Modeling information required to support the proposed revision, including input data, output data, models used, justification of model selections, ambient monitoring data used, meteorological data used, justification for use of offsite data (where used), modes of models used, assumptions, and other information relevant to the determination of adequacy of the modeling analysis.

Appendix B discusses the required details of the modeling methodology and ambient monitoring data used to support this plan.

### (f) Evidence, where necessary, that emission limitations are based on continuous emission reduction technology.

Not applicable.

### (g) Evidence that the plan contains emission limitations, work practice standards and recordkeeping/reporting requirements, where necessary, to ensure emission levels.

Not applicable.

### (h) Compliance/enforcement strategies, including how compliance will be determined in practice.

See Sections 6 and 7.

### (i) Special economic and technological justifications required by any applicable EPA policies, or an explanation of why such justifications are not necessary.

No known deviation from EPA policy.

# 1 Introduction

This chapter describes the purpose of this Maintenance Plan Renewal for the Douglas $SO_2$ Maintenance Area (MA), summarizes the regulatory background and requirements, and provides a general overview of the maintenance area and sulfur dioxide ($SO_2$) National Ambient Air Quality Standards (NAAQS).

## 1.1 Statement of Purpose

Pursuant to Clean Air Act (CAA) Section 107(d)(3)(E), the U.S. Environmental Protection Agency (EPA) redesignated the Douglas nonattainment area to attainment/maintenance for the 1971 $SO_2$ NAAQS in 2006 after approval of Arizona Department of Environmental Quality's (ADEQ) first maintenance plan submittal.[1]

ADEQ is responsible for the preparation and submittal of this Maintenance Plan Renewal. This SIP demonstrates that the Douglas MA will continue to meet the 1971 $SO_2$ primary NAAQS beyond the second maintenance period and through 2030.

## 1.2 $SO_2$ Pollution

$SO_2$ is a highly reactive gas and is part of the sulfur oxides family. Fossil fuels are the largest source of $SO_2$ and other sulfur oxides.[2] These emissions are generated by combustion at power plants and other industrial facilities. $SO_2$ is a precursor to $PM_{2.5}$, or particulate matter that is 2.5 micrometers in diameter or smaller. $PM_{2.5}$ is a major contributor to smog and can cause premature death and lung disease.

Scientific evidence demonstrates that short-term exposure to $SO_2$ emissions can lead to adverse health effects including bronchoconstriction and increased asthma symptoms. These symptoms can also cause economic consequences such as increased hospital admissions and missed work/school days. $SO_2$, in addition to nitrogen dioxide ($NO_2$), is a primary cause of acid rain[3] which can deteriorate infrastructure, toxify water sources, destroy vegetation, and impair visibility.

EPA sets the NAAQS to lessen the impact of $SO_2$ emissions on public health, welfare, and the environment.

[1] *See* 71 FR 9941 (Feb. 28, 2006).
[2] *Sulfur Dioxide,* U.S. Environmental Protection Agency. (1 Dec. 2015) Retrieved: http://www3.epa.gov/airquality/sulfurdioxide/index.html.
[3] For more information on acid rain's impacts, visit EPA's website at: http://www.epa.gov/airmarkets/acid-rain-program.

## 1.3 National Ambient Air Quality Standards

Title I of the CAA requires EPA to set the NAAQS for those pollutants that are considered harmful to both the public health and the environment, otherwise referred to as "criteria pollutants." There are six criteria pollutants:

1. ground-level ozone
2. particulate matter
3. carbon monoxide
4. nitrogen dioxide
5. sulfur dioxide
6. lead

There are two types of NAAQS: primary and secondary. Primary standards are set to protect human health and secondary standards are established to protect public welfare, such as visibility, animals, crops, vegetation, and buildings.[4]

The standard for each pollutant is set at a maximum concentration in parts per million (ppm) by volume, parts per billion (ppb) by volume, or micrograms per cubic meter of air ($\mu/m^3$). Each standard also has a distinct averaging time in order to provide the necessary level of protection.[5] These standards are reviewed periodically and are retained or revised based on scientific literature and analyses.

### 1.3.1 1971 $SO_2$ NAAQS

In 1971, EPA established the first $SO_2$ NAAQS to set a 24-hour primary standard at 0.14 ppm and a primary annual average standard at 0.03 ppm to protect human health. EPA also set a three-hour secondary standard at 0.5 ppm and a secondary annual standard at 0.02 ppm to protect public welfare and the environment. In 1973, EPA revoked the secondary annual standard.[6]

In 1996, EPA reviewed the primary NAAQS, but did not revise them.[7] On June 22, 2010, EPA promulgated a new one-hour $SO_2$ standard at a level of 75 ppb, based on the three-year average of the annual 99$^{th}$ percentile of one-hour daily maximum concentrations. At the same time, EPA tightened the existing $SO_2$ standards in order to provide requisite protection of public health with an adequate margin of safety.[8] In 2012, EPA reviewed and retained the existing secondary $SO_2$ NAAQS without revision.[9]

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[4] *National Ambient Air Quality Standards (NAAQS),* U.S. Environmental Protection Agency. (1 Dec. 2015) Retrieved: http://www3.epa.gov/ttn/naaqs/criteria.html.
[5] *Id*.
[6] 38 FR 25678 (Sept. 4, 1973).
[7] 61 FR 25566 (May 22, 1996).
[8] 75 FR 35520 (June 22, 2010).
[9] 77 FR 20218 (April 3, 2012).

Planning obligations for the 1971 $SO_2$ standards, including this renewal of the Douglas maintenance plan, continue until such time as they are subsumed by any new planning and control requirements associated with the new NAAQS. This plan does not address the 2010 $SO_2$ NAAQS.

Table 1 summarizes the history of the $SO_2$ NAAQS for each of EPA's review cycles from 1971 through 2012.

**Table 1: Historical $SO_2$ Standards[10]**

| Final Rule/Decision | Primary/ Secondary | Indicator | Averaging Time | Level | Form |
|---|---|---|---|---|---|
| 1971<br><br>36 FR 8186<br>Apr 30, 1971 | Primary | $SO_2$ | 24-Hour | 0.14 ppm | Not to be exceeded more than once per year |
| | | | Annual | 0.03 ppm | Annual arithmetic average |
| | Secondary | | 3-Hour | 0.5 ppm | Not to be exceeded more than once per year |
| | | | Annual[11] | 0.02 ppm | Annual arithmetic average |
| 1973<br><br>38 FR 25678<br>Sept 14, 1973 | Secondary | Secondary 3-hour $SO_2$ standard retained, without revision; secondary annual $SO_2$ standard revoked. | | | |
| 1996<br><br>61 FR 25566<br>May 22, 1996 | Primary | Existing primary $SO_2$ standards retained, without revision. | | | |
| 2010<br><br>75 FR 35520<br>Jun 22, 2010[12] | Primary | $SO_2$ | 1-hour | 75 ppb | 99th percentile, averaged over 3 years[13] |
| | | Primary annual and 24-hour $SO_2$ standards revoked. | | | |

[10] *Sulfur Dioxide ($SO_2$) Primary Standards – Table of Historical $SO_2$ NAAQS,* U.S. Environmental Protection Agency. (1 Dec. 2015) Retrieved: http://www3.epa.gov/ttn/naaqs/standards/so2/s_so2_history.html.

[11] The 1971 final rule also included a secondary 24-hour $SO_2$ standard of 0.1 ppm, maximum 24-hour concentration not to be exceeded more than once per year, as a guide to be used in assessing implementation plans to achieve the annual standard.

[12] The 1-hour $SO_2$ standard added in 2010 is a primary standard. The revision of the $SO_2$ NAAQS in 2010 did not address the secondary standard, which remains a 3-hour standard with a level of 0.5 ppm.

[13] The form of the 1-hour standard is the 3-year average of the 99th percentile of the yearly distribution of 1-hour daily maximum $SO_2$ concentrations.

| | | |
|---|---|---|
| 2012<br><br>77 FR 20218<br>April 3, 2012 | Secondary | Existing secondary $SO_2$ standard retained, without revision. |

## 1.4 Regulatory Background

Historically, the largest source of $SO_2$ in the Douglas nonattainment area was the Phelps Dodge Douglas Reduction Works Smelter (PDDRWS). The facility was located off Highway 80, approximately 1.5 miles west of the City of Douglas. It used a standard reverberatory furnace smelting process, and major equipment included 24 roasters, three reverberatory furnaces, five converters, and two anode furnaces. Copper feed arrived at the plant by rail and was transferred to the bedding plant. Feed material was dropped onto the top hearth of a roaster. The resulting material produced in the roasters (calcines) was charged into one of the two operating reverberatory furnaces. Matte from these two furnaces was then tapped into ladles and transferred by overhead cranes to one of five converters. Slag was carried by rail to a nearby dump. Blister copper from the converters was then cast into anodes after refining in one of two anode furnaces. The final product was approximately 99.7 percent pure copper anodes. Emissions from these sources were collected, treated for particulate removal, and ducted to one of two stacks.

The State of Arizona submitted a SIP for all major $SO_2$ sources on January 30, 1972. The portion of the SIP pertaining to $SO_2$ in the Douglas area was not approved due to failing to analyze the impact of fugitive emissions from PDDRWS on ambient air quality.

In 1978, EPA designated the entire area of Cochise County as nonattainment for the 1971 $SO_2$ primary[14] NAAQS for lack of a state recommendation.[15] In 1979, at the request of ADEQ, EPA approved the state's recommendation to reduce the nonattainment area to three townships and designate three other surrounding townships unclassified.[16] This designation remained in place after the 1990 Clean Air Act Amendments.

On November 30, 1981, Arizona submitted a proposed Multi-Point Rollback (MPR) rulemaking as a revision to the Arizona SIP and the submittal was approved by EPA on January 14, 1983.[17] The rule established standards of performance for existing primary copper smelters and set requirements for analyzing the impact of fugitive $SO_2$ emissions from smelters on ambient air quality.

PDDRWS failed to meet those performance standards and subsequently made the decision to cease operations. On January 15, 1987, the facility permanently closed and dismantling began. In 1991, the facility was completely dismantled and by January 30, 1992, ADEQ confirmed the

[14] The Douglas area was not designated nonattainment for the secondary $SO_2$ NAAQS. See Footnote 2 in 71 FR 9941 (February 28, 2006).
[15] 43 FR 8968 (March 3, 1978).
[16] 44 FR 21261 (April 10, 1979).
[17] 48 FR 1717 (January 14, 1983).

facility no longer existed.[18] No other point, area, or mobile sources have contributed in the past or currently contribute to the same levels of $SO_2$ emissions as the PDDRWS.

On December 14, 2001, ADEQ submitted to EPA the *Douglas Sulfur Dioxide Nonattainment Area State Implementation and Maintenance Plan* and requested to redesignate the area to attainment. The SIP addressed nonattainment area requirements, summarized the area's progress, and included a maintenance plan under CAA Section 175A.

On April 2, 2004 and September 16, 2005, ADEQ submitted additional supplements with evidence to demonstrate attainment of the 1971 $SO_2$ primary standard. The evidence included updated emissions inventories, a revised modeling demonstration to incorporate a new stationary source, and a revised map to correct the geographical nonattainment area boundary.

EPA approved the maintenance plan and redesignated the area to attainment effective May 1, 2006.[19] In its ruling, EPA also found that cumulative minor $SO_2$ sources could not cause a violation and that Arizona has a fully approved SIP for the Douglas area under CAA section 110(k) and has met all the relevant requirements under CAA Section 110 and Part D.[20]

CAA Section 175A(a) requires states to demonstrate maintenance of the NAAQS for at least 10 years after redesignation to attainment. ADEQ's approved first maintenance plan submittal included a demonstration of attainment through 2015.

CAA Section 175A(b) requires states to submit a subsequent maintenance plan to EPA no later than eight years after the area has been redesignated, also referred to as a maintenance plan renewal. The maintenance plan renewal must demonstrate that the area will continue to maintain the standard for another ten years after the expiration of the first ten-year period.

In addition to these actions, Arizona has 2 rules that have been approved by the EPA for incorporation into the Arizona SIP to regulate emissions of $SO_2$. The first rule is A.A.C. R18-2-202 Sulfur Oxide (Sulfur Dioxide) which details the Arizona $SO_2$ ambient air quality standards[21]. The second rule is A.A.C R18-2-406 which pertains to New Source Review and permit requirements for new and modified sources that would be constructed in an area designated as attainment or unclassifiable for any regulated NSR pollutant[22].

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[18] See *Douglas Sulfur Dioxide Nonattainment Area State Implementation and Maintenance Plan*, Air Quality Division, Arizona Department of Environmental Quality, November 29, 2001 (submitted on December 14, 2001).
[19] 71 FR 9941 (February 28, 2006).
[20] See ADEQ's Douglas $SO_2$ SIP submissions, including the 2001 *Douglas Sulfur Dioxide Nonattainment Area State Implementation and Maintenance Plan,* the 2004 modeling supplement, and the 2005 emissions inventory and modeling supplement. Available in docket EPA-R09-OAR-2005-AZ-0008-0002. Retrieved from: http://www.regulations.gov/#!documentDetail;D=EPA-R09-OAR-2005-AZ-0008-0002. *See also* 71 FR 9941 (February 28, 2006).
[21] EPA Approval FR Notice: 79 FR 56655
[22] EPA Approval FR Notice: 80 FR 67319

## 1.5 Maintenance Area Description

The following sections describe the planning area boundary and provide information on the geography, climate, population, and economy of the maintenance area.

### 1.5.1 Area Boundary

The Douglas $SO_2$ maintenance area encompasses a portion of Cochise County in southeast Arizona, including part of the City of Douglas and the neighboring community of Pirtleville. The City of Douglas is located approximately 100 miles southeast of Tucson and lies on the U.S.-Mexico border adjacent to the Mexican city of Agua Prieta. Douglas was first established as a smelter site for copper mined in the nearby City of Bisbee. This area has a history of cattle ranching and agriculture dating back to the 1800s that continues to this day.[23]

The maintenance area comprises 73.5 square miles, which is approximately 1.19 percent of the entire area of Cochise County.[24]

Table 2 summarizes the township boundaries and classifications for the Douglas $SO_2$ maintenance area as codified in 40 CFR 81.303.

**Table 2: Maintenance Area Boundaries by Townships**

| Township | Cannot Be Classified | Better Than National Standards |
|---|---|---|
| **T23S, R27E** | | X |
| **T24S, R27E** | | X |
| **T24S, R28E** | | X |
| **T23S, R26E** | X | |
| **T23S, R28E** | X | |
| **T24S, R26E** | X | |
| Source: 71 FR 9941; Effective May 1, 2006 | | |

Figure 1 depicts the boundaries of the Douglas $SO_2$ maintenance area within Cochise County.

[23] *About Douglas,* City of Douglas. (29 Dec. 2015) Retrieved from: http://visitdouglas.com/index.php?option=com_content&task=blogcategory&id=16&Itemid=50.
[24] Internal Report, Arizona Department of Administration. (29 Dec. 2015).

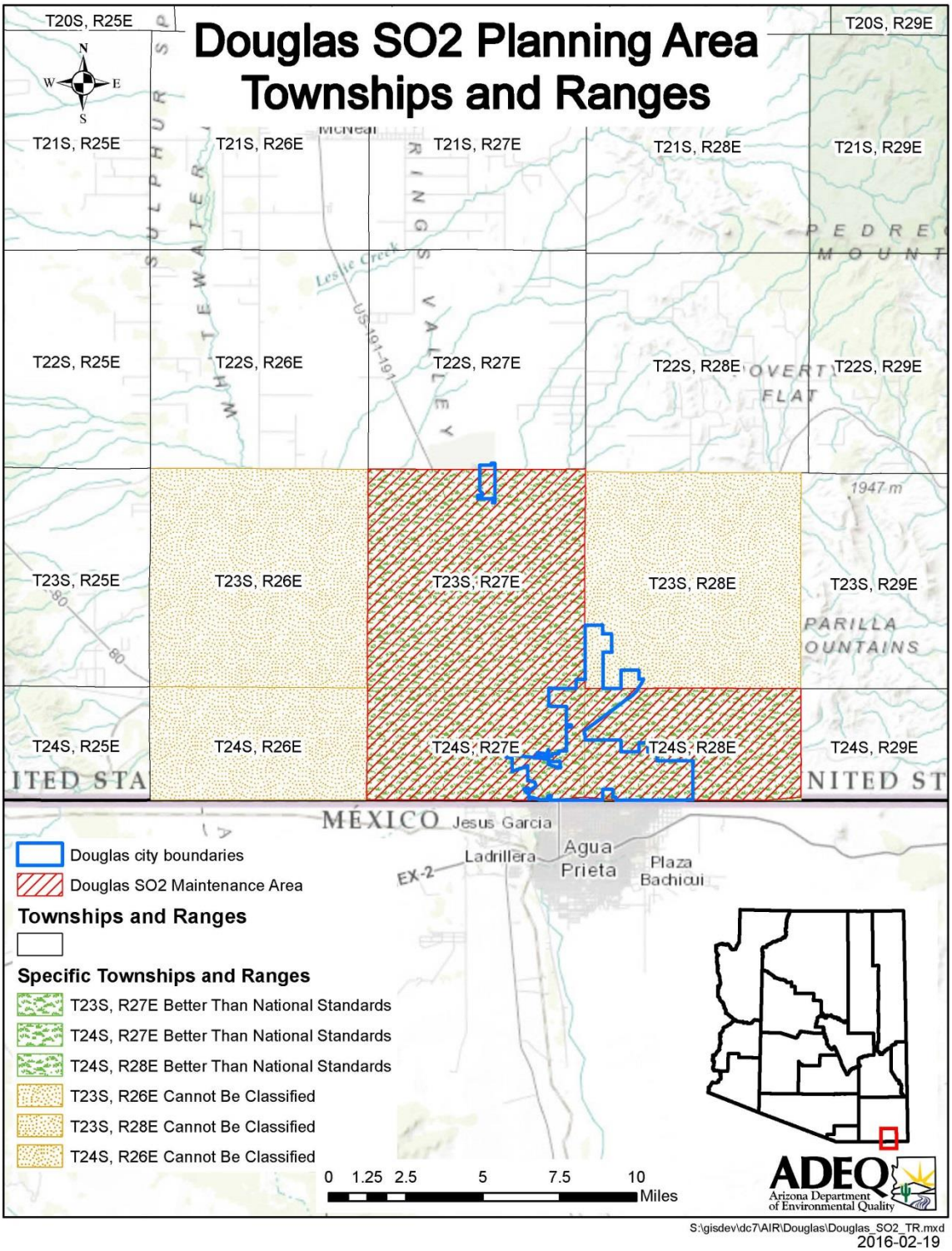


**Figure 1: Map of Douglas $SO_2$ Maintenance Area Boundaries**

### 1.5.2 Geography and Climate

As mentioned earlier, the maintenance area is situated in Cochise County in the southeast corner of Arizona. The county landscape combines growing urban areas such as Douglas, Sierra Vista, and Benson with rural unincorporated communities. These communities sit on various elevations ranging from 3,585 to 5,539 feet above sea level.[25]

Figure 2 shows the Douglas $SO_2$ maintenance area in reference to other communities within Cochise County.

[25] *Science for a Changing World – The National Map Viewer and Download Platform*, USGS. (19 Nov. 2013) Retrieved: http://www.usgs.gov/pubprod/.

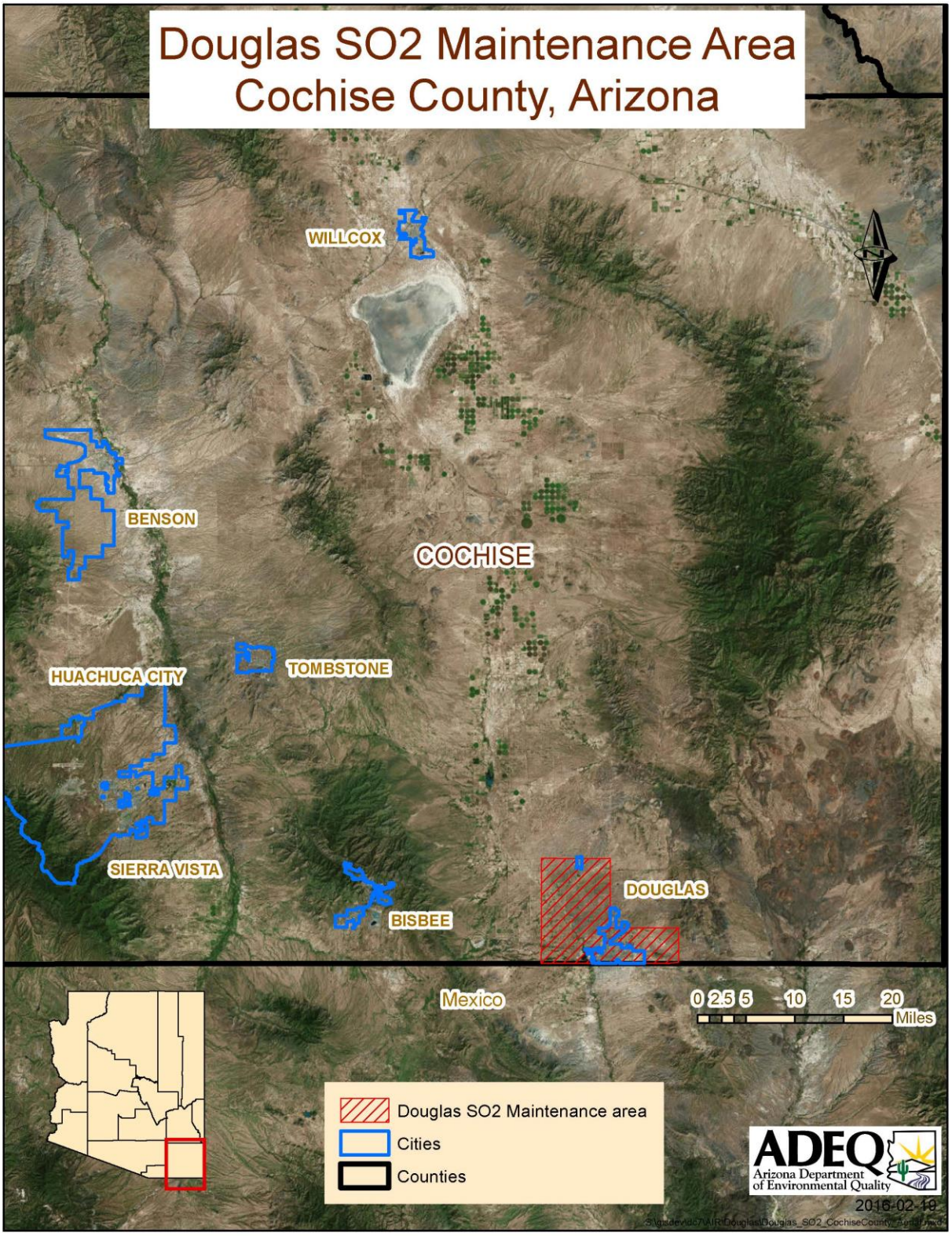


**Figure 2: Map of Douglas $SO_2$ Maintenance Area, Cochise County**

Cochise County experiences both warm desert and cool alpine climates. In the City of Douglas, the hottest month of the year is July, when the monthly average temperature is 81°F. December and January are the coldest months of the year, with monthly average temperatures of 48°F. Douglas only receives about 14 inches of rainfall per year, half of which typically falls in the summer.

Figure 3 below illustrates Douglas's annual average, minimum, and maximum monthly temperatures and precipitation normals between 1981 and 2010 from the National Oceanic and Atmospheric Administration.

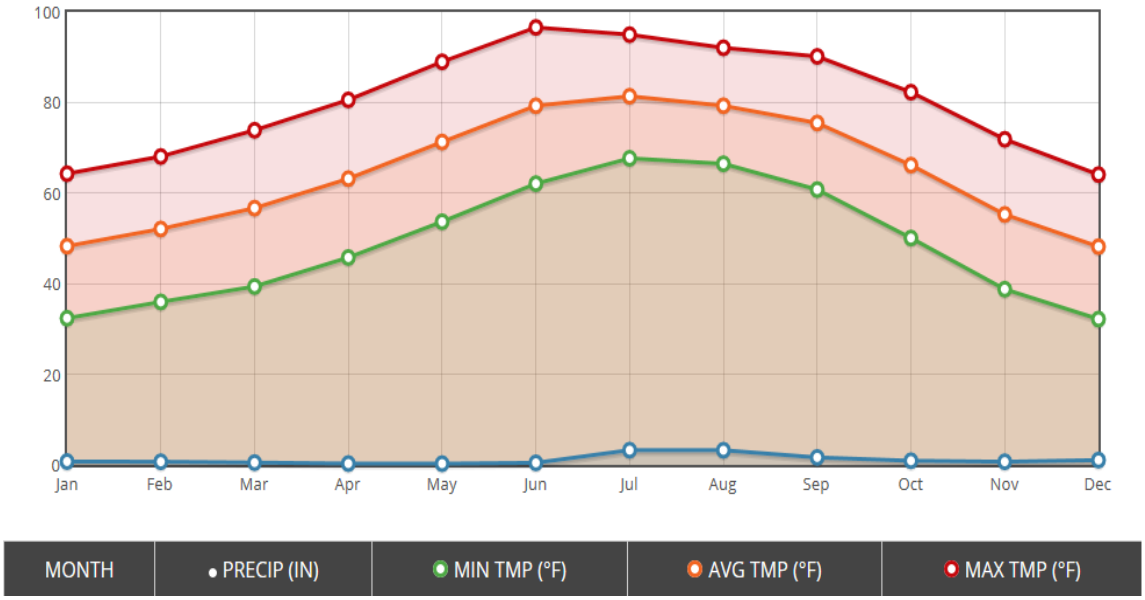


**Figure 3: Douglas, Arizona Annual Monthly Average Temperatures and Precipitation: 1981-2010 Normals[26]**

### 1.5.3 Population

Table 3 includes population estimates and projections from the Arizona Department of Administration (ADOA)[27] for Cochise County for selected years between 2010 and 2030. In 2010, over 16 percent of the total county population lived in the maintenance area.

[26] *Data Tools: 1981-2010 Monthly Normals for Douglas, Arizona,* National Oceanic and Atmospheric Administration. (29 Dec. 2015) Retrieved: http://www.ncdc.noaa.gov/cdo-web/datatools/normals.

[27] As required by Exec. Order No. 2011-04 (June 23, 2011), available at http://seago.org/sites/default/files/documents/Executive%20Order%202011-04.pdf.

**Table 3: Population Distribution, Selected Years, 2010-2030**

| Population Estimates and Projections for Douglas $SO_2$ Maintenance Area | | | | | |
|---|---|---|---|---|---|
| **Year** | **2010** | **2015** | **2020** | **2025** | **2030** |
| **Maintenance Area** | 21,626 | 21,243 | 21,809 | 22,547 | 23,219 |
| **Cochise County** | 131,436 | 129,112 | 132,547 | 137,033 | 141,122 |

### 1.5.4 Economy

Cochise County was created in 1881 by the Eleventh Territorial Assembly. Douglas was founded in 1901 as a site for a copper smelter and was incorporated in 1905.[28]

Douglas has three manufacturing plants. The nearby border community of Agua Prieta in Sonora, Mexico has 32 manufacturing plants. Some of the Agua Prieta plants are "maquiladoras" or twin-plants that operate on both sides of the border. These maquiladoras manufacture clothing, electronics, auto parts, and plastic injection moldings. Agriculture and ranching are still contributors to the economy. Douglas also serves as a retail center for shoppers on both sides of the border.[29]

Douglas's geographic location fosters international commerce. Tourists visit the area to see the mining town of Tombstone, shopping center in Agua Prieta, and historic and scenic sites of Old Fort Bowie, Fort Huachuca, Chiricahua National Monument, Coronado National Forest, and more.

Based on current U.S. Census data, the City of Douglas experienced a higher unemployment rate than Cochise County did as a whole in 2014. The nearby City of Bisbee's unemployment rate in 2014 was nearly 7 percent, compared to nearly 15 percent in Douglas. Pirtleville, a Census-Designated Place in the maintenance area, experienced the highest unemployment in 2014 at 34 percent.

Table 4 shows the employment statuses of the civilian labor force in areas within and surrounding the Douglas $SO_2$ maintenance area for 2011 and 2014.

[28] *About Douglas,* City of Douglas. (29 Dec. 2015) Retrieved: http://visitdouglas.com/index.php?option=com_content&task=blogcategory&id=16&Itemid=50.

[29] See the 2001 *Douglas Sulfur Dioxide Nonattainment Area State Implementation and Maintenance Plan* and the 2005 emissions inventory and modeling supplement for more history on Douglas's economy. Available in docket EPA-R09-OAR-2005-AZ-0008-0002. Retrieved from: http://www.regulations.gov/#!documentDetail;D=EPA-R09-OAR-2005-AZ-0008-0002.

**Table 4: Employment Status for 2011 and 2014[30]**

| Civilian Labor Force for Douglas $SO_2$ Maintenance Area | | |
|---|---|---|
| **Employment Status** | **2011*** | **2014**** |
| ***Cochise County*** | | |
| **Civilian Labor Force (Pop. 16 years and over)** | 103,900 | 104,263 |
| **Percent in labor force** | 54.6% | 52.2% |
| **Percent Employed** | 46.6% | 43.6% |
| **Percent Unemployed** | 8.60% | 9.3% |
| ***City of Douglas*** | | |
| **Civilian Labor Force (Pop. 16 years and over)** | 13,512 | 13,688 |
| **Percent in labor force** | 44.8% | 33.5% |
| **Percent Employed** | 39.4% | 29.4% |
| **Percent Unemployed** | 12.1% | 12.2% |
| ***City of Bisbee*** | | |
| **Civilian Labor Force (Pop. 16 years and over)** | 4,871 | 4,591 |
| **Percent in labor force** | 49.4% | 50.1% |
| **Percent Employed** | 45.8% | 46.7% |
| **Percent Unemployed** | 7.4% | 6.8% |
| ***Pirtleville CDP*** | | |
| **Civilian Labor Force (Pop. 16 years and over)** | 809 | 1,115 |
| **Percent in labor force** | 48.8% | 62.6% |
| **Percent Employed** | 41.5% | 41.3% |
| **Percent Unemployed** | 14.9% | 34.0% |
| **2007-2011 American Community Survey 5-Year Estimates (2011 report)* | | |
| ***2010-2014 American Community Survey 5-Year Estimates (2014 report)* | | |

The educational services, healthcare, and social assistance industries ranked the highest in 2014 for Cochise County, Douglas, and Bisbee while the agriculture, forestry, fishing, hunting, and mining industries ranked the highest for Pirtleville. Employees in Douglas and Bisbee also work in the retail trade and public administration.

Table 5 shows employment industries for the Douglas $SO_2$ maintenance area for 2010 through 2014.

[30] *American Community Survey 5-Year Estimates* (2011 and 2014 reports), U.S. Census Bureau. (22 Dec. 2015) Retrieved: http://factfinder.census.gov/faces/nav/jsf/pages/index.xhtml.

### Table 5: Top Employment Industries for 2010-2014[31]

| Top Employment Industries in Douglas $SO_2$ Maintenance Area for 2010-2014 | |
|---|---|
| **Industry** | **Percent of Employed Pop. Age 16 and Over** |
| ***Cochise County*** | |
| **Educational services, health care, social assistance** | 21% |
| **Public administration** | 17% |
| **Professional, scientific, management, administrative, waste management services** | 12% |
| ***City of Douglas*** | |
| **Educational services, health care, social assistance** | 25% |
| **Public administration** | 14% |
| **Retail trade** | 14% |
| ***City of Bisbee*** | |
| **Educational services, health care, social assistance** | 27% |
| **Arts, entertainment, recreation, accommodation, food services** | 15% |
| **Retail trade** | 14% |
| ***Pirtleville CDP*** | |
| **Agriculture, forestry, fishing, hunting, mining** | 19% |
| **Educational services, health care, social assistance** | 18% |
| **Other services, except public administration** | 18% |

[31] *2010-2014 American Community Survey 5-Year Estimates* (2014 report), U.S. Census Bureau. (22 Dec. 2015) Retrieved: http://factfinder.census.gov/faces/nav/jsf/pages/index.xhtml.

## 1.6 General SIP Approach

In November 1990, the U.S. Congress enacted a series of amendments to the CAA. One of the primary effects of the revision was to expand and clarify the planning provisions for those areas not meeting the NAAQS. The CAA, as amended, requires comprehensive federal and state programs to provide for attainment and maintenance of the NAAQS.

The following sections describe the approach ADEQ took in satisfying the requirements applicable to the Douglas $SO_2$ maintenance area. Section 1.6.1 outlines the particular CAA requirements addressed in this SIP. Section 0 lists EPA guidance referenced during the development and submittal of this SIP.

### 1.6.1 Regulatory Requirements

EPA's historic redesignation policy for $SO_2$ nonattainment areas has called for eight quarters of clean ambient air quality data as a prerequisite for redesignation to attainment. The October 18, 2000 memorandum, *Redesignation of Sulfur Dioxide Nonattainment Areas in the Absence of Monitored Data,* or the "Seitz memo," was developed to provide guidance on redesignating $SO_2$ areas to attainment in cases where an area's historic $SO_2$ violations were caused by major point sources that are no longer in operation and where monitors were removed immediately following the shutdown of the emissions sources, and there is therefore, insufficient air quality data to demonstrate attainment of the standard.

Table 6 outlines applicable CAA requirements in addition to provisions set forth in EPA's memorandum from John Calcagni, *Procedures for Processing Requests to Redesignate Areas to Attainment* ("Calcagni memo") as well as the Seitz memo.

**Table 6: Applicable Regulatory Requirements**

| CAA Title I – Air Pollution Prevention and Control; Part D – Plan Requirements for Nonattainment Areas; Section 175A – Maintenance Plan Requirements | | | |
|---|---|---|---|
| **Regulation** | **Requirement** | **Action to Meet Requirement** | **Location in SIP** |
| **§ 175A(b) – Second Maintenance Plan** | "8 years after redesignation of any area as an attainment area under section 107(d), the State shall submit to the Administrator an additional revision of the applicable [SIP] for maintaining the [NAAQS] for 10 years after the expiration of the 10-year period referred to in subsection (a)." | This maintenance plan renewal satisfies this requirement. | See this submittal. |
| **§ 175A(c) - NAA Requirements** | "Until such plan revision is approved and an area is redesignated as attainment for any area designated as a nonattainment area, the requirements of this part shall continue in force and effect with respect to such area." | This provision is not applicable for this maintenance plan renewal because the Douglas SO2 planning area is no longer designated nonattainment. | No additional location. |
| **§ 175A(d) - Contingency Provisions** | "Each plan revision submitted under this section shall contain such contingency provisions as the Administrator deems necessary to assure that the State will promptly correct any violation of the standard which occurs after the redesignation of the area as an attainment area. Such provisions shall include a requirement that the State will implement all measures with respect to the control of the air pollutant concerned which were contained in the State implementation plan for the area before redesignation..." | Because the primary source of SO2 emissions in the Douglas MA (PDDWRS) no longer exists, the area is not subject to such stringent contingency measure requirements. In general, the maintenance area would be subject to new source permitting requirements under ADEQ's Prevention of Significant Deterioration (PSD) program as a contingency measure. | See chapter 7. |

| CAA Title I – Air Pollution Prevention and Control; Part D – Plan Requirements for Nonattainment Areas; Section 176 – General and Transportation Conformity Requirements | | | |
|---|---|---|---|
| **Regulation** | **Requirement** | **Action to Meet Requirement** | **Location in SIP** |
| **§ 176(c) - General Conformity Regulations** | Section 176(c) of the Clean Air Act prohibits Federal entities from taking actions in nonattainment or maintenance areas which do not conform to the State implementation plan (SIP) for the attainment and maintenance of the NAAQS. Therefore, the purpose of conformity is to (1) ensure Federal activities do not interfere with the budgets in the SIPs; (2) ensure actions do not cause or contribute to new violations, and (3) ensure attainment and maintenance of the NAAQS. | General conformity needs to be addressed to assure SO2 emissions from any federal actions or plans do not exceed the rates outlined in 40 CFR § 93.153(b)[32]. Criteria for general conformity are located in R18-2-1438 of the Arizona Administrative Code. There are no known federal plans or actions affecting air quality currently in the Douglas area. ADEQ commits to review and comment, as appropriate, on federal agency draft general conformity determinations it receives pursuant to 40 CFR § 93.155 for activities planned for this air quality planning area. | No additional location. |
| **§ 176(c) - Transportation Conformity** | Transportation conformity is required by the CAA section 176© (42 U.S.C. 7506(c)) to ensure that federal funding and approval are given to highway and transit projects that are consistent with the air quality goals established by a state's SIP. Conformity, to the purpose of the SIP, means that transportation activities will not cause new air quality violations, worsen existing violations, or delay timely attainment of the NAAQS. | Title 40 CFR § 93.102(b) waives transportation conformity for SO2 nonattainment and maintenance areas. | No additional location. |

[32] 58 FR 63253; November 30, 1993

| EPA Guidance: *Procedures for Processing Requests to Redesignate Areas to Attainment*, Memorandum issued by John Calcagni in 1992 | | | |
|---|---|---|---|
| **Regulation** | **Requirement** | **Action to Meet Requirement** | **Location in SIP** |
| **Calcagni Memo (5) - Maintenance Projection Duration** | "The maintenance demonstration should project maintenance for 10 years, beginning from a date which factors in the time necessary for EPA review and approval action on the redesignation request [at least 18 months]." | This maintenance plan renewal projects maintenance through 2030, which is 15 years after the first maintenance period. | See chapter 3. |
| **Calcagni Memo (5)(a)- Attainment Emissions Inventory** | "The State should develop an attainment emissions inventory to identify the level of emissions in the area which is sufficient to attain the NAAQS." | This submittal includes an emissions inventory for the base year of 2011 using the most recently available National Emissions Inventory (NEI) data. | See chapter 3. |
| **Calcagni Memo (5)(b)- Maintenance Demonstration** | "A State may generally demonstrate maintenance of the NAAQS by either showing that future emissions of a pollutant or its precursors will not exceed the level of the attainment inventory, or by modeling to show that the future mix of sources and emission rates will not cause a violation of the NAAQS." | This submittal includes emissions inventories for the maintenance period between 2015 and 2030 as well as a modeling demonstration and analysis. | See chapters 3 and 5. |
| **Calcagni Memo (5)(c)- Verification of Attainment Through Monitoring Network** | "The maintenance plan should contain provisions for continued operation of air quality monitors that will provide such verification [of attainment status of the area]." | While ambient air quality monitoring is currently exempt in the Douglas SO2 maintenance area due to the permanent closure of the primary source, ADEQ commits to resume monitoring should any new sources apply through the permitting process. | See chapter 2. |

| | | | |
|---|---|---|---|
| **Calcagni Memo (5)(d)- Progress Tracking** | "Each State should ensure that it has the legal authority to implement and enforce all measures necessary to attain and to maintain the NAAQS.....the State submittal should indicate how the State will track the progress of the maintenance plan." | ADEQ has general authority to implement and enforce all measures to maintain the 1971 SO2 primary NAAQS per A.R.S. §§ 49-104, 49-404, 49-422, and 49-424. ADEQ will track the progress of this maintenance plan renewal by updating modeling parameters and through permitting requirements. | See chapter 6. |
| **Calcagni Memo 5(e) - Maintenance Contingency Plan** | "...The contingency plan is considered to be an enforceable part of the SIP and should ensure that the contingency measures are adopted expediently once they are triggered. The plan should clearly identify the measures to be adopted, a schedule and procedure for adoption and implementation, and a specific time limit for action by the State...the State should also identify specific indicators, or triggers, which will be used to determine when the contingency measures need to be implemented." | The contingency provisions for the Douglas SO2 maintenance area are within the state's PSD program. | See chapter 7. |

| **EPA Guidance: *Redesignation of Sulfur Dioxide Nonattainment Areas in the Absence of Monitored Data*, Memorandum issued by John Seitz in 2000** | | | |
|---|---|---|---|
| **Regulation** | **Requirement** | **Action to Meet Requirement** | **Location in SIP** |
| **Seitz Memo – EI for Period of NAAQS Violations** | The maintenance plan should include "an inventory representing actual emissions during the period when there were violations of the SO2 NAAQS." | In the first Douglas SO2 maintenance plan, ADEQ submitted an emissions inventory for 1985 when the PDDRW smelter was operating and NAAQS violations occurred. | No additional location. |
| **Seitz Memo – EI for Actual/Allowable Emissions** | The maintenance plan should include "an inventory representing current actual and allowable emissions (or potential emissions, if there is no allowable emissions level)." | This submittal includes an emissions inventory for the base year of 2011, using the most recently available NEI data. | See chapter 3. |

| | | | |
|---|---|---|---|
| **Seitz Memo - EI Projecting Allowable Emissions** | The maintenance plan should include "an inventory projecting allowable emissions (or potential emissions, if there is no allowable emissions level) to the 10th year after redesignation." | This submittal includes emissions inventories for the second maintenance duration between 2015 and 2030. | See chapter 3. |
| **Seitz Memo - Dispersion Modeling Analysis** | The maintenance plan should "include a dispersion modeling analysis of all SOx point sources in, and within 50 kilometers of, the nonattainment area boundaries using the emissions inventories described above and the techniques and data prescribed in 40 CFR 51 Appendix W. The modeling analysis should show that no SO2 NAAQS violations presently occur or can be projected to occur during the next 10 years anywhere within the nonattainment area and point sources, which have since shut down, were the dominant sources contributing to high SO2 concentrations in the airshed." | ADEQ's modeling analysis, maintenance demonstration, and methods are explained in Appendix A of this plan and chapter 5. The analysis demonstrates that no SO2 NAAQS violations presently occur nor are projected to occur in future years. The analysis includes sources located within the maintenance area and a 50-km buffer. | See chapter 5. |
| **Seitz Memo - New SOx Sources Provisions** | The maintenance plan should include "evidence that if the SOx point source that caused the SO2 NAAQS violations in the past resumes operation, it would be considered a 'new' source...the plan should show that if this 'new' SOx source would be a major source, it should obtain a permit conforming to applicable requirements of the Prevention of Significant Deterioration program before resuming operations; or it would not be a major source, it should obtain a minor source permit...the plan should provide that before such a permit is issued, the dispersion model should be re-run to determine whether re-starting the source would interfere with maintenance..." | This submittal includes provisions that require any new SOx source or major modifications to a source to be subject to modeling and BACT requirements under ADEQ's PSD program, which covers major and minor sources. | See chapter 6. |
| **Seitz Memo - Commitment to Resume Monitoring** | The maintenance plan should include "commitments to resume ambient monitoring before any major source of SOx emissions commences operation." | ADEQ commits to resume monitoring before any source of SOx begins operating. | See chapter 2. |

### 1.6.2 EPA Guidance

The following EPA guidance was referenced in the development and submission of this SIP:

- *Redesignation of Sulfur Dioxide Nonattainment Areas in the Absence of Monitored Data*, Memorandum from John Seitz. U.S. Environmental Protection Agency. October 18, 2000.
- *Procedures for Processing Requests to Redesignate Areas to Attainment,* Memorandum from John Calcagni. U.S. Environmental Protection Agency. September 4, 1992.
- *Second 10-Year Maintenance Plans for the National Ambient Air Quality Standards,* Frequently Asked Questions. U.S. Environmental Protection Agency. December 2014.

# 2 Ambient Monitoring Network

Section 2.1 presents an overview of monitoring requirements for $SO_2$ planning areas that no longer have monitor networks in place as well as a history of the Douglas maintenance area's air quality. Section 2.2 describes ADEQ's commitment to resume monitoring should a new source enter the area. Finally, section 2.3 summarizes the area's continued attainment of the 1971 $SO_2$ primary standard.

## 2.1 $SO_2$ Monitoring Requirements

EPA's protocols for $SO_2$ air monitoring and designations are located in the following sections of the CFR:

- 40 CFR Part 50, Appendix A, *Reference Method for the Determination of Sulfur Dioxide in the Atmosphere*
- 40 CFR Part 53, Subpart B, *Procedures for Testing Performance Characteristics of Automated Methods for $SO_2$, CO, $O^3$, and $NO_2$*
- 40 CFR Part 58, Subparts A, B, and C, *Ambient Air Quality Surveillance*

ADEQ began monitoring for $SO_2$ in the Douglas area as early as 1970[33] and the PDDRWS began monitoring ambient $SO_2$ air quality in 1975.[34] PDDRWS was by far the largest source of $SO_2$ in the Douglas area. It closed in 1987 and was dismantled in 1991. The last recorded 24-hour or annual average exceedances of the 1971 primary NAAQS occurred in 1986, the last year of extensive monitoring.[35]

Historically, PDDRWS was the main source of $SO_2$ in the Douglas maintenance area. Once it was permanently closed, $SO_2$ concentrations decreased. With approval from EPA, $SO_2$ monitors in the area were deemed unnecessary and were removed. It is reasonable to conclude that the historical NAAQS violations were caused by the smelter and not by existing sources. Even without current monitoring data, the dismantling of the smelter ended NAAQS exceedances and violations.[36]

In cases where major $SO_2$ sources shut down and monitoring is discontinued, states faced the prospect of continued nonattainment designations for areas where there is no reasonable basis for assuming that $SO_2$ violations persist. EPA released a memorandum entitled *Redesignation of Sulfur Dioxide Nonattainment Areas in the Absence of Monitored Data* to provide an approach states could take to redesignate $SO_2$ nonattainment areas where complete monitoring data is not available. As

[33] Air Quality Report for 1970, Air Quality Division, Arizona Department of Environmental Quality.
[34] *Douglas Sulfur Dioxide Nonattainment Area State Implementation and Maintenance Plan*, Air Quality Division, Arizona Department of Environmental Quality, November 29, 2001.
[35] 71 FR 9941 (Feb. 28, 2006).
[36] *Id.*, at 9944

outlined in the guidance, redesignation does not require eight current consecutive quarters (two years) of quality-assured, violation-free data. The guidance also exempts areas like Douglas from maintenance plan requirements regarding continued monitoring.

## 2.2 Commitment to Resume Monitoring

ADEQ will continue to demonstrate maintenance of the $SO_2$ NAAQS through updates to the parameters in the dispersion modeling. ADEQ still commits to re-establishing an appropriate ambient monitoring network before any major source of $SO_2$ begins operation in the Douglas $SO_2$ maintenance area. Additionally, ADEQ's new source permitting requirements under its Prevention of Significant Deterioration (PSD) program[37] require new sources to conduct preconstruction monitoring to identify baseline ambient air concentrations.

## 2.3 Continued Attainment of the Standards

Under CAA Section 107(d)(3)(E), states must show that a maintenance area continues to attain the NAAQS. Usually this requirement is met through ambient air quality data and modeling. But for areas like Douglas, where large sources of $SO_2$ shut down and air monitoring is no longer necessary, current air quality data is not available. For this reason, EPA's Seitz Memo provides states an opportunity to request redesignation where an area's historical violations were caused by major point sources of $SO_2$ emissions that are no longer in operation and where there is no monitoring.

For the first 10-year maintenance plan for Douglas, ADEQ provided aerial photographs illustrating the dismantled PDDRWS to show that no $SO_2$ source currently exists in the area.[38] The SIP also included a modeling analysis and emissions inventories that demonstrated attainment and maintenance of the 1971 $SO_2$ primary standards. To demonstrate continued attainment through the second 10-year maintenance period, this maintenance plan renewal includes updated emissions inventories and an updated modeling analysis demonstrating maintenance beyond the second maintenance period and through 2030 (see chapters 3 and 5).

[37] See Arizona Administrative Code (A.A.C.) R18-2-406, *Permit Requirements for Sources Located in Attainment and Unclassifiable Areas.*

[38] See Appendix A of *Douglas Sulfur Dioxide Nonattainment Area State Implementation and Maintenance Plan,* Air Quality Division, Arizona Department of Environmental Quality, November 29, 2001.

# 3 Emissions Inventories

Section 3.1 presents the regulatory requirements for the emission inventories for a $SO_2$ maintenance area. ADEQ then presents its technical approach for developing emission inventories for the base year (2011), and all future maintenance years (2015, 2020, 2025, and 2030) in Section 3.2. The results of such inventories are in Sections 3.4 and 3.5. Lastly, a summary of ADEQ's analysis is in Section 3.6.

## 3.1 Requirements

ADEQ is required to submit to EPA a maintenance plan renewal to demonstrate that the Douglas $SO_2$ MA will continue to attain the 1971 $SO_2$ NAAQS ten years after the first maintenance plan duration.[39] The 1992 Calcagni Memo and the 2000 Seitz Memo suggest that states develop three inventories for the maintenance plan:

1. an inventory representing actual emissions during the period when violations of the NAAQS were occurring;
2. an inventory representing current and allowable (or potential) emissions; and
3. an inventory that projects allowable (or potential) emissions to the tenth year after redesignation (or in this SIP's case, the tenth year after the first maintenance duration).

The Seitz memo also stipulates that the inventories must include emissions from all point sources within a 50 km range of the nonattainment area boundary.

## 3.2 Approach

ADEQ submitted a supplement[40] to the first maintenance SIP in 2005 with updated emissions inventories for sources in, and within 50 km of, the Douglas MA. In the supplement, ADEQ submitted an inventory for 1985 to represent emissions while the PDDWRS copper smelter was operating; this inventory satisfies the requirement in number 1 above in section 3.1. The 2005 supplement also included a base year inventory for 1999 and a projected maintenance inventory for 2015.

For this maintenance plan renewal, ADEQ used EPA's 2011 National Emissions Inventory (NEI) Version 2 to identify most sources of $SO_2$ emissions in and around the MA. To identify point sources in Mexico (but within 50 km of the MA) ADEQ considered the 2008 *Inventario Nacional de Emisiones*

[39] See CAA § 175A

[40] See *Douglas Sulfur Dioxide Nonattainment Area State Implementation Plan Emissions Inventory and Air Quality Dispersion Modeling Update,* Air Quality Division, Arizona Department of Environmental Quality, September 2005.

*de México* (INEM) and consulted its authors, the *Secretaría de Medio Ambiente y Recursos Naturales* (SEMARNAT), the Mexican counterpart to the U.S. EPA.

Because the 2011 NEI provided the most recent comprehensive inventory of $SO_2$ emissions in Cochise County as of the development of these inventories[41], ADEQ selected 2011 as the base inventory year to comply with inventory requirement number 2 in section 3.1. ADEQ rolled this base inventory forward to generate an inventory for 2015, the final inventory year of the first maintenance period. ADEQ built additional inventories in five year increments through the end of the second maintenance period for 2020, 2025, and 2030 to comply with inventory requirement number 3 in section 3.1.

This chapter provides a summary of methodologies used to calculate emissions. The following subsections summarize total $SO_2$ emissions inventoried from point, mobile (nonroad and onroad), event-related, and area (nonpoint) source categories. A detailed description of the development of these inventories is in the Emission Inventory Technical Support Document found in Appendix A.

## 3.3 Methodologies

### 3.3.1 Base Year

For the 2011 base year inventory, ADEQ utilized a top-down approach to estimate area and mobile source emissions for the Douglas $SO_2$ MA. ADEQ scaled down the county-level emissions estimates to the MA level. The scaling factors which allocate emissions from Cochise County at large down to the MA vary depending on the source(s) in question. ADEQ examined each area (nonpoint) and mobile source of $SO_2$ from the 2011 NEI and determined the most appropriate surrogate for allocation, for example, population or railway length. ADEQ then estimated emissions for the MA using top-down allocation factors.

For point source emissions and localized emission events, ADEQ considered the precise location of each facility. A facility's emissions were allocated to the MA if and only if the facility was located within it. The point source inventory for the 50-km buffer around the MA also employs this location-based method.

For event-related, or wildfire emissions, ADEQ used Version 6 of the 2011 NEI Modeling Platform to determine which fires burned inside the MA and how much $SO_2$ they emitted.

### 3.3.2 Future Years

In order to demonstrate attainment throughout the second maintenance period, ADEQ projected emissions in the MA and the 50-km buffer for future years. ADEQ made the conservative

[41] Revisions to the EIs for this plan were completed in June 2016. At the time of this SIP drafting, the 2014 NEI was expected to be released in September 2016.

assumption that each facility would emit the maximum amount of $SO_2$ that it could each year, according to Potential to Emit (PTE) limits or the capacity of installed equipment at the facility. ADEQ projected inventories starting with 2015 (the last inventory year of the first maintenance period) and continued in five-year increments past the end of the second maintenance period. The inventory years are 2015, 2020, 2025, and 2030. Although 2015 had already elapsed at the time that the projections were made, ADEQ collectively refers to these years as "future years" and these inventories as "future year inventories" for notational convenience.

For most emissions sources in the MA, ADEQ developed growth factors, which are presented in the EI TSD. ADEQ applied these factors to develop Cochise County emissions estimates for each future year. These county-level projections map down to the MA using the same allocation methods as in the base year inventory.

ADEQ estimated growth factors for mobile source emissions by using EPA's Motor Vehicle Emissions Simulator (MOVES) to model $SO_2$ emissions totals for Cochise County.

Methodologies are further detailed in the Emissions Inventory TSD in Appendix A.

## 3.4 Base Year Emissions – All Sources

In the 2011 base year, the on-road mobile source sector contributed nearly half of $SO_2$ emissions in the Douglas MA, totaling 2.94 tons per year (tpy). The second highest contributor was railroads, totaling 1.09 tpy. This is despite four point sources in the MA: the Bisbee Douglas International Airport, Douglas Municipal Airport, APS Fairview Power Plant, and the Arizona State Prison-Douglas Complex. The total $SO_2$ emissions from point sources in 2011 is roughly 0.30 tpy.

Other sources of $SO_2$ included nonpoint fuel combustion, agricultural burning, wildfires, and open burning.

For historical context Table 7 summarizes $SO_2$ emissions for the nonattainment area in 1985 and shows that the Phelps Dodge Douglas Reduction Works Smelter accounted for 99.9% of all the emitted $SO_2$.

**Table 7: $SO_2$ Emissions in the Nonattainment Area in 1985**

| Source Category | | Nonattainment Area Emissions in tons per year (tpy) |
|---|---|---|
| **Area** | Fuel Combustion - Industrial | 23.02 |
| | Fuel Combustion - Other | 1.63 |
| | Waste Disposal and Recycling | 0.68 |
| **On-road Mobile** | | 51.76 |
| **Non-road Mobile** | | 14.30 |
| **Miscellaneous** | | 1.63 |
| **Point** | Copper Smelter | 330,000.00 |
| | Power Plant | 0.14 |
| | Other Facilities | 0.00 |
| **Total** | | **330,093.16** |

Table 8 summarizes $SO_2$ emissions estimates for Cochise County and for the MA in 2011.

**Table 8: SO2 Emissions in Cochise County and the MA in 2011**

| Source Category | | Cochise County Emissions (tpy) | Maintenance Area Emissions (tpy) |
|---|---|---|---|
| **On-road Mobile** | | 17.8603 | 2.9386 |
| **Non-road Mobile** | | 1.4951 | 0.2460 |
| **Area** | Railroads | 22.6721 | 1.0885 |
| | Fuel Combustion | 3.6634 | 0.6027 |
| | Agricultural Burning | 25.9493 | 0.3095 |
| | Open Burning | 2.3676 | 0.3895 |
| | Cremation | 0.0549 | 0.0090 |
| **Point** | Airports | 1.3011 | 0.1945 |
| | Power Plants | Not computed | 0.1023 |
| | Other Facilities | Not computed | 0.0000 |
| **Event** | Wildfires | 2554.3965 | 0.0178 |
| | Prescribed Burns | 13.7320 | 0.0000 |
| **Total** | | **Not computed** | **5.8984** |

ADEQ also identified point sources of $SO_2$ in the 50 km buffer zone, including those located in Sonora, Mexico. A majority of point sources in the Arizona portion are airports, while the largest contributor of $SO_2$ in the Mexican portion is the Agua Prieta II power plant.

As shown in Table 9, point sources located in Mexico were the majority contributor of $SO_2$ emissions in 2011 in the 50 km buffer area.

**Table 9: SO2 Point Source Emissions in the 50 km Buffer in 2011**

| Source Category | Buffer Emissions (tpy) |
|---|---|
| **U.S. Facilities** | 0.4327 |
| **Mexican Facilities** | 959.0230 |
| **Total** | **959.4557** |

## 3.5 Future Year Emissions – All Sources

Several major changes could occur in the Douglas MA during the second maintenance period.

First, the point source category could increase significantly in contrast to the 2011 base year. To obtain worst-case estimates, ADEQ assumed that point sources would achieve the maximum allowable quantity of $SO_2$ emissions in each future year, that is, their permitted (and federally enforceable) PTE. Since the 2011 inventory estimated actual emissions, rather than the outer limits estimated for future years, one must take care when interpreting direct comparisons between the two.

Second, on-road mobile sources are projected to decrease through the second maintenance period, from 2.95 tpy in 2015 to 1.28 tpy in 2030. Emissions from railroads and non-road mobile sources are also projected to drop significantly below their 2011 levels.

Other sources in the MA, like airports and agricultural burning, are projected to change very little in future years.

Table 10 below summarizes $SO_2$ emissions projections for the Douglas MA through the second maintenance period.

**Table 10: SO2 Emissions in the MA in Maintenance Years**

| Source Category | | Maintenance Area Emissions (tpy) | | | |
|---|---|---|---|---|---|
| | | **2015** | **2020** | **2025** | **2030** |
| **On-road Mobile** | | 2.9476 | 1.3520 | 1.3030 | 1.2770 |
| **Non-road Mobile** | | 0.1265 | 0.0797 | 0.0846 | 0.0897 |
| **Area** | Railroads | 0.4208 | 0.4089 | 0.4234 | 0.4394 |

| | | | | | |
|---|---|---|---|---|---|
| | Fuel Combustion | 0.5962 | 0.6120 | 0.6327 | 0.6516 |
| | Agricultural Burning | 0.3095 | 0.3095 | 0.3095 | 0.3095 |
| | Open Burning | 0.3853 | 0.3955 | 0.4089 | 0.4211 |
| | Cremation | 0.0089 | 0.0092 | 0.0095 | 0.0098 |
| **Point** | Airports | 0.1924 | 0.1975 | 0.2042 | 0.2103 |
| | Power Plants | 69.5400 | 69.5400 | 69.5400 | 69.5400 |
| | Other Facilities | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| **Event** | Wildfires | 0.0178 | 0.0178 | 0.0178 | 0.0178 |
| | Prescribed Burns | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| **Total** | | **74.5450** | **72.9221** | **72.9336** | **72.9661** |

Just like for the 2011 base year, ADEQ also considered $SO_2$ emissions from point sources in the 50 km buffer area. As shown in Table 11 below, U.S. facilities are the major contributor, as opposed to Mexican facilities in 2011. Again, the maximum permitted limit or PTE was used to project emissions in future years, so direct comparisons between 2011 and future years should be made with caution.

**Table 11: SO2 Point Source Emissions in the 50-km Buffer in Maintenance Years**

| Source Category | Maintenance Area Emissions (Tons per year) | | | |
|---|---|---|---|---|
| | **2015** | **2020** | **2025** | **2030** |
| **U.S. Facilities** | 4,424.9590 | 4,424.9550 | 4,424.9647 | 4,424.9773 |
| **Mexican Facilities**[42] | 1,882.2510 | 1,882.2510 | 1,882.2510 | 1,882.2510 |
| **Total** | **6,307.2101** | **6,307.2061** | **6,307.2157** | **6,307.2283** |

## 3.6 Summary

ADEQ estimated that nearly 5.9 actual tons of $SO_2$ were emitted in the MA in 2011. Because direct comparisons between 2011 actual point source emissions and future PTE emissions can obscure the details of other source sectors, ADEQ excluded the APS Fairview Generating Station from the figure below to illustrate a more accurate comparative analysis. Figure 4 below shows that in future years,

[42] The permits under which the Mexican point sources operate do not specify PTEs. However, based on the maximum capacity of the equipment covered by each permit, ADEQ calculated the maximum possible emissions. The Agua Prieta II Power Plant, which contributed 5.17 TPY of $SO_2$ to the 2011 inventory, was projected to emit up to 30.031 TPY in future years. The Mexicana de Cobre Lime Plant, which only contributed 0.24 TPY in 2011, was projected to emit up to 1,852.22 TPY in future years. Like the PTEs for U.S. facilities, these estimates do not reflect actual expected emissions, but rather worst-case conditions.

actual $SO_2$ emissions are projected to drop precipitously; the projections for 2020-2030 are about 3.4 tpy, more than a 40 percent reduction from 2011.

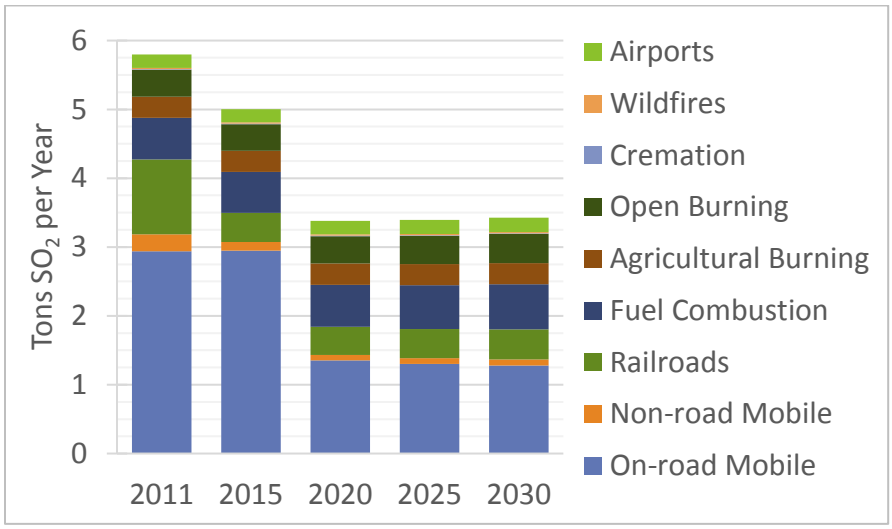


**Figure 4: MA Emission Projections, Excluding APS Fairview**

However, as Figure 5 shows, the PTE of the APS Fairview Generating Station makes future year emissions reductions relatively insignificant—the power plant contributes over 95 percent of the projected emissions for 2020-2030. Therefore, the impacts of this facility (as well as the high-PTE sources in the buffer area) on $SO_2$ levels in the MA are explored via dispersion modeling in Appendix B. As discussed in Chapter 5, that analysis demonstrates that the MA is projected to meet the NAAQS through 2030.

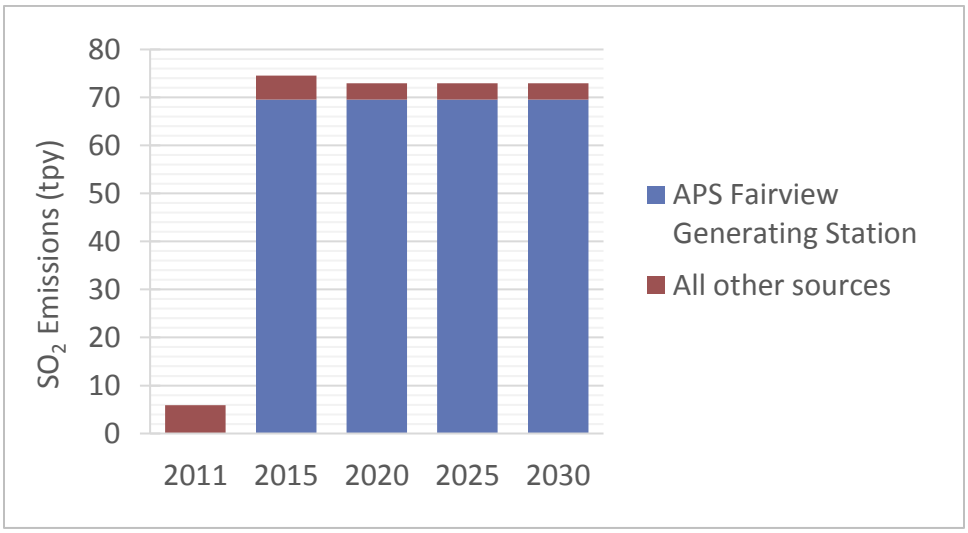


**Figure 5: Relative MA Emissions Projections, Including APS Fairview**

# 4 Control Measures

This chapter discusses the necessary control-related provisions for the Douglas MA. Section 4.1 outlines the regulatory requirements. Sections 4.2 and 4.3 present the applicable $SO_2$ emission control measures for sources within the Douglas $SO_2$ maintenance area and the 50-km buffer zone.

## 4.1 Requirements

Nonattainment area plans are required to provide for the implementation of all Reasonably Available Control Measures (RACM) including reductions in emissions from existing sources in the area that may be obtained through Reasonably Available Control Technology (RACT). RACT is the emissions control level for sources located in $SO_2$ nonattainment areas. RACT is determined, in part, by the technological and economic feasibility of the control for the specific source and is generally defined for $SO_2$ as control which will achieve the NAAQS within statutory timeframes.[43]

As stated earlier, ADEQ submitted a combined nonattainment/maintenance SIP for the Douglas $SO_2$ area in 2001 with a subsequent supplement submitted in 2005 that required RACM/RACT.

Maintenance plans, per CAA Section 175A, should ensure that the level of control that allowed the area to reach attainment will continue to do so in the future.

## 4.2 Point Sources

### 4.2.1 Phelps Dodge Douglas Reduction Works Smelter

As previously noted, the PDDRWS was the major source of emissions in the Douglas $SO_2$ maintenance area. When this facility was in operation in 1985, the source emitted an annual total of roughly 330,000 tons of $SO_2$. The source was subject to R18-2-715(A)-(E), *Standards of Performance for Existing Primary Copper Smelters; Site-Specific Requirements*; R18-2-715.01, *Compliance and Monitoring*; and R18-2-715.02, *Fugitive Emissions*.[44] R18-2-715, known as a Multi-Point Rollback Rule (MPR rule), contained site-specific requirements for all existing primary copper smelters. The MPR rule included a compliance date of January 14, 1986.

At the time the MPR rule was promulgated, PDDWRS was seeking a Nonferrous Smelter Order (NSO) determination from EPA and the State of Arizona. Therefore, no site-specific requirements for this facility were listed in the MPR rule. Upon receipt of the denial of the NSO determination on

[43] U.S. EPA, Office of Air and Radiation, Office of Air Quality Planning and Standards, *$SO_2$ Guideline Document*, February 1994.

[44] Please note that at the time of this SIP's development, R18-2-715 and R18-2-715.01 were in the process of being amended as part of the 2010 $SO_2$ NAAQS SIPs for the Hayden and Miami nonattainment areas. These amendments, however, do not directly affect the Douglas MA.

April 17, 1986, PDDRWS was scheduled for closure, which was completed on January 15, 1987, thus showing compliance with the MPR rule.

The permanent closure of the PDDRWS greatly reduced $SO_2$ emissions in the maintenance area, thus meeting RACM requirements. Since PDDRWS was the only major source of emissions, adoption of additional control measures is not necessary to maintain the NAAQS. Furthermore, since the closure of PDDRWS, there have been no new sources of $SO_2$ the magnitude of PDDRWS. Should new major sources enter, or major modifications to existing sources arise in the Douglas $SO_2$ maintenance area, they would be subject to Arizona's PSD permitting program in order to protect air quality.

### 4.2.2 Other Point Sources

#### Point Sources in the Douglas $SO_2$ Maintenance Area

ADEQ identified four other point sources within the Douglas $SO_2$ MA, aside from the now closed PDDRWS. These are:

1. Bisbee-Douglas International - Airport
2. Douglas Municipal - Airport
3. APS Fairview - Power Plant
4. Arizona State Prison Complex – Prison/Jail

The still-operating APS Fairview Generating Station is controlled by a Standard Class I permit[45] from ADEQ. The station's maximum permitted $SO_2$ emissions limit (or PTE) is less than 70 tpy. But because the station is used on an as-needed basis, primarily during emergency situations, actual emissions were considerably lower, 0.10 tpy, in 2011. The station is required to use #2 diesel fuel with sulfur content less than or equal to 0.05 percent. The permit also requires a $SO_2$ emission limit of 1.0 pound per million BTU heat input. The Arizona State Prison Complex operates and is controlled by a Class II permit for its emergency generators.[46] In 2011, each of the point sources identified above emitted at or less than 0.11 tpy and are considered minor. Furthermore, airports are controlled through federal programs, therefore, additional controls are not required.

#### Point Sources in the U.S. Portion of the 50km Buffer

ADEQ identified 16 facilities located within Arizona, outside of the MA itself, but within 50 km of the MA. These are:

1. Ash Creek – Airport

[45] *See* ADEQ Air Quality Control Permit No. 61353, issued on March 19, 2015.
[46] *See* ADEQ Authorization to Operate Permit No. 113752, issued on March 13, 2012.

2. Bisbee Municipal – Airport
3. Circle H Ranch – Airport
4. Cochise College – Airport
5. Copper Queen Hospital – Airport
6. Evelyn Field – Airport
7. Fort Omotse – Airport
8. Rancho San Marcos – Airport
9. Thompson international –Airport
10. Tombstone Municipal – Airport
11. Tribal Air – Airport
12. Lhoist North America – Mine/Lime Plant
13. Freeport Copper Queen – Mine
14. Fiesta Canning Co – Food Processing Plant
15. Chiricahua Building Supplies – Equipment Yard

The majority of the point sources in this portion of the buffer are airports and in 2011 each airport emitted 0.3 tpy or less of $SO_2$ emissions. As stated above, airports in this area are subject to federal programs and do not require additional controls. Emissions from both the lime plant owned by Lhoist North America[47] and the mine owned by Freeport McMoRan located within the 50-km buffer area have the potential to emit significantly more $SO_2$ than they did in 2011 due to their PTE. For future years, ADEQ projected emissions using PTE. The Lhoist North American lime plant is controlled via its Class I permit,[48] requiring the same emission limit of 1.0 pound of sulfur dioxide per million BTU heat input as the APS Fairview Generating Station. Freeport McMoran's Copper Queen mine is controlled via its Class II Synthetic Minor permit.[49] The remaining two sources Fiesta Canning Co (.0097 tpy) and Chiricahua Building Supplies (none reported) had only minor emissions for 2011. See Figure 6 below for a map of point sources in and around the MA.

[47] Please note that the Lhoist North America lime plant was not operating in 2011. However, because the facility still has a permit, ADEQ modeled their permit limit (PTE) of 4,420.66 tpy in each future year.
[48] See ADEQ Air Quality Class I Permit No. 61785, issued September 16, 2015.
[49] See ADEQ Class II Minor Synthetic Operating Permit No. 53591 issued on December 16, 2011 and as amended by Minor Permit Revision Nos. 55192 and 62505.

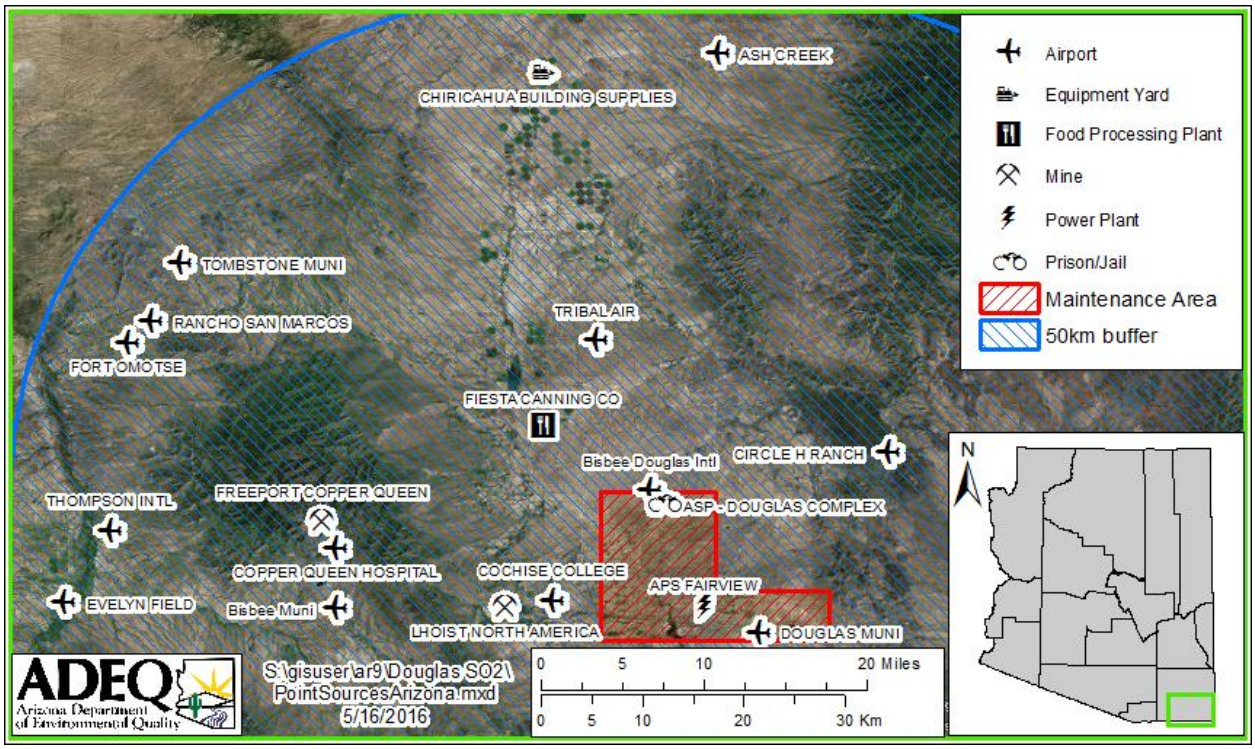


**Figure 6. Arizonan Point Sources of SO2 in and around the MA**

## Point Sources in the Mexican Portion of the 50km Buffer

1. Agua Prieta II – Power Plant
2. Reliance Mexicana – Textile Mill
3. Mexicana de Cobre – Mine/Lime Plant
4. Adobe Air – Appliance Manufacture
5. Dix-Mex – Electric Motor Plant
6. MWC de Mexico – Auto Parts Manufacturer
7. VEM MEX – Auto Parts Manufacturer

ADEQ also identified a number of other point sources in the Mexican portion of the 50-km buffer area. A majority of these sources are auto manufacturers, in addition to the Agua Prieta power plant and the Mexicana de Cobre lime plant. In 2008, the Agua Prieta power plant emitted over 5 tpy. In 2008, the Mexicana de Cobre lime plant emitted 0.24 tpy of $SO_2$. The remaining sources Adobe Air, Reliance Mexicana, DIX-MEX (none reported), MWC de Mexico, and VEM MEX had negligible $SO_2$ emissions under .0001 tpy for 2011. Controls for these sources are either covered by

federal programs, or are not under ADEQ's jurisdiction. For more information on emissions and source locations, see the Emissions Inventory Technical Support Document in Appendix A and the map in Figure 7 below.

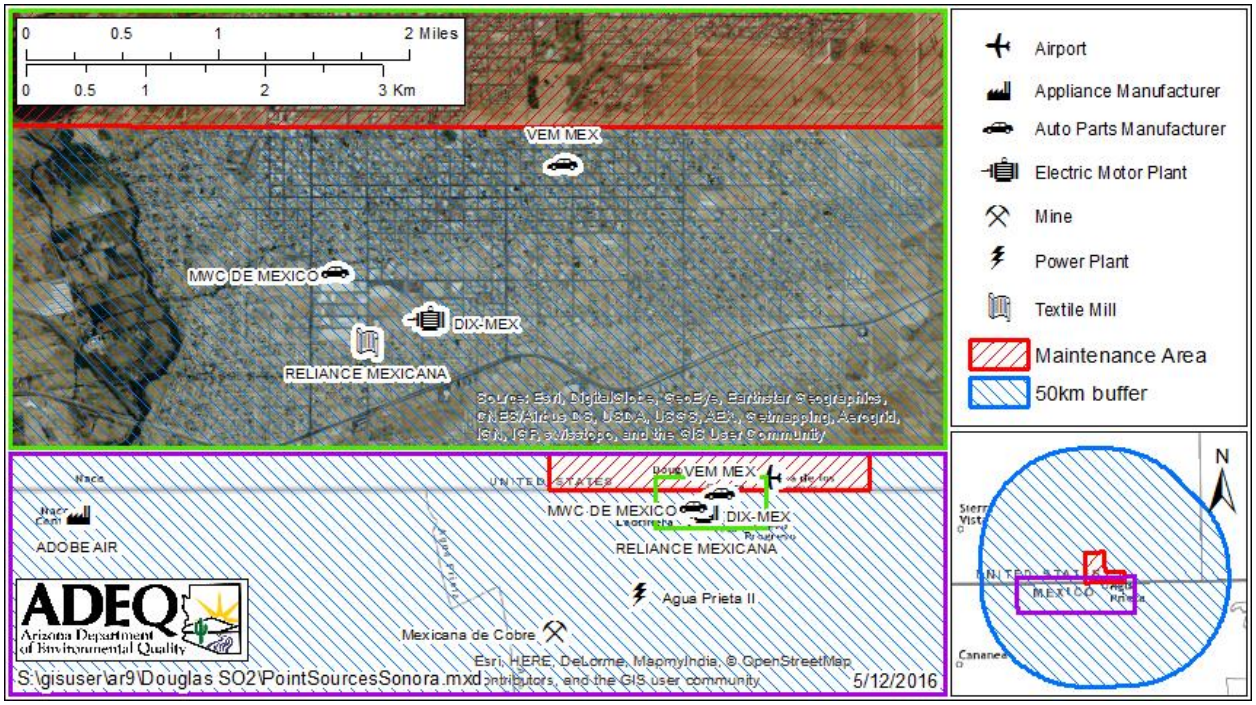


**Figure 7. Sonoran Point Sources of $SO_2$, around the MA**

## 4.3 Area and Mobile Sources

For the 2011 base year, ADEQ estimated area and mobile source emissions at about 5.6 tpy within the MA. In 2030, area and mobile emissions are projected to total roughly 3 tpy. The emissions from area and mobile sources are too minimal to require control measures.

Additionally, there are several EPA programs in place related to the sulfur content of fuels. Due to these national programs, future $SO_2$ emissions are low, as projected in Chapter 3 of this SIP and in the Emissions Inventory TSD in Appendix A. Federal programs include:

1. Tier 2 Vehicle and Gasoline Sulfur Program for passenger vehicles
2. Tier 3 Vehicle Emission and Fuel Standards Program
3. Heavy-Duty Engine and Vehicle Standards and Highway Diesel Fuel Sulfur Control Requirements for highway trucks and buses
4. Clean Air Nonroad Diesel Rule for nonroad diesel equipment

EPA's Tier 2 program implements stringent emissions standards for nitrogen oxides from all passenger cars and light trucks. To meet the emission standards, the program incorporates

requirements that substantially reduce sulfur levels in gasoline. Sulfur in fuel impairs the effectiveness of vehicle emission control systems and by removing most of the sulfur from gasoline, emission controls work longer and more efficiently. As a result, the standards reduce the average national sulfur content in gasoline by up to 90 percent.[50]

The Tier 3 program, published in 2014, will set more stringent vehicle emissions standards and will lower sulfur content in gasoline beginning in 2017. The vehicle standards will reduce both tailpipe and evaporative emissions from passenger cars, light-duty trucks, medium-duty passenger vehicles, and some heavy-duty vehicles. The gasoline sulfur standard will enable more stringent vehicle emissions standards and will make emissions control systems more effective.[51]

The 2007 Heavy-Duty Engine and Vehicle standards and Highway Diesel Fuel Sulfur Control program established new nitrogen oxides and particulate matter emissions standards for heavy-duty highway engines and vehicles. The standards are based on high-efficiency catalytic exhaust emission control technologies. Because emissions control devices are damaged by sulfur, associated regulations reduce the sulfur in highway diesel fuel by 97 percent.[52]

The Clean Air Nonroad Diesel Rule established new oxides of nitrogen and particulate matter emission standards that are applicable to diesel engines used in construction, agricultural, industrial, and other equipment. To prevent damage to emissions control systems, the regulations also require a reduction in sulfur levels in nonroad diesel fuel from the current approximately 3,000 parts per million to 15 parts per million when fully implemented. Fuel sulfur reductions are being phased in over a number of years that began in 2007.[53]

To demonstrate that the Douglas $SO_2$ MA would continue to attain the NAAQS in the future despite the higher PTE limits, ADEQ conducted dispersion modeling, which is discussed in the following chapter.

[50] To learn more about the Tier 2 vehicle program, visit http://www3.epa.gov/tier2/.
[51] To learn more about the Tier 3 vehicle program, visit http://www3.epa.gov/otaq/tier3.htm. http://www.epa.gov/otaq/tier3.htm
[52] To learn more about the Heavy-Duty Highway Diesel program, visit http://www3.epa.gov/otaq/highway-diesel/index.htm.
[53] To learn more about the Nonroad Diesel rule and requirements, visit http://www3.epa.gov/otaq/nonroad-diesel.htm.

# 5 Maintenance Demonstration

Subsection (b) of §175A of the Clean Air Act requires states to demonstrate continued attainment of the NAAQS for 10 years beyond the initial maintenance period for a MA (throughout a *second maintenance period*). Since no ambient air quality monitors are currently measuring $SO_2$ in the Douglas MA, ADEQ performed air quality modeling for this demonstration.[54] The modeling results demonstrate that the Douglas MA will continue to maintain the 1971 $SO_2$ primary standard beyond the second maintenance period and through 2030.

Section **Error! Reference source not found.** provides a summary of the chosen model. Section 5.2 iscusses the methodology used to model the $SO_2$ emissions from all point sources that hold active permits to operate within the maintenance area and 50-km buffer. Section 5.3 summarizes the modeling results.

## 5.1 Modeling Demonstration Overview

Screen modeling is typically performed to determine whether or not a given simulation needs to be run in a more sophisticated model. In order to make sure that no potentially significant impacts slip through the cracks, an effective screen model only makes conservative and/or representative assumptions. AERSCREEN is EPA's recommended screening model. It uses AERMOD, EPA's regulatory Gaussian plume dispersion model, to estimate concentrations. Unlike the full version of AERMOD, however, AERSCREEN requires no detailed meteorological data. Instead, it uses the MAKEMET program to impose a meteorological scenario whose influence maximizes pollutant concentrations for the given simulation. ADEQ ran all simulations described below using version 15181 of AERSCREEN, AERMOD, and MAKEMET.

## 5.2 Methodologies

In the Emission Inventory TSD in Appendix A, ADEQ identified the sources of $SO_2$ emissions which may impact ambient air quality in the MA. The EI TSD documents emissions inventories representing these sources every five years up to 2030.

ADEQ took two distinct approaches to estimating $SO_2$ emissions in future years. For each facility which individually emitted a significant quantity of $SO_2$, ADEQ made the conservative assumption that the facility would attain its permitted maximum PTE $SO_2$ in all future years. This method covered not only facilities in the MA, but also those within 50 km of the MA. In the case of significant emitters with no explicit permitted PTEs (facilities in the Mexican portion of the 50 km

[54] Per the October 18, 2000 guidance memo from John S. Seitz, "Redesignation of Sulfur Dioxide Nonattainment Areas in the Absence of Monitored Data," commonly referred to as the "Seitz Memo."

annular buffer around the MA), ADEQ estimated the theoretical maximum quantity of $SO_2$ that a facility could emit using its permitted equipment.

For all other sources of $SO_2$ emissions (including, for example, mobile source emissions, which have no theoretical limit on their PTE), ADEQ projected a likely growth trajectory in order to produce unbiased estimates of future year emissions.

ADEQ regarded a facility as *individually significant* if it was estimated to emit half a ton per year of $SO_2$ or more in any future year. These significant sources include the APS Fairview Generating Station, the Douglas Chemical Lime Plant, the Copper Queen Branch mine, the Agua Prieta II power plant, and the Mexicana de Cobre lime plant.

For each such facility, ADEQ performed air dispersion modeling to determine the facility's maximum impact on the air quality of the MA during a worst-case hour. "Worst case," in this context, means all $SO_2$-emitting processes at the facility emitting at full capacity while meteorological conditions minimize ventilation. ADEQ used EPA's AERSCREEN application to estimate these maximum one-hour impacts. From each simulation, AERSCREEN extrapolated each facility's maximum impacts on 24-hour and annual average $SO_2$ concentrations.

For facilities emitting less than half a ton of $SO_2$ per year (*de minimis* sources) ADEQ did not perform dispersion modeling. Instead, ADEQ estimated the collective impacts of all such sources—plus nonpoint, mobile, and biogenic sources—based on actual concentrations of $SO_2$ observed by ambient air monitors.

Finally, for each future year, ADEQ combined the impacts of all emissions sources and compared the resulting estimate to the relevant NAAQS.

Further methodology details are discussed in the Modeling TSD in Appendix B.

## 5.3 Predicted Ambient Concentrations

ADEQ modeled the worst-case impact of each significant facility in AERSCREEN and combined the results with "background" concentrations which estimate the impacts of all remaining sources of $SO_2$ emissions in the MA. The results are presented in Table 12 and Table 13, below.

**Table 12: Estimated Worst Case 24-hour Average $SO_2$ Concentrations in the MA**

| Source | Worst case 24-hour average concentrations (ppm) | | | |
|---|---|---|---|---|
| | 2015 | 2020 | 2025 | 2030 |
| **APS Fairview** | 0.020157 | 0.020157 | 0.020157 | 0.020157 |
| **Lhoist Lime Plant** | 0.048044 | 0.048044 | 0.048044 | 0.048044 |
| **Copper Queen** | 0.002071 | 0.002071 | 0.002071 | 0.002071 |

| | | | | |
|---|---|---|---|---|
| **Agua Prieta II** | 0.000130 | 0.000130 | 0.000130 | 0.000130 |
| **Mexicana de Cobre** | 0.033486 | 0.033486 | 0.033486 | 0.033486 |
| **Background** | 0.003900 | 0.003368 | 0.002276 | 0.002283 |
| **Total** | **0.107788** | **0.107255** | **0.106163** | **0.106171** |

**Table 13: Estimated Worst Case Annual Average $SO_2$ Concentrations in the MA**

| Source | Worst case annual average concentrations (ppm) | | | |
|---|---|---|---|---|
| | 2015 | 2020 | 2025 | 2030 |
| **APS Fairview** | 0.003359 | 0.003359 | 0.003359 | 0.003359 |
| **Lhoist Lime Plant** | 0.008011 | 0.008011 | 0.008011 | 0.008011 |
| **Copper Queen** | 0.000345 | 0.000345 | 0.000345 | 0.000345 |
| **Agua Prieta II** | 0.000022 | 0.000022 | 0.000022 | 0.000022 |
| **Mexicana de Cobre** | 0.005581 | 0.005581 | 0.005581 | 0.005581 |
| **Background** | 0.000930 | 0.000803 | 0.000543 | 0.000545 |
| **Total** | **0.018248** | **0.018121** | **0.017861** | **0.017863** |

Figure 8 below illustrates that each total is comfortably smaller than the 1971 $SO_2$ NAAQS (.14 ppm for the 24-hour averages and .030 ppm for the annual averages).

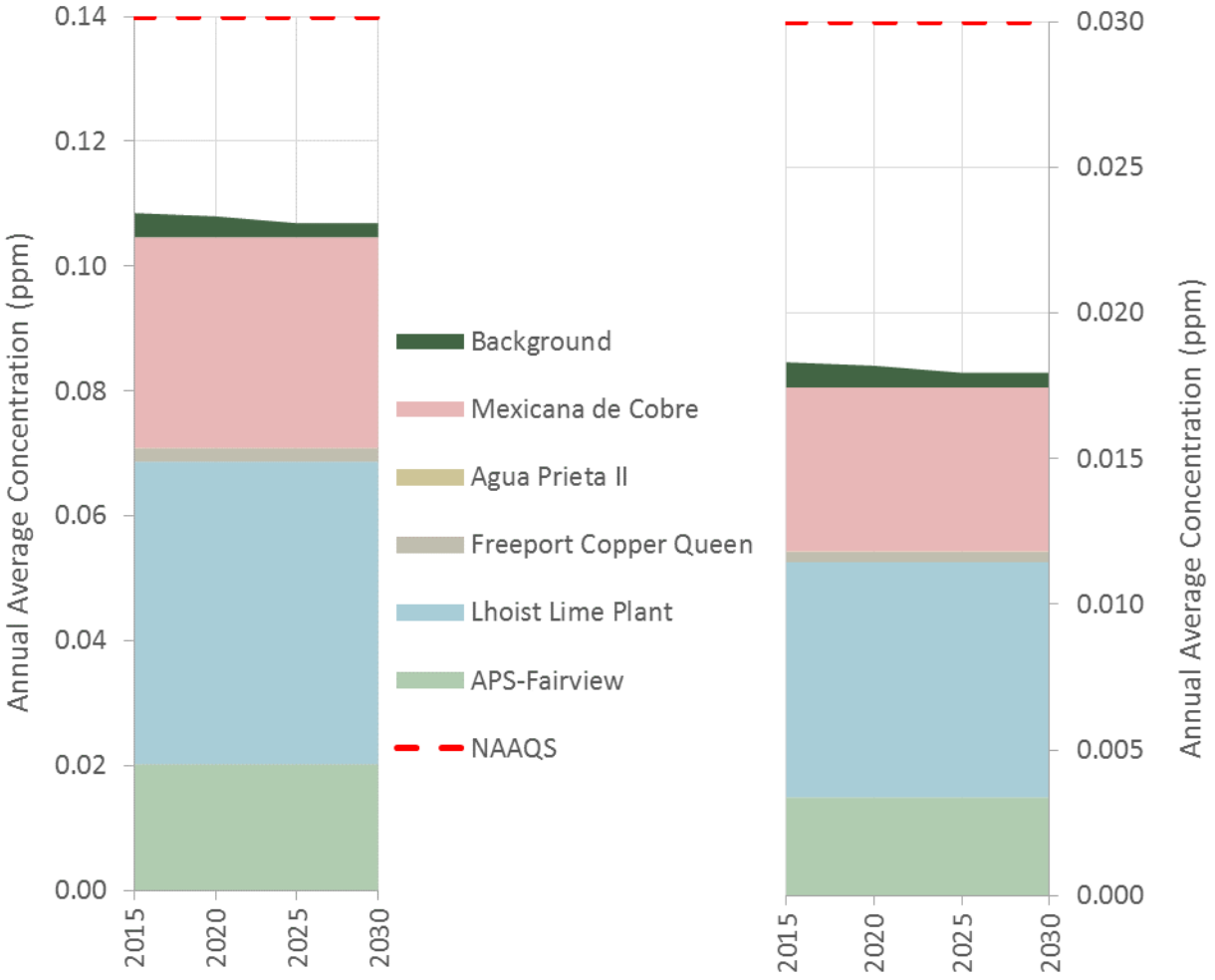


**Figure 8: Estimated Worst Case SO2 Concentrations in the Douglas MA**

ADEQ concludes that even under worst-case conditions, the MA would continue to meet both the 24-hour and annual primary 1971 $SO_2$ NAAQS throughout the second maintenance period.

# 6 Verification of Continued Attainment

The state is required to provide assurance that it has the legal authority[55] necessary to implement and enforce all necessary measures used to attain and maintain the NAAQS and include an indication of how it will track the progress of the maintenance plan.

ADEQ anticipates no relaxation of any implemented control measures used to attain and maintain the ambient air quality standards. ADEQ commits to submit to EPA Region 9 any changes to rules or emission limits applicable to $SO_2$ sources as a SIP revision. ADEQ also commits to maintain the necessary resources to actively enforce any violations of the provisions contained in this submittal.

Emissions reductions sufficient to meet the NAAQS were accomplished due to the permanent closure of the primary source of $SO_2$ emissions in the area. PDDRWS does not currently hold an active permit, and no subsequent Title V permit application has been submitted to ADEQ for this closed facility. The smelting facility cannot rebuild and reopen without submittal of a Prevention of Significant Deterioration (PSD) and Title V (Part 70) permit application according to A.R.S. § 49-426 and A.A.C. R18-2-406*, Permit Requirements for Sources Located in Attainment and Unclassifiable Areas.*

Any new major sources or major modifications to existing point sources of $SO_2$ in the Douglas MA are subject to the new source permitting procedures contained the SIP-approved[56] rule, R18-2-406. These regulations were established to preserve the air quality in areas where ambient concentrations are below the NAAQS and require stationary sources to undergo preconstruction review, install Best Available Control Technology (BACT), and conduct modeling demonstrating protection of the $SO_2$ NAAQS and increments before the facility is constructed, modified, or reconstructed.

Additionally, the 2000 Seitz memo requires states to commit to re-running the modeling conducted for this maintenance plan renewal before any new source permits are issued to see if the sources would contribute to a NAAQS violation.[57] ADEQ therefore commits to re-run the modeling explained in chapter 5 and the Modeling TSD of this submittal when any new sources located in the Douglas $SO_2$ maintenance area and 50-km buffer zone apply for a permit. If the modeling shows that the source would interfere with the maintenance of the NAAQS, the permit will not be issued.

Because the maintenance demonstration is based on modeling, ADEQ commits to track the progress of the Douglas $SO_2$ maintenance area by re-evaluating the modeling assumptions and input data every three years to see if any major changes have occurred that would impact $SO_2$

[55] ADEQ has permitting and planning jurisdiction for the Douglas $SO_2$ MA within Cochise County. See A.R.S. § 49-402. ADEQ has general authority to implement and enforce all measures to maintain the 1971 SO2 NAAQS per A.R.S §§ 49-104, 49-404, 49-422, and 49-424.

[56] See 80 FR 67319, November 2, 2015.

[57] See *Redesignation of Sulfur Dioxide Nonattainment Areas in the Absence of Monitored Data*, memorandum issued by John S. Seitz, Environmental Protection Agency, dated October 18, 2000, page 3.

emissions.[58] Furthermore, ADEQ is able to periodically retrieve accurate emissions data through the National Emissions Inventory in order to assess the status of the Douglas MA.

[58] See *Procedures for Processing Requests to Redesignate Areas to Attainment*, memorandum issued by John Calcagni, Environmental Protection Agency, issued September 4, 1992, page 11.

# 7 Maintenance Contingency Plan

According to the 1992 Calcagni Memo, an $SO_2$ maintenance plan's contingency plan should include schedules for adoption of control measures and action levels to trigger the implementation of the contingency plan. However, in the final action[59] on ADEQ's first maintenance plan for the Douglas $SO_2$ nonattainment area, EPA found that this level of specificity is not appropriate, considering there are no remaining $SO_2$ sources with emissions the magnitude of the PDDWRS and ambient air monitors ceased operating shortly after the PDDWRS' shutdown.

## 7.1 New Source Permitting Requirements

While a specific contingency plan is not needed for the Douglas MA, ADEQ commits to implement and enforce measures needed to maintain the NAAQS. The only threat to the NAAQS in the Douglas MA would be from new sources. ADEQ has permitting jurisdiction over sources in the Douglas MA, located in Cochise County.

As mentioned earlier in Chapter 6, new major sources of $SO_2$ would be subject to PSD requirements in A.A.C. R18-2-406. Under the PSD program, new major sources are required to undergo preconstruction review, install BACT, and conduct modeling demonstrating protection of the $SO_2$ NAAQS and increments before the facility is constructed, modified, or reconstructed. These requirements also apply to existing sources making major modifications that would increase $SO_2$ emissions.

If a new $SO_2$ source is deemed minor instead of major, it is required to obtain a permit under A.A.C. R18-2-334, *Minor New Source Review*.[60]

Through the permitting process, ADEQ is able to identify the potential for $SO_2$ violations before they occur and is therefore able to ascertain what measures would be needed to avoid such violations.

[59] 71 FR 9941 (Feb. 28, 2006).
[60] R18-2-334 and R18-2-406 were approved into Arizona's SIP on November 2, 2015 (see 80 FR 67319).

# 8 Conclusion

The Douglas $SO_2$ MA continues to meet the 1971 24-hour $SO_2$ NAAQS. This submittal demonstrates that all the essential regulatory elements have been met and the Douglas area will continue to attain the 1971 primary $SO_2$ NAAQS beyond the second maintenance period and through year 2030. This is due to the permanent closing of the PDDWRS, the primary copper smelter that was operated by Phelps-Dodge.

Maintenance of the NAAQS in the Douglas area has been demonstrated by the emissions inventories in chapter 3 and Appendix A, the control measures discussed in chapter 4, and the modeling in chapter 5 and Appendix B. In sum, these analyses show that:

1. No $SO_2$ NAAQS violations are expected to occur during the next 10 years anywhere within the maintenance area; and,
2. The major point source, which has since shutdown, was the dominant source contributing to high $SO_2$ concentrations.

As a contingency measure to protect the NAAQS, ADEQ's new source permitting programs will require pre-permitting modeling and adequate controls for any future sources that may operate nearby.

ADEQ requests that EPA approve this demonstration of maintenance through the second maintenance period.

ADEQ
Arizona Department of Environmental Quality

# Appendix A
# 2011-2030 Douglas, AZ Sulfur Dioxide Emissions Inventories

*Air Quality Division*
*November 3, 2016 Proposed*

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# Glossary of Terms

| | |
|---|---|
| **ADEQ** | Arizona Department of Environmental Quality |
| **ADOA** | Arizona Department of Administration |
| **EI** | Emissions Inventory |
| **EPA** | U.S. Environmental Protection Agency |
| **INEM** | *Inventario Nacional de Emisiones de México*; Mexican National Emissions Inventory |
| **ISCC** | Integrated Solar and Combined Cycle natural gas power plant |
| **km** | Kilometers |
| **MA** | Maintenance Area; herein, the Douglas Sulfur Dioxide Maintenance Area |
| **MOVES** | Motor Vehicle Emissions Simulator |
| **MW** | Megawatts |
| **NAAQS** | National Ambient Air Quality Standard(s) |
| **NEI** | National Emissions Inventory |
| **PTE** | Potential to Emit |
| **SEMARNAT** | *SEcretaría de Medio Ambiente y Recursos NATurales*; Mexican counterpart to U.S. EPA |
| **SIP** | State Implementation Plan |
| **$SO_2$** | Sulfur Dioxide |
| **SRO** | Southern Regional Office of ADEQ |
| **tpy** | U.S. short tons per year |
| **TSD** | Technical Support Document |
| **USDA** | U.S. Department of Agriculture |

# A1 Introduction

This Technical Support Document (TSD) is an appendix to a 2016 revision[1] to the Arizona air quality State Implementation Plan (SIP), revising the portion of the SIP which addresses the 1971 Sulfur Dioxide ($SO_2$) primary National Ambient Air Quality Standards (NAAQS). This TSD provides an overview of the Douglas $SO_2$ Maintenance Area (MA) and discusses the methodologies and calculations used to compile annual $SO_2$ Emissions Inventories (EIs) for the MA. Each EI estimates the $SO_2$ emissions which may impact ambient air quality in the MA.

## A1.1 Purpose

Part (b) of §175A of the Clean Air Act requires states to demonstrate continued attainment of the NAAQS for ten years beyond the initial maintenance period for a MA (throughout a *second maintenance period*). Since no ambient air quality monitors are currently measuring $SO_2$ in the MA, the Arizona Department of Environmental Quality (ADEQ) performed air quality modeling for this demonstration.[2] The EIs documented herein are the primary source of input data for that modeling. The modeling itself is documented in another TSD[3] in this SIP revision package.

## A1.2 Regulatory Background

On December 14, 2001, ADEQ submitted the *Douglas Sulfur Dioxide Nonattainment Area State Implementation and Maintenance Plan* and requested that the U.S. Environmental Protection Agency (EPA) redesignate the area as attaining the 1971 NAAQS. On April 2, 2004 and September 16, 2005, ADEQ submitted to the EPA packages of supplemental information to demonstrate that the area continued to attain the 1971 $SO_2$ standard. The supplemental information included an updated EI for the 2005 base year, a revised modeling demonstration that incorporated an additional stationary source, and a revised map to correct the boundary of the Douglas $SO_2$ geographical area.[4]

In its direct final rule, effective May 1, 2006, EPA approved the 2001 Douglas $SO_2$ plan and redesignated the area as attainment for the 1971 primary $SO_2$ NAAQS.[5] ADEQ undertook this technical analysis—which projects that the MA will continue to meet the 1971 NAAQS for at least ten years beyond the expiration of the first maintenance period—in order to develop a 2016 SIP revision which provides a second maintenance plan for the MA.

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[1] *Maintenance Plan Renewal, 1971 Sulfur Dioxide National Ambient Air Quality Standards, Douglas Maintenance Area*. Arizona Department of Environment Quality. Proposed November 7, 2016.
[2] Per the October 18, 2000 guidance memo from John S. Seitz, "Redesignation of Sulfur Dioxide Nonattainment Areas in the Absence of Monitored Data," commonly referred to as the "Seitz Memo."
[3] "Appendix B: 2015-2030 Douglas, AZ Sulfur Dioxide Emissions Modeling" to the *supra* SIP revision.
[4] Each of these documents is available in docket EPA-R09-OAR-2005-AZ-0008-0002.
[5] 71 FR 9941, Feb. 28, 2006 (effective May 1, 2006).

## A1.3 Sources of $SO_2$

Anthropogenic $SO_2$ emissions are dominated by point sources such as coal-powered thermoelectric generators. Power plants account for 73% of total emissions in the U.S., and fossil fuel combustion at other industrial facilities accounts for another 20%.[6]

In Arizona, major point sources of $SO_2$ emissions include metallic ore smelters, such as the Phelps Dodge Douglas Reduction Works Smelter. In 1985, this smelter emitted over 99.9% of the $SO_2$ in what is now the MA (but which was a nonattainment area at the time) as shown in Table A1-1.

**Table A1-1. $SO_2$ Emissions in the Nonattainment Area in 1985[7]**

| Source Category | | Nonattainment Area Emissions in tons per year (tpy) |
|---|---|---|
| Area | Fuel Combustion - Industrial | 23.02 |
| | Fuel Combustion - Other | 1.63 |
| | Waste Disposal and Recycling | 0.68 |
| On-road Mobile | | 51.76 |
| Non-road Mobile | | 14.30 |
| Miscellaneous | | 1.63 |
| Point | Copper Smelter | 330,000.00 |
| | Power Plant | 0.14 |
| | Other Facilities | 0.00 |
| **Total** | | **330,093.16** |

Other than metallurgy and fossil fuel combustion, the major contributor in the table above is exhaust from diesel-fueled internal combustion. Most diesel fuel today is required to contain much less sulfur than it did in 1985, but diesel emissions are still appreciable.

Although the majority of $SO_2$ emissions in Cochise County are anthropogenic, biogenic sources of $SO_2$ are also highly significant. Wildfires accounted for nearly 40% of $SO_2$ emissions in the county in 2011.[8]

[6] National figures retrieved from EPA's $SO_2$ homepage (www.epa.gov/airquality/sulfurdioxide) on 12/24/2015.
[7] For additional information, see Attachment 6 to the 2005 Supplement in the *supra* EPA docket.
[8] Version 2 of the 2011 National Emissions Inventory estimates that 6564 tons of $SO_2$ were emitted in Cochise County that year, including 2554 tons emitted by wildfires.

## A1.4 Scope of the Emissions Inventories

In order to provide a comprehensive account of $SO_2$ emissions in the MA, ADEQ estimated total emissions from the following source categories:

- point (stationary) sources inside the MA and within 50 kilometers (km) of the MA,
- nonpoint (area) sources,
- on-road mobile sources,
- non-road mobile sources, and
- events (wildfires and prescribed burns).

ADEQ used EPA's 2011 National Emissions Inventory (NEI) Version 2 to identify most sources of $SO_2$ emissions in and around the MA. To identify point sources in Mexico (but within 50 km of the MA) ADEQ considered the 2008 *Inventario Nacional de Emisiones de México* (INEM) and consulted its authors, the *Secretaría de Medio Ambiente y Recursos Naturales* (SEMARNAT), the Mexican counterpart to the U.S. EPA.

Because the 2011 NEI provided the most recent comprehensive inventory of $SO_2$ emissions in Cochise County as of the development of these inventories[9], ADEQ selected 2011 as the base inventory year. ADEQ rolled this base inventory forward to generate an inventory for 2015, the final inventory year of the first maintenance plan. ADEQ built additional inventories in five year increments through the end of the second maintenance period: for 2020, 2025, and 2030.

The spatial extent of the MA is described in Sections A2.1 and A2.2 and in detail in Exhibit AI.

[9] Revisions to the EIs in this document were completed in June 2016. The 2014 NEI was released in September 2016.

# A2 The Douglas $SO_2$ Maintenance Area

## A2.1 Geography and Climate

The MA is located at the southern edge of Cochise County, Arizona, encompassing most of the City of Douglas, the census-designated place of Pirtleville, and some additional unincorporated land. Cochise County, in turn, is in southeast Arizona, along the border with the Mexican state of Sonora. In particular, Douglas is adjacent to the Sonoran city of Agua Prieta. The nearest major cities are Tucson, AZ, and Nogales, Sonora, both of which are considerably farther than 50 km from the MA (about 160 and 130 km, respectively).

The Douglas area has a warm/temperate desert climate, ranging from a mean temperature of 48ºF in January to 81ºF in July. Mean precipitation ranges from 3.27 inches in July to just 0.28 inches of rainfall in May.[10]

## A2.2 Land Areas

The boundaries of the MA encompass the townships and ranges classified as "Better than National Standards" in Table A2-1.[11] A detailed characterization of the boundaries is provided in Exhibit AI. These three cells of the Arizona cadastral survey grid cover just over 1% of the total land area of Cochise County (see Table A3-1 in Section A3.1).

**Table A2-1: Boundary Designations – Douglas $SO_2$ MA**

| Designated Area | Cannot be Classified | Better than National Standards |
|---|---|---|
| T23S, R27E | | X |
| T24S, R27E | | X |
| T24S, R28E | | X |
| T23S, R26E | X | |
| T23S, R28E | X | |
| T24S, R26E | X | |

Table reproduced from 71 FR 9941

[10] NOAA National Climatic Data Center – *1981-2010 Summary of Monthly Normals.* Retrieved from: http://www.ncdc.noaa.gov/cdo-web/search on May 24, 2016.

[11] These townships and ranges formerly made up the Douglas $SO_2$ Nonattainment Area, but were redesignated as attaining the 1971 NAAQS in the *supra* Federal Register notice dated Feb. 28, 2006 (effective May 1, 2006).

## A2.3 Population Estimates and Projections

The Arizona Department of Administration (ADOA) prepares population estimates for Arizona counties in both recent and historical years, as well as several series of projections of county populations for future years. Using the projection series based on medium growth rate assumptions, ADEQ determined average population growth rates in Cochise County from the base inventory year, 2011. These growth rates are presented in Table A2-2.

**Table A2-2. Population Projections for Cochise County**

| Year | Cochise County population | Growth since 2011 |
|---|---|---|
| 2011 | 130,537 | 0.00% |
| 2015 | 129,112 | -1.09% |
| 2020 | 132,547 | 1.54% |
| 2025 | 137,033 | 4.98% |
| 2030 | 141,122 | 8.11% |

ADOA also periodically provides population estimates and projections for sub-county areas. However, the sub-county projections based on the same assumptions as those used for the county-level projections were not available at the time that these inventories were developed.[12] Therefore, ADEQ made the simplifying assumption that the ratio between the MA population and the county population remained constant from 2010 through 2030. Based on a GIS analysis of 2010 census data[13], ADEQ assumed that the MA was home to a fixed 16.45% of the total county population (see Table A3-1, below). This assumption implies that the relative growth rate of the MA population matches the rate for the county. Figure A2-1 presents projected population trends for the county.

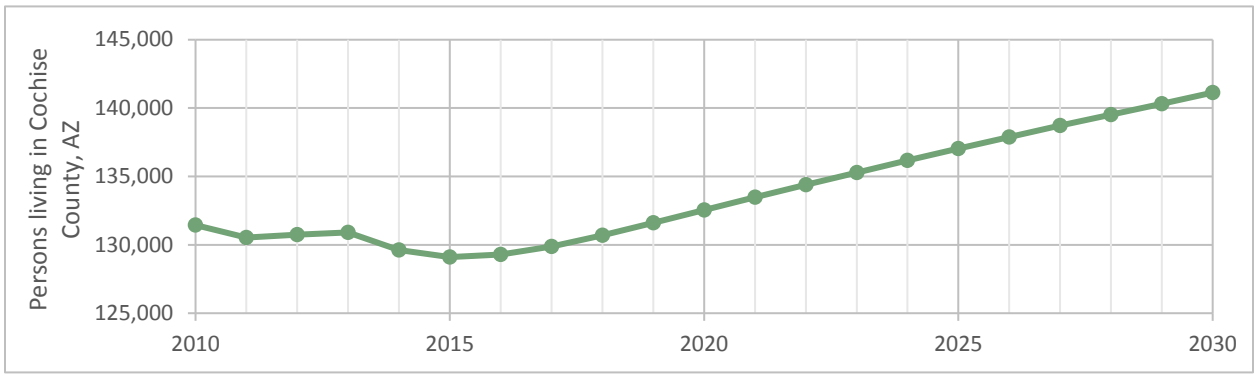


**Figure A2-1. Projected Population Trends for Cochise County**

[12] Revisions and updates to the inventories described in this document were completed in June 2016. ADOA's *Sub-County Population Projections* were updated to match the county projection assumptions in September 2016.
[13] See Exhibit AI, especially Section AI2.

# A3 2011 Base Year Emissions Inventories

Version 2 of the 2011 NEI estimates $SO_2$ emissions from a variety of source sectors in Cochise County. For most area and mobile source sectors, ADEQ scaled down the county-level emissions estimates to the MA level. For point source emissions and localized emission events, ADEQ considered the precise location of each facility. A facility's emissions were allocated to the MA if and only if the facility was located within it. The point source inventory for the 50-km buffer around the MA also employs this location-based method.

## A3.1 Top-Down Emissions Allocation Methodology

The scaling factors which allocate emissions from Cochise County at large down to the Maintenance Area vary depending on the source(s) in question. ADEQ examined each nonpoint and mobile source of $SO_2$ from the 2011 NEI and determined the most appropriate surrogate for allocation. ADEQ then estimated emissions for the MA using the following equations.

**Equation A3-1: Top-Down 2011 Emissions Allocation**

$$E_{MA} = E_{CC} \cdot AF$$

**Equation A3-2: Top-Down Allocation Factors**

$$AF = S_{MA}/S_{CC}$$

where for each source sector

- $E_{MA}$ is the estimate of $SO_2$ emissions from that source sector in the MA in 2011 (in tpy),
- $E_{CC}$ is the 2011 NEI estimate of the sector's $SO_2$ emissions in Cochise County (in tpy),
- $AF$ is the allocation factor (unitless) best suited to the given source sector,
- $S_{MA}$ is the value of a surrogate for the source's activity level, evaluated for the MA, and
- $S_{CC}$ is the value of the same surrogate, evaluated for Cochise County instead.

The units and methodology used to evaluate a surrogate for the MA must match those used for the Cochise County evaluation. Exhibit AI describes how each surrogate is evaluated. Table A3-1 presents the resulting surrogate values and allocation factors, per Equation A3-2.

**Table A3-1: Top-Down 2011 Allocation Factors**

| Surrogate | Units | Surrogate Value in Cochise County | Surrogate Value in MA | Allocation Factor |
|---|---|---|---|---|
| Population | Persons | 131,346 | 21,611 | 16.45% |
| Land area | $Km^2$ | 15,969.61 | 190.45 | 1.19% |
| Railway length | Km | 474.16 | 22.76 | 4.80% |
| Highway length | Km | 1,081.96 | 42.76 | 3.95% |

# A3.2 2011 Base Year Emissions Calculations

## A3.2.1 On-road Mobile Sources

The 2011 NEI estimates 17.8603 tpy of $SO_2$ emissions from highway vehicles in Cochise County. No travel demand modeling results for the MA were available at the time that this EI was prepared, so ADEQ selected the more conservative of two relevant allocation factors: 16.45% (population) as opposed to 3.95% (highway length). Per Equation A3-1, ADEQ estimated that $17.8603 \cdot 0.1645 \cong \mathbf{2.9386}$ **tpy** of $SO_2$ were emitted by highway vehicles in the MA in 2011.

## A3.2.2 Non-road Mobile Sources

The 2011 NEI estimates 1.4951 tpy of $SO_2$ emissions from non-road mobile sources[14] in Cochise County. ADEQ allocated a portion of these emissions to the MA using an allocation factor of 16.45% (population). Per Equation A3-1, ADEQ estimated that $1.4951 \cdot 0.1645 \cong \mathbf{0.2460}$ **tpy** of $SO_2$ were emitted by non-road vehicles in the MA in 2011.

## A3.2.3 Area (Nonpoint) Sources

$SO_2$ is emitted by several categories of widespread combustion processes. These include internal combustion of fuel by locomotives, as well as external combustion, whether of fuel or waste. The majority of external combustion in Cochise County is of biomass, both on the fuel side (e.g. firewood) and the waste side (e.g. agricultural residue).

### A3.2.3.1 Railroads

The 2011 NEI estimates 22.6721 tpy of $SO_2$ emissions from railroads in Cochise County. ADEQ allocated a portion of these emissions to the MA using an allocation factor of 4.80% (railway length). Per Equation A3-1, ADEQ estimated that $22.6721 \cdot 0.0480 \cong \mathbf{1.0885}$ **tpy** of $SO_2$ were emitted by locomotives in the MA in 2011.

### A3.2.3.2 Fuel Combustion

The 2011 NEI estimates 3.6634 tpy of $SO_2$ emissions from nonpoint fuel combustion in Cochise County, comprising 2.7922 tpy from residential wood burning, 0.6028 tpy from other residential fuel combustion, and just 0.2683 tpy from institutional fuel combustion. ADEQ allocated a portion of these emissions to the MA using an allocation factor of 16.45% (population). Per Equation A3-1, ADEQ estimated that $3.6634 \cdot 0.1645 \cong \mathbf{0.6027}$ **tpy** of $SO_2$ were emitted by nonpoint fuel combustion sources in the MA in 2011.

[14] The non-road mobile category excludes off-highway vehicles which are accounted for in other source sectors, namely aircraft and airport support vehicles (both rolled into airport point sources) and railroads (see A3.2.3.1).

#### A3.2.3.3 Agricultural Burning

ADEQ considered a variety of surrogates to represent agricultural burning activity. Based on the United States Department of Agriculture (USDA)'s 2011 Cropland Data Layer[15], ADEQ determined that there were 308,646.8 total acres of cropland in Cochise County, 3,062.7 acres of which were in the MA. Using Equation A3-2, this surrogate would yield an allocation factor of 0.99%. ADEQ tried excluding fallow and idle cropland as identified by the Cropland Data Layer (since it is unlikely that these fields would hold significant biomass for burning); the acreages became 63,608.4 and 93.3, respectively, yielding an allocation factor of 0.15%. Since only certain crops produce residue that is burned, ADEQ also examined the proportion of acreage in the MA by individual crop grown in Cochise County. These proportions ranged from 0% for many grain crops up to a maximum of 1.03% for peppers. In all cases, the total land area allocation factor of 1.19% was more conservative. Therefore, ADEQ elected to use it.

The 2011 NEI estimates 25.9493 tpy of $SO_2$ emissions from agricultural burning in Cochise County. Per Equation A3-1, ADEQ estimated that $25.9493 \cdot 0.0119 \cong \mathbf{0.3095}$ **tpy** of $SO_2$ were emitted by agricultural burning in the MA in 2011.

#### A3.2.3.4 Household Waste Burning

The 2011 NEI estimates 2.3676 tpy of $SO_2$ emissions from the open burning of household waste (other than leaves and grass) in Cochise County. ADEQ allocated a portion of these emissions to the MA using an allocation factor of 16.45% (population). Per Equation A3-1, ADEQ estimated $2.3676 \cdot 0.1645 \cong \mathbf{0.3895}$ **tpy** of $SO_2$ emitted by open burning in the MA in 2011.

#### A3.2.3.5 Cremation

The 2011 NEI estimates 0.0549 tpy of $SO_2$ emissions from the cremation of human remains in Cochise County. ADEQ allocated a portion of these emissions to the MA using an allocation factor of 16.45% (population). Per Equation A3-1, ADEQ estimated that $0.0549 \cdot 0.1645 \cong$ $\mathbf{0.0090}$ **tpy** of $SO_2$ were emitted by cremation in the MA in 2011.

### A3.2.4 Point Source Emissions in the MA

ADEQ identified four point sources of $SO_2$ in the MA:

**Table A3-2: $SO_2$ Point Source Emissions in the MA in 2011**

| Facility Type | Facility Name | 2011 Emissions (tpy) |
|---|---|---|
| Airport | Bisbee Douglas Intl | 0.118178 |
| Airport | DOUGLAS MUNI | 0.076332 |
| Power Plant | APS FAIRVIEW | 0.102256 |
| Prison/Jail | ASP - DOUGLAS COMPLEX | 0.029100 |

[15] USDA, National Agricultural Statistics Service, *2011 Cropland Data Layer*. Washington, D.C., 2012. Retrieved from https://nassgeodata.gmu.edu/CropScape/ on May 6, 2016.

Bisbee-Douglas International Airport is on the northern border of the MA (see Figure A3-1). Its north-south runway and terminal complex are bisected by the township line. For simplicity, ADEQ allocated all of its emissions to the MA inventory and none to the buffer inventory.

The Arizona State Prison Complex at Douglas operates under a Class II permit, and as a result its emissions are not routinely reported in the point source section of the NEI. In particular, its emissions were not used to develop Version 2 of the 2011 NEI. Therefore, the area source emissions discussed in Section A3.2.3.2, which cover institutional boilers and generators, are not reconciled to exclude the 0.0291 tpy of $SO_2$ represented in Table A3-2. Moreover, the portion of the emissions from Section A3.2.3.2 representing institutional fuel combustion ($0.2683 \cdot 0.1645 \cong 0.0442$ tpy) is greater than the $0.0291$ tpy listed in the table. Therefore, to avoid double-counting, ADEQ chose to count the unreconciled area source emissions, and to disregard the emissions total reported by the facility.

ADEQ therefore estimated $0.1182 + 0.0763 + 0.1023 = \mathbf{0.2968}$ **tpy** of $SO_2$ emissions from point sources in the MA.

## A3.2.5 Point Source Emissions in the 50-km Buffer

Table A3-3 presents the 2011 emissions reported by facilities located within Arizona, outside of the MA itself, but within 50 km of it. The small portion of New Mexico within 50 km of the MA did not report any stationary source emissions for 2011. The portion of Sonora, Mexico within 50 km of the MA did contain some point sources, presented in Table A3-4.

**Table A3-3: $SO_2$ Point Source Emissions in the 50-km Buffer in 2011 (US)**

| Facility Type | Facility Name | 2011 Emissions (tpy) |
|---|---|---|
| Airport | ASH CREEK | 0.000005 |
| Airport | Bisbee Muni | 0.034002 |
| Airport | CIRCLE H RANCH | 0.000005 |
| Airport | COCHISE COLLEGE | 0.326145 |
| Airport | COPPER QUEEN HOSPITAL | 0.001308 |
| Airport | EVELYN FIELD | 0.000450 |
| Airport | FORT OMOTSE | 0.001308 |
| Airport | RANCHO SAN MARCOS | 0.000005 |
| Airport | THOMPSON INTL | 0.000450 |
| Airport | TOMBSTONE MUNI | 0.002359 |
| Airport | TRIBAL AIR | 0.000005 |
| Mine/Lime Plant | LHOIST NORTH AMERICA | 0.000000 |
| Mine | FREEPORT COPPER QUEEN | 0.057000 |
| Food Processing Plant | FIESTA CANNING CO | 0.009700 |
| Equipment Yard | CHIRICAHUA BUILDING SUPPLIES | None reported |

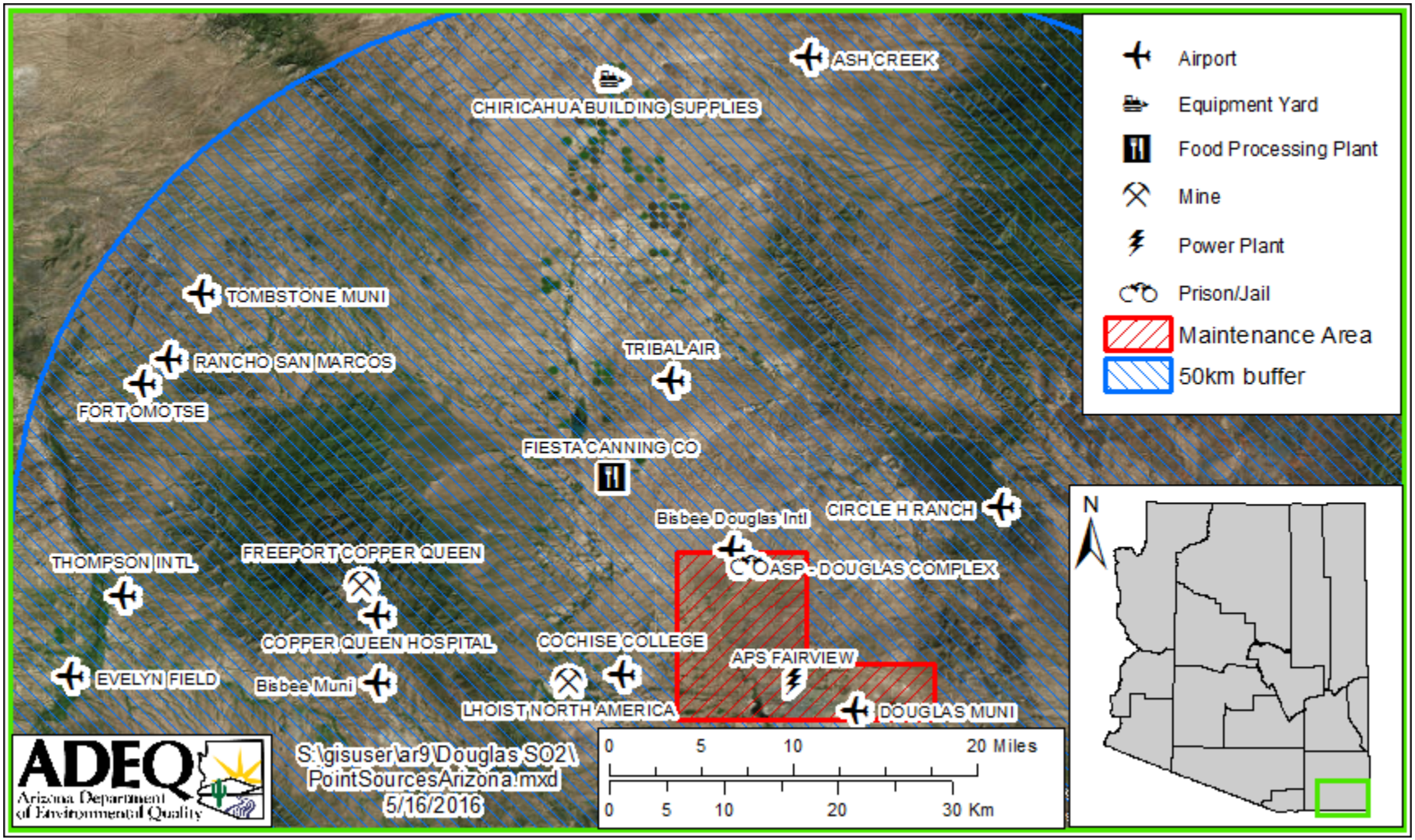


**Figure A3-1. Arizonan Point Sources of $SO_2$ in and around the MA**

One facility, Chiricahua Building Supplies, reported to ADEQ that it did not operate in 2009. Its operating permit was closed in 2013, and it did not report any emissions in the interim (including the 2011 reporting year). Therefore, ADEQ assumed that the actual emissions from this facility in 2011 were 0 tpy of $SO_2$. The emissions from the remaining facilities in the U.S. portion of the buffer total about **0.4327 tpy** of $SO_2$, mainly from airports (about 0.366 tpy).

Another buffer facility which did not actively operate in 2011 (and has been out of operation since the end of 2001) is the Douglas Chemical Lime Plant operated by Lhoist North America. However, the lime plant's permit is still open as of 2016, and so it could theoretically begin operating again at any time. This possibility is addressed in Section A4.2.2.

ADEQ identified stationary sources of $SO_2$ emissions in the Mexican state of Sonora using SEMARNAT's 2008 INEM, which was adapted for inclusion in Version 6 of the 2011 NEI Modeling Platform by ERG[16]. These sources are presented in the table below and in Figure A3-2.

**Table A3-4: $SO_2$ Point Source Emissions in the 50-km Buffer in 2008 (Mexico)**

| Facility Type | Facility Name | 2008 Emissions (tpy) |
|---|---|---|
| Power Plant | Agua Prieta II | 5.170000 |
| Textile Mill | RELIANCE MEXICANA | 0.000001 |
| Mine/Lime Plant | Mexicana de Cobre | 0.240000 |
| Appliance Manufacturer | ADOBE AIR | 0.000002 |
| Electric Motor Plant | DIX-MEX | None reported |
| Auto Parts Manufacturer | MWC DE MEXICO | 0.000001 |
| Auto Parts Manufacturer | VEM MEX | 0.000118 |

The predominant source in Table A3-4 is an integrated solar/combined-cycle natural gas (ISCC) power plant operated by Fuerza y Energia de Naco Nogales (a subsidiary of Unión Fenosa). The 0.24 tpy estimate for the hydrated lime plant operated by Mexicana de Cobre actually represents just one stack at the plant; the INEM identifies another stack plus a dozen sources of process fugitives at the facility, but does not estimate their 2008 emissions.

ADEQ decided to develop new 2011 emissions estimates for both sources. ADEQ's Southern Regional Office (SRO) obtained the following data from SEMARNAT's regional office in Sonora:

- The lime plant reported operating at 89.63% of its installed capacity in 2011, while the ISCC power plant reported that it had consumed 461,901,372 $m^3$ of natural gas that year.
- No new, significant sources of $SO_2$ were permitted to operate in the buffer area since 2008.

[16] Eastern Research Group, Inc. "Database of point source annual emissions, *2008 INEM ANNUAL MEXICO NEI*." Retrieved on May 13, 2016 from ftp://ftp.epa.gov/EmisInventory/2011v6/v2platform/2011emissions/2011eh_v6_11g_inputs_oth.zip.

- The Mexicana de Cobre plant's permit was updated to reflect a major modification, but that took place after 2011 (the impact of this modification is discussed in Section A4.2.2).[17]

[17] The 2011 activity data, as well as the information on new permits and permit revisions, were provided via email correspondence between ADEQ SRO's Gerardo Monroy and SEMARNAT Sonora's Leonardo Valenzuela from February 11 through February 24, 2016 (available via public records request to ADEQ).

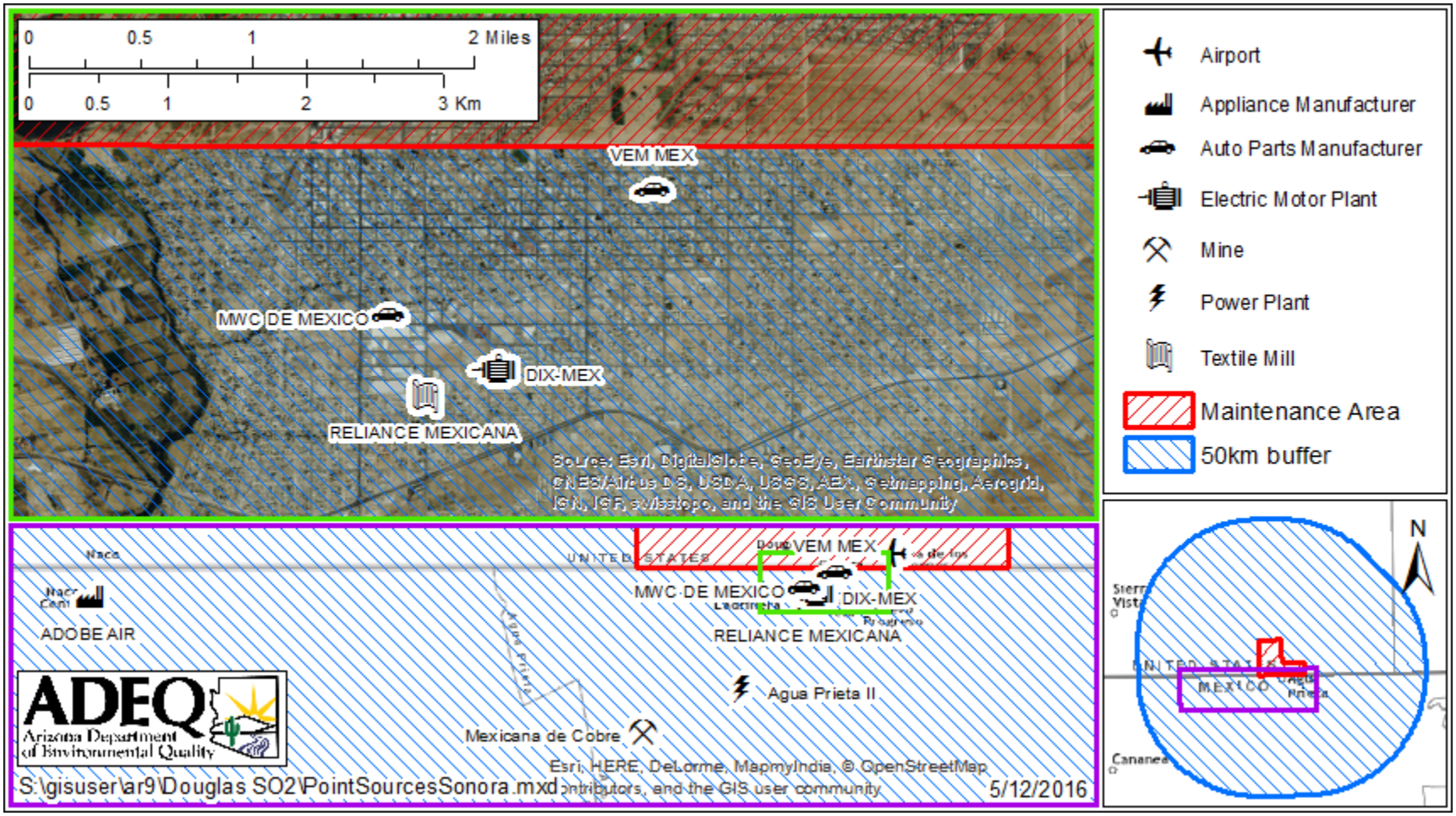


**Figure A3-2. Sonoran Point Sources of $SO_2$ around the MA**

An inventory supplement for the first maintenance plan explored the Mexicana de Cobre facility's maximum theoretical potential to emit $SO_2$ (PTE).[18] At maximum capacity, the facility could have emitted 1,064.52 tons of $SO_2$ per year. Therefore, ADEQ estimated facility-wide 2011 emissions of

$$1{,}064.52 \text{ tpy} \cdot 89.63\% = 1{,}064.52 \text{ tpy} \cdot 0.8963 \cong 954.1293 \text{ tpy}.$$

For the power plant, ADEQ applied an emissions factor of 0.6 lbs of $SO_2$ emitted per million $ft^3$ of natural gas consumed[19] and estimated actual 2011 $SO_2$ emissions of

$$\frac{461{,}901{,}372\,\frac{\text{m}^3}{\text{year}} \cdot \left(3.28084\,\frac{\text{ft}}{\text{m}}\right)^3}{10^6\,\frac{\text{ft}^3}{10^6\text{ft}^3}} \cdot \frac{0.6\,\frac{\text{lbs}}{10^6\text{ft}^3}}{2000\,\frac{\text{lbs}}{\text{ton}}} \cong 4.8936 \text{ tpy}.$$

ADEQ assumed that the reported 2008 emissions for all other sources, totaling just over 0.0001 tpy, were representative of actual 2011 emissions. Therefore, ADEQ estimated an emissions total of $954.1293 + 4.8936 + 0.0001 = \mathbf{959.0230}$ **tpy** of $SO_2$ from point sources in the Mexican part of the buffer.

## A3.2.6 Event (Wildfire) Emissions

Total Cochise County emissions from wildfires and prescribed wildland burns were highly significant in 2011—over 2,500 tons, as estimated in the 2011 NEI. However, as shown in Figure A3-3, almost all of these emissions were from fires around the Chiricahua and Miller Peak Wilderness Areas (both of which host considerable fuel in the form of Madrean pine/oak sky islands surrounded by brush)[20]. The MA is separated from these areas by playa (dry lakebed) grasslands and sparsely vegetated desert, both of which saw very few fires in 2011.

ADEQ used Version 6 of the 2011 NEI Modeling Platform to determine which fires burned inside the MA and how much $SO_2$ they emitted. Emissions estimates for the MA and for Cochise County are detailed in Table A3-5. Only **0.0178 tons** of $SO_2$ were emitted in the MA in 2011.

**Table A3-5. $SO_2$ Emissions from Wildland Fires in 2011**

| Fire Category | Cochise County Emissions (tpy) | Maintenance Area Emissions (tpy) |
|---|---|---|
| Wildfires | 2554.3965 | 0.0178 |
| Prescribed Burns | 13.7320 | 0.0000 |

[18] The relevant calculations are summarized in Attachment 1 to the September 6, 2005 *Emissions Inventory and Air Quality Dispersion Modeling Update* to the Douglas $SO_2$ Nonattaimnent Area State Implementation Plan.
[19] Table 1.4-2 of the Fifth Edition of AP-42 Volume I presents 0.6 lbs as the $SO_2$ emitted by the combustion of one million $ft^3$ of natural gas, assuming that the sulfur content of that million $ft^3$ is 2,000 grains.
[20] Observe that most of the fire detects other than those clustered in the mountains were small and were located near major roads. Some of these fires may have actually been fueled by vehicles rather than biomass.

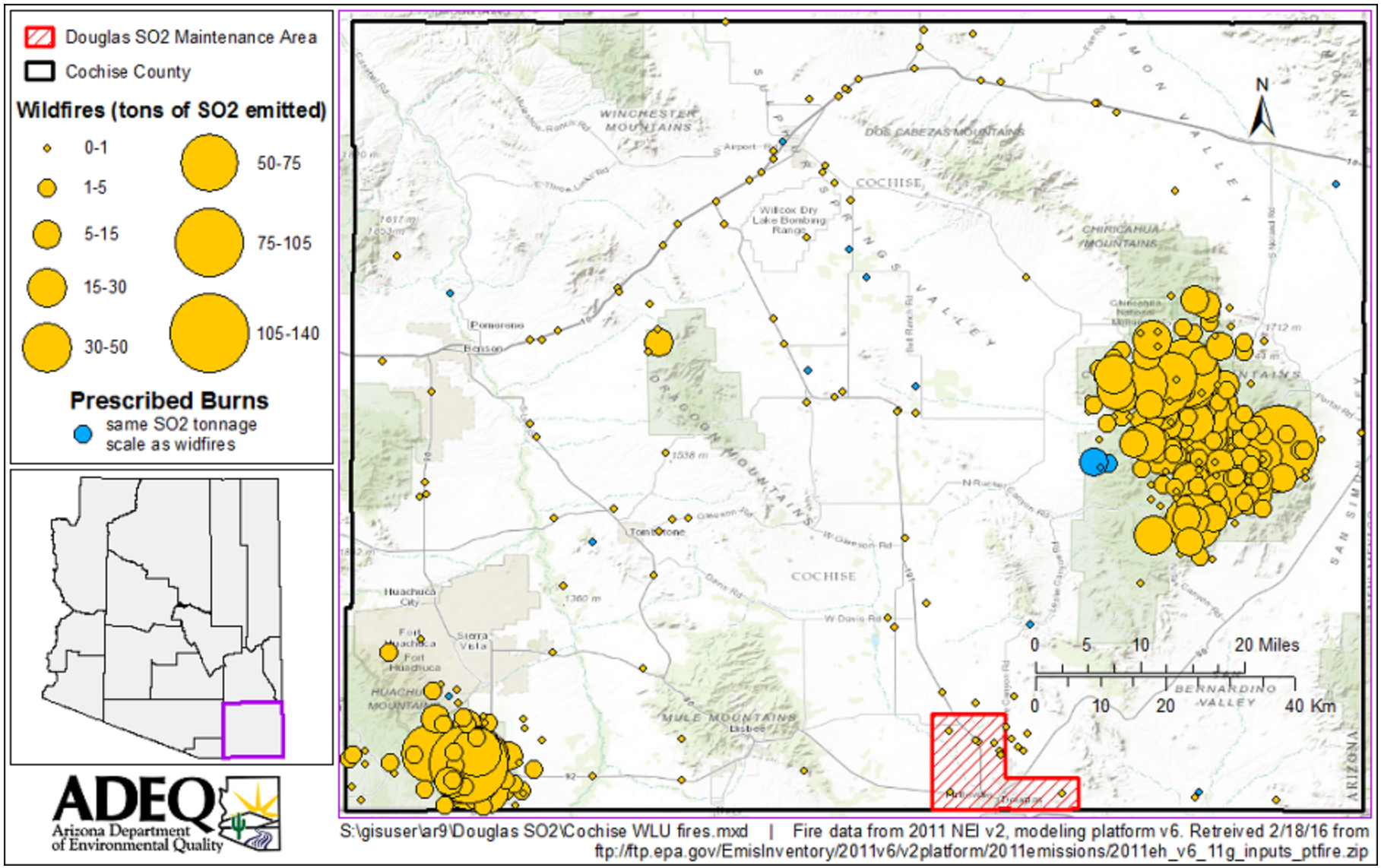


**Figure A3-3. Cochise County Wildland Fire Events in 2011**

## A3.3 Summary of 2011 Emissions Estimates

Table A3-6 summarizes $SO_2$ emissions estimates for Cochise County and for the MA in 2011.

**Table A3-6. $SO_2$ Emissions in Cochise County and the MA in 2011**

| Source Category | | Cochise County Emissions (tpy) | Maintenance Area Emissions (tpy) |
|---|---|---|---|
| On-road Mobile | | 17.8603 | 2.9386 |
| Non-road Mobile | | 1.4951 | 0.2460 |
| Area | Railroads | 22.6721 | 1.0885 |
| | Fuel Combustion | 3.6634 | 0.6027 |
| | Agricultural Burning | 25.9493 | 0.3095 |
| | Open Burning | 2.3676 | 0.3895 |
| | Cremation | 0.0549 | 0.0090 |
| Point | Airports | 1.3011 | 0.1945 |
| | Power Plants | Not computed | 0.1023 |
| | Other Facilities | Not computed | 0.0000 |
| Event | Wildfires | 2554.3965 | 0.0178 |
| | Prescribed Burns | 13.7320 | 0.0000 |
| **Total** | | **Not computed** | **5.8984** |

Table A3-7 summarizes $SO_2$ point source emissions estimates for the 50-km buffer in 2011.

**Table A3-7. $SO_2$ Point Source Emissions in the 50-km Buffer in 2011**

| Source Category | Buffer Emissions (tpy) |
|---|---|
| U.S. Facilities | 0.4327 |
| Mexican Facilities | 959.0230 |
| **Total** | **959.4557** |

The point source emissions estimates in both tables above represent actual 2011 emissions. The corresponding projections for these sources in the next section are orders of magnitude larger. Those projections do not represent actual emissions, nor do they represent probable emissions in those future years; they represent the maximum possible emissions that each source could legally emit, and so are highly conservative upper bounds. This qualitative difference should be kept in mind whenever the numbers above are compared to those found in the next section.

# A4 Future Year Emissions Inventories

In order to demonstrate attainment throughout the second maintenance period, ADEQ projected emissions in the MA and the 50-km buffer for years after 2011. ADEQ projected inventories starting with 2015 (the last inventory year included in the 2005 maintenance plan supplement) and continued in five-year increments through the end of the second maintenance period; the inventory years are 2015, 2020, 2025, and 2030. Although 2015 had already elapsed at the time that the projections were made, we collectively refer to these years as "future years" and these inventories as "future year inventories" for notational convenience.

## A4.1 Emissions Projection Methodologies

For most emissions sources in the MA, ADEQ used Equation A4-2 to develop growth factors, which are presented in Table A4-1. Per Equation A4-1, ADEQ applied these factors to develop Cochise County emissions estimates for each future year. These county-level projections map down to the MA using the same allocation methods as in the base year inventory.

**Equation A4-1: Future Year Emissions Projections**

$$E_x = E_{2011} \cdot GF_x$$

**Equation A4-2: Projection Growth Factors**

$$GF_x = S_x / S_{2011}$$

where for each source sector and each year $x$

- $E_x$ is the estimate of $SO_2$ emissions from that source sector in year $x$ for Cochise County (in tpy),
- $GF_x$ is the year $x$ growth factor (unitless) best suited to the given source sector, and
- $S_x$ is the value of a surrogate for the source sector's county-level emissions in year $x$.

**Table A4-1. Growth Factors**

| Surrogate (units): | | Population (persons) | Land Area (km²) | MOVES-Modeled $SO_2$ emissions (lbs) | | | |
|---|---|---|---|---|---|---|---|
| | | | | On-road | Airport support | Railroads | Other non-road |
| Surrogate Values for Cochise County | 2011 | 130,537 | 15,969.6 | 32,488.6 | 1.0846 | 16.4476 | 4,598.95 |
| | 2015 | 129,112 | 15,969.6 | 32,588.0 | 0.3976 | 6.3590 | 2,365.50 |
| | 2020 | 132,547 | 15,969.6 | 14,947.1 | 0.3982 | 6.1786 | 1,490.04 |
| | 2025 | 137,033 | 15,969.6 | 14,405.5 | 0.4185 | 6.3977 | 1,582.14 |
| | 2030 | 141,122 | 15,969.6 | 14,117.7 | 0.4547 | 6.6400 | 1,676.13 |
| Growth Factors | 2015 | 98.91% | 100% | 100.31% | 36.66% | 38.66% | 51.44% |
| | 2020 | 101.54% | 100% | 46.01% | 36.72% | 37.57% | 32.40% |
| | 2025 | 104.98% | 100% | 44.34% | 38.59% | 38.90% | 34.40% |
| | 2030 | 108.11% | 100% | 43.45% | 41.93% | 40.37% | 36.45% |

Note that, despite the name, a growth factor may actually reduce an emissions estimate (rather than growing it). This occurs whenever the surrogate's value contracts over time. A factor larger than 1 (i.e. larger than 100%) indicates growth, while a factor under 1 indicates contraction.

The land area and population figures used in Table A4-1 come from Table A3-1 and Table A2-2, respectively. The land area growth factors' value of exactly 1 reflects the assumption that the land area of the County will remain constant from 2011 through 2030.

ADEQ ran EPA's Motor Vehicle Emissions Simulator (MOVES) using the default data and settings to obtain $SO_2$ emissions totals for Cochise County. Detailed simulation run specifications are presented in Exhibit AII. The version used here, MOVES2014a, models emissions from both on-road and non-road engines. The simulator captures the impact of federal regulations on fuel and vehicles, such as Transmix provisions[21] and Tier 3 standards[22], which significantly reduce non-road/railroad diesel emissions and highway gasoline emissions, respectively. It also considers factors such as fleet aging and turnover and overall travel demand increases.

ADEQ partitioned the non-road modeling results to match the relevant source sectors (see footnote 14 on page A-7 for details).

## A4.2 Future Year Emissions Calculations

The following discussion employs the methods described above to project the majority of emissions source sectors into future years. The remaining sources are facilities whose potential future year emissions are discussed later in this section.

### A4.2.1 Grown Emissions Projections

Most area source sectors—residential/institutional fuel combustion, open burning of household waste, and cremation—were projected using the population growth factors from Table A4-1. For airport emissions, ADEQ considered both the population growth factors and the MOVES-modeled airport support vehicle growth factors. In each future year, the more conservative growth factor was for population. Therefore ADEQ used those factors.

However, the other MOVES-based growth factors were used. The on-road mobile source category was projected according to the modeling results for on-road vehicles. The railroad emissions were projected according to the modeling results for railroads. The remaining non-road mobile emissions (excluding railroads, airport support vehicles, and aircraft) were projected according to the modeling results for the applicable subset of non-road vehicles.

ADEQ projected agricultural burning and wildland fires using the land area growth factors.

Table A4-2 presents the projected emissions for these source sectors per Equation A4-1.

[21] 77 FR 75868, Dec. 26, 2012.
[22] 80 FR 9078, Feb. 19, 2015.

**Table A4-2. Grown Cochise County $SO_2$ Emissions**

| Source Category | | Cochise County Emissions (tpy) | | | | |
|---|---|---|---|---|---|---|
| | | 2011 | 2015 | 2020 | 2025 | 2030 |
| On-road Mobile | | 17.8603 | 17.9150 | 8.2171 | 7.9193 | 7.7611 |
| Non-road Mobile | | 1.4951 | 0.7690 | 0.4844 | 0.5143 | 0.5449 |
| Area | Railroads | 22.6721 | 8.7656 | 8.5169 | 8.8188 | 9.1529 |
| | Fuel Combustion | 3.6634 | 3.6234 | 3.7198 | 3.8457 | 3.9604 |
| | Agricultural Burning | 25.9493 | 25.9493 | 25.9493 | 25.9493 | 25.9493 |
| | Open Burning | 2.3676 | 2.3417 | 2.4040 | 2.4854 | 2.5595 |
| | Cremation | 0.0549 | 0.0543 | 0.0557 | 0.0576 | 0.0593 |
| Point | Airports | 1.3011 | 1.2869 | 1.3211 | 1.3659 | 1.4066 |
| Event | Wildfires | 2,554.3965 | 2,554.3965 | 2,554.3965 | 2,554.3965 | 2,554.3965 |
| | Prescribed Burns | 13.7320 | 13.7320 | 13.7320 | 13.7320 | 13.7320 |

These emissions are allocated down to the MA just as they were for the base year inventory. The resulting emissions are summarized in Table A4-3. Airports in the 50-km buffer contributed to the buffer's future year point source inventories, as presented in Table A4-4.

**Table A4-3. Grown MA $SO_2$ Emissions**

| Source Category | | Maintenance Area Emissions (tpy) | | | | |
|---|---|---|---|---|---|---|
| | | 2011 | 2015 | 2020 | 2025 | 2030 |
| On-road Mobile | | 2.9386 | 2.9476 | 1.3520 | 1.3030 | 1.2770 |
| Non-road Mobile | | 0.2460 | 0.1265 | 0.0797 | 0.0846 | 0.0897 |
| Area | Railroads | 1.0885 | 0.4208 | 0.4089 | 0.4234 | 0.4394 |
| | Fuel Combustion | 0.6027 | 0.5962 | 0.6120 | 0.6327 | 0.6516 |
| | Agricultural Burning | 0.3095 | 0.3095 | 0.3095 | 0.3095 | 0.3095 |
| | Open Burning | 0.3895 | 0.3853 | 0.3955 | 0.4089 | 0.4211 |
| | Cremation | 0.0090 | 0.0089 | 0.0092 | 0.0095 | 0.0098 |
| Point | Airports | 0.1945 | 0.1924 | 0.1975 | 0.2042 | 0.2103 |
| Event | Wildfires | 0.0178 | 0.0178 | 0.0178 | 0.0178 | 0.0178 |
| | Prescribed Burns | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |

**Table A4-4. Grown 50-km Buffer $SO_2$ Emissions**

| Source Category | | Buffer Emissions (tpy) | | | | |
|---|---|---|---|---|---|---|
| | | 2011 | 2015 | 2020 | 2025 | 2030 |
| Point | Airports | 0.3660 | 0.3620 | 0.3717 | 0.3843 | 0.3957 |

## A4.2.2 Potential Point Source Emissions

### A4.2.2.1 Methodology

Section A3.2.5 discussed the status of Lhoist North America's Douglas Chemical Lime Plant, located in the 50-km buffer. As of 2016, the plant still has a valid operating permit even though it has not operated in over a decade. ADEQ has no reliable means of projecting when—if ever—the facility would resume operation, nor of predicting the activity level at which it would resume operation. In order to address these uncertainties, ADEQ employed a highly conservative approach to projecting emissions for this facility. ADEQ assumed that in each future year, the lime plant would emit the maximum allowable total of $SO_2$ prescribed in its permit, i.e., its PTE.

This assumption does not reflect any substantiated expectation that the plant will actually operate at full capacity, or in fact resume operation at all, during the second maintenance period. The emissions estimates described in this section are not meant to represent the likely state of the ambient air in future years, but rather present a worst-case scenario.

In order to keep methodology consistent, ADEQ applied this worst-case, PTE-based approach to all of the projections in this section. As in the case of the lime plant, this does not indicate that ADEQ anticipates that the emissions estimates in this section will be realized.

Appendix B to this SIP revision will demonstrate that the MA would stay in attainment even in this worst-case scenario, which directly implies that the MA would also stay in attainment under any more plausible circumstances.

### A4.2.2.2 Potential Point Source Emissions in the MA

Recall from Section A3.2.4 that the ASP complex near Douglas is already accounted for in the Fuel Combustion source sector. The airports in the MA are similarly accounted for in the grown emissions above. This leaves just one point source in the MA, namely the APS Fairview Generating Station. The facility-wide PTE for this power plant is **69.54 tpy** of $SO_2$.[23]

### A4.2.2.3 Potential U.S. Point Source Emissions in the 50-km Buffer

Recall from Section A3.2.5 that the air quality permit for Chiricahua Building Supplies expired prior to 2015. Table A4-5 presents annual, facility-wide PTEs for the other non-airport point sources in the U.S. portion of the 50-km buffer. ADEQ made the conservative assumption that each such facility would emit its full PTE in every future year.

[23] Arizona Department of Environmental Quality. *Technical Review and Evaluation of Application for Air Quality Permit #61353*. 2015. Available via public records request to ADEQ.

**Table A4-5: $SO_2$ Point Source PTEs in the 50-km Buffer (US)**

| Facility Type | Facility Name | PTE (tpy) |
|---|---|---|
| Mine/Lime Plant | LHOIST NORTH AMERICA | 4420.6600[24] |
| Mine | FREEPORT COPPER QUEEN | 3.7900[25] |
| Food Processing Plant | FIESTA CANNING CO | 0.1430[26] |

### A4.2.2.4 Potential Mexican Point Source Emissions in the 50-km Buffer

As noted in Section A3.2.5, the first maintenance plan included an update which estimated PTEs for the major Sonoran point sources.[27] ADEQ has revised both of those estimates based on capacity changes at the facilities, described below.

The estimate for the Agua Prieta power plant, 115.51 tons of $SO_2$ per year, was based on the conservative assumption that each capacity increase at the facility would result in a proportional increase to sulfur emissions. However, some of the plant's capacity increases have been cleaner than assumed; the 14 megawatt (MW) solar field, for example, emits no $SO_2$. Moreover, the capacity of 1,462 total MW (on which the previous PTE estimate was based) was never reached, and no current plans exist to expand to that aggressive target. The plant's actual operating capacity is 394.1 MW.[28] ADEQ therefore revised the PTE estimate for Agua Prieta II to

$$115.51 \cdot \frac{394.1 - 14}{1462} \cong \mathbf{30.0310\ tpy}$$

of $SO_2$.

The previous PTE estimate for Mexicana de Cobre included two boilers, each of which was estimated to have an emissions limit of 138.41 tons of $SO_2$ per year, and a kiln, which was estimated to have a limit of 787.7 tons of $SO_2$ per year. SEMARNAT confirmed that a second kiln was authorized in 2014, and that the technical and operational characteristics of the new kiln match those of the old kiln. ADEQ therefore estimated a facility-wide PTE of

$$(2 \cdot 138.41) + (2 \cdot 787.7) = \mathbf{1,852.22\ tpy}$$

of $SO_2$ for each year after 2014—in particular, each future year.

[24] Arizona Department of Environmental Quality. *Technical Review and Evaluation of Application for Air Quality Permit #61785*. 2015. Available via public records request to ADEQ.
[25] Arizona Department of Environmental Quality. *Technical Review and Evaluation of Application for Air Quality Minor Permit Revision #55192 to Operating Permit #37218*. 2012. Available via public records request to ADEQ.
[26] Arizona Department of Environmental Quality. *Technical Review and Evaluation of Application for Air Quality Minor Permit Revision #61467*. 2015. Available via public records request to ADEQ.
[27] Mexicana de Cobre's PTE estimates are discussed in Attachment 1 to the September 6, 2005 *Emissions Inventory and Air Quality Dispersion Modeling Update* to the Douglas $SO_2$ Nonattaimnent Area State Implementation Plan. Agua Prieta II's PTE estimates are discussed in Attachment 4 to the same update.
[28] Comisión Federal de Electricidad (CFE). "*La CFE Prepara Entrada en Operación Comercial de Central de Ciclo Combinado con Campo Solar en Agua Prieta, Sonora*." Feb. 28, 2016 press release retrieved from http://saladeprensa.cfe.gob.mx/boletines/show/8328/ on May 23, 2016.

## A4.3 Summary of Future Year Emissions Estimates

Table A4-6 summarizes $SO_2$ emissions projections for the MA in future years.

**Table A4-6. $SO_2$ Emissions in the MA in Future Years**

| Source Category | | Maintenance Area Emissions (tpy) | | | |
|---|---|---|---|---|---|
| | | 2015 | 2020 | 2025 | 2030 |
| On-road Mobile | | 2.9476 | 1.3520 | 1.3030 | 1.2770 |
| Non-road Mobile | | 0.1265 | 0.0797 | 0.0846 | 0.0897 |
| Area | Railroads | 0.4208 | 0.4089 | 0.4234 | 0.4394 |
| | Fuel Combustion | 0.5962 | 0.6120 | 0.6327 | 0.6516 |
| | Agricultural Burning | 0.3095 | 0.3095 | 0.3095 | 0.3095 |
| | Open Burning | 0.3853 | 0.3955 | 0.4089 | 0.4211 |
| | Cremation | 0.0089 | 0.0092 | 0.0095 | 0.0098 |
| Point | Airports | 0.1924 | 0.1975 | 0.2042 | 0.2103 |
| | Power Plants | 69.5400 | 69.5400 | 69.5400 | 69.5400 |
| | Other Facilities | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| Event | Wildfires | 0.0178 | 0.0178 | 0.0178 | 0.0178 |
| | Prescribed Burns | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| **Total** | | **74.5450** | **72.9221** | **72.9336** | **72.9661** |

Table A4-7 summarizes $SO_2$ point source emissions projections for the buffer in future years.

**Table A4-7. $SO_2$ Point Source Emissions in the 50-km Buffer in Future Years**

| Source Category | Buffer Emissions (tpy) | | | |
|---|---|---|---|---|
| | 2015 | 2020 | 2025 | 2030 |
| U.S. Facilities | 4,424.9590 | 4,424.9550 | 4,424.9647 | 4,424.9773 |
| Mexican Facilities | 1,882.2510 | 1,882.2510 | 1,882.2510 | 1,882.2510 |
| **Total** | **6,307.2101** | **6,307.2061** | **6,307.2157** | **6,307.2283** |

# A5 Analysis

ADEQ estimated that nearly 5.9 tons of $SO_2$ were emitted in the MA in 2011—5.8 tons if the emissions from APS's Fairview Generating Station are excluded. In future years, this 5.8 tpy estimate is projected to drop precipitously, as shown in Figure A5-1; the corresponding projections for 2020-2030 are about 3.4 tpy, more than a 40% reduction from 2011. However, as Figure A5-2 shows, the PTE of the generating station makes this dwindling subtotal relatively insignificant—the power plant contributes over 95% of the projected emissions for 2020-2030. Therefore, the impacts of this facility (as well as the high-PTE sources in the buffer) on $SO_2$ levels in the MA are explored via dispersion modeling in Appendix B to this SIP revision. That analysis demonstrates that the MA is projected to meet the NAAQS through 2030.

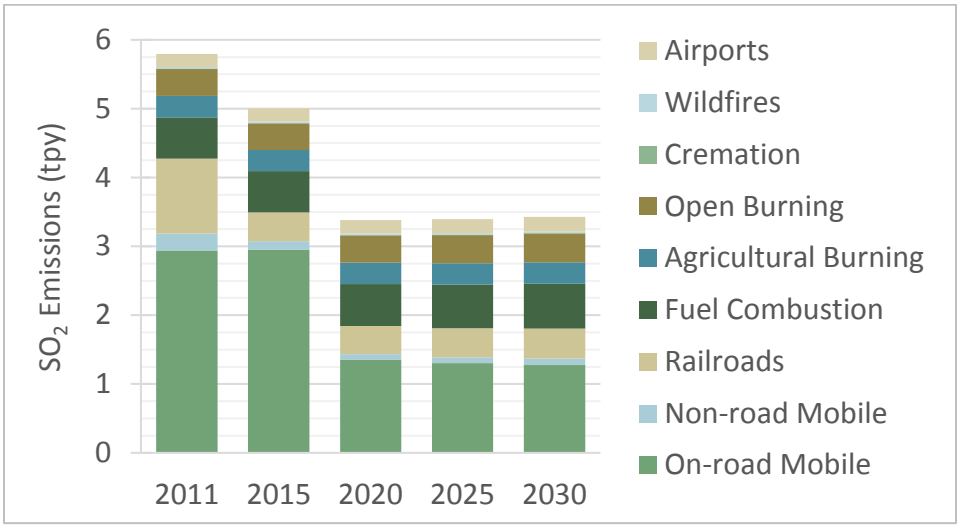


**Figure A5-1. MA Emissions Projections, Excluding APS Fairview**

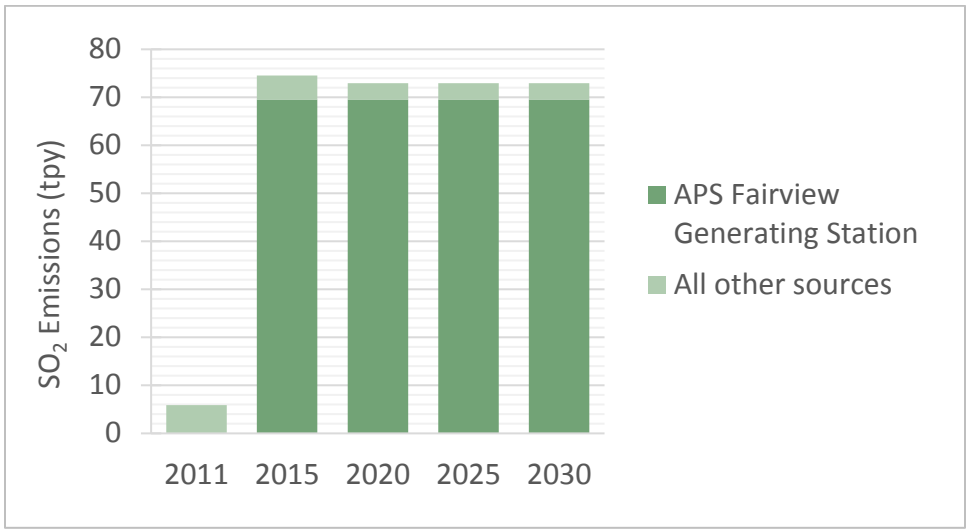


**Figure A5-2. MA Emissions Projections, Including PTE from APS Fairview**

# Exhibit AI
# Geodata and Related Methodologies

The following is a detailed account of how ADEQ estimated the surrogate values in Table A3-1.

AI1 Summary of Geodata Used in Evaluations ..... AI-2
AI2 Land Area and 2010 Population Methodology ..... AI-5
AI3 Highway and Railroad Length Methodology ..... AI-6

# AI1 Summary of Geodata Used in Evaluations

The primary source of geodata for analyses supporting this inventory was the U.S. Census Bureau's suite of TIGER/Line® Shapefiles. ADEQ retrieved data representing 2011 whenever possible, except for census block data, which ADEQ retrieved from the closest census year (2010). For each relevant dataset in the suite, ADEQ used the most recent version of the desired vintage available as of May 23, 2016 (version date shown after each layer description):

[1] 2011 Arizona counties vector digital dataset (12/12/11 release)
ftp://ftp2.census.gov/geo/tiger/TIGER2011/COUNTY/tl_2011_us_county.zip

[2] 2011 U.S. railroad vector digital dataset (12/12/11 release)
ftp://ftp2.census.gov/geo/tiger/TIGER2011/RAILS/tl_2011_us_rails.zip

[3] 2011 Cochise County road (highway) vector digital dataset (12/9/11 release)
ftp://ftp2.census.gov/geo/tiger/TIGER2011/ROADS/tl_2011_04003_roads.zip

[4] 2010 Cochise County census block vector digital dataset (3/26/12 update)
ftp://ftp2.census.gov/geo/tiger/TIGER2010/TABBLOCK/2010/tl_2010_04003_tabblock10.zip

In its analysis, ADEQ used three masking geometries: Cochise County, the MA, and the 50-km annular buffer around the MA. The geometry for Cochise County was obtained by extracting the Cochise County feature from the county polygon layer [1]. The MA geometry was defined per Table A2-1 using survey points along the cadastral grid. These points are listed in Table AI-1 and shown in Figure AI-1. The coordinates are expressed in meters, measured in the Universal Transverse Mercator (UTM) plane for zone 12 north, with a false easting of X = 500,000 meters at 111° West in the North American Datum (NAD) of 1983.

**Table AI-1. MA Boundary Vertices as UTM Zone 12N Coordinates**

| ID | X | Y | ID | X | Y | ID | X | Y |
|---|---|---|---|---|---|---|---|---|
| 1 | 638237.6 | 3482248 | 18 | 648046.4 | 3469406 | 35 | 628653.0 | 3470775 |
| 2 | 638249.3 | 3480627 | 19 | 648061.6 | 3467797 | 36 | 628633.5 | 3471965 |
| 3 | 638246.9 | 3478969 | 20 | 648067.5 | 3467665 | 37 | 628626.6 | 3472405 |
| 4 | 638268.3 | 3477351 | 21 | 646449.3 | 3467639 | 38 | 628599.6 | 3474036 |
| 5 | 638269.8 | 3477323 | 22 | 644826.5 | 3467619 | 39 | 628588.6 | 3475643 |
| 6 | 638289.4 | 3475737 | 23 | 643213.1 | 3467602 | 40 | 628580.8 | 3477248 |
| 7 | 638321.3 | 3474117 | 24 | 641611.5 | 3467571 | 41 | 628567.3 | 3478863 |
| 8 | 638334.8 | 3472895 | 25 | 640006.0 | 3467549 | 42 | 628550.5 | 3480503 |
| 9 | 638337.9 | 3472492 | 26 | 638362.4 | 3467526 | 43 | 628532.8 | 3482119 |
| 10 | 639948.1 | 3472514 | 27 | 638352.3 | 3467526 | 44 | 630149.8 | 3482128 |
| 11 | 641556.1 | 3472548 | 28 | 636754.8 | 3467505 | 45 | 630568.6 | 3482132 |
| 12 | 643161.1 | 3472579 | 29 | 635138.4 | 3467494 | 46 | 631757.1 | 3482140 |
| 13 | 644776.3 | 3472592 | 30 | 633519.0 | 3467480 | 47 | 633374.8 | 3482160 |
| 14 | 646742.0 | 3472609 | 31 | 631908.8 | 3467461 | 48 | 634175.6 | 3482170 |
| 15 | 647983.9 | 3472624 | 32 | 630284.8 | 3467438 | 49 | 635004.4 | 3482181 |
| 16 | 648008.5 | 3471020 | 33 | 628641.3 | 3467422 | 50 | 636618.4 | 3482193 |
| 17 | 648027.4 | 3470211 | 34 | 628647.8 | 3469159 | 51 | 638237.6 | 3482248 |

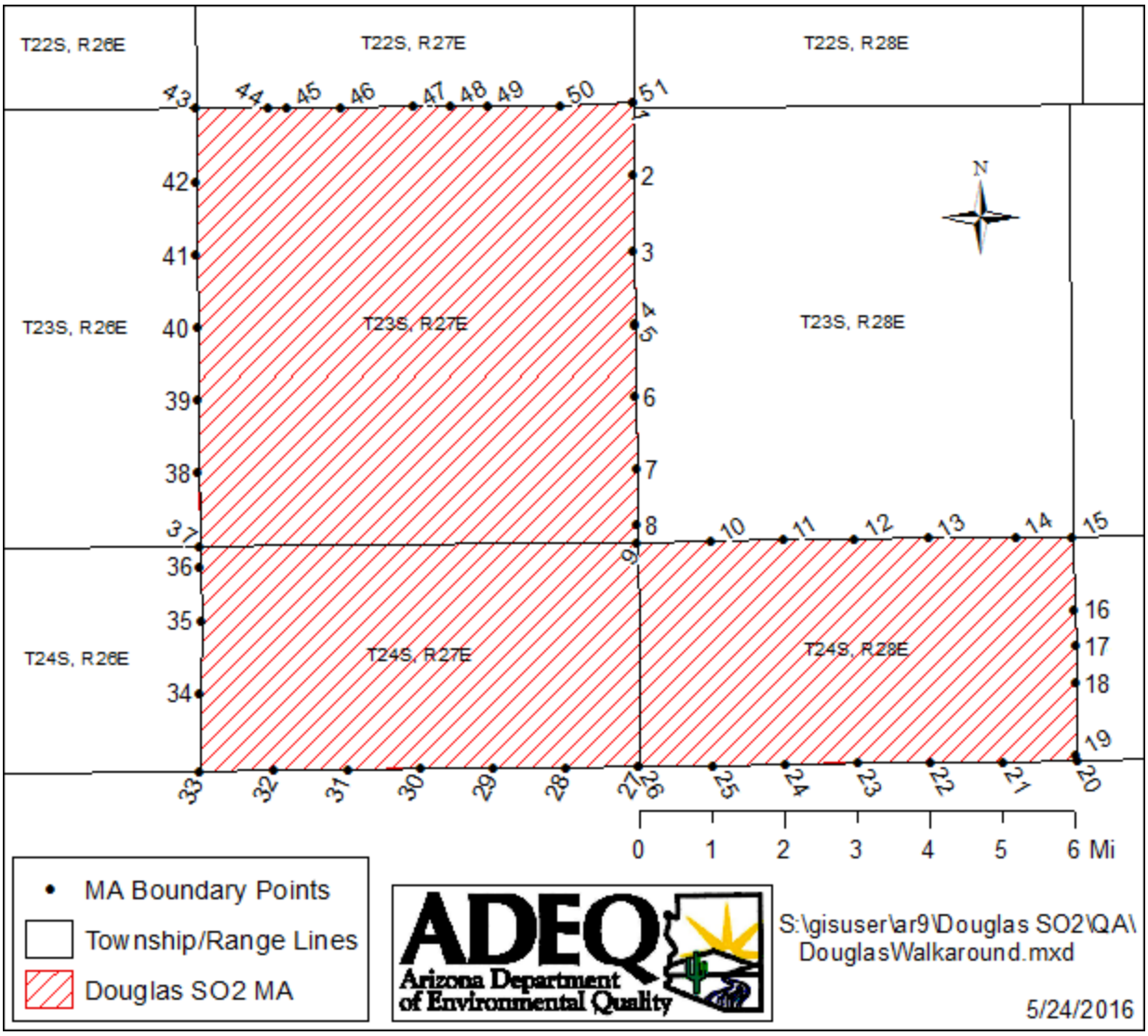


**Figure AI-1. MA Boundaries**

There are actually only 50 distinct vertices; the final vertex is a duplicate of the first vertex, indicating the end of the cycle. This cycle provides a clockwise walkaround of the MA; that is, if one were to walk the vertices in order, the MA would always be on one's right. These conventions are used in ESRI ArcGIS 10.3 to define a simple polygon. ADEQ used ArcGIS 10.3 (and in particular the ArcMap application) and the UTM projected coordinate system described above Table AI-1 to perform each of the analyses described in this exhibit, with one exception noted at the end of this section. For example, the 50-km buffer's geometry was developed using the *Buffer* tool in ArcMap 10.3's *Analysis* toolbox. Its 50-km radii were measured in the UTM coordinate system (that is, as *planar* rather than *geodesic* distances).

ADEQ also used EPA geodata for emissions events and point sources. ADEQ retrieved the following packages from version 6.2 of the modeling platform for the 2011 NEI:

[5] 2011 SmartFire2 detect event database (11/24/14 update v5)
ftp://ftp.epa.gov/EmisInventory/2011v6/v2platform/2011emissions/2011eh_v6_11g_inputs_ptfire.zip

[6] 2011 Arizona point source database
ftp://ftp.epa.gov/EmisInventory/2011v6/v2platform/2011emissions/point_by_state/2011eh_v6_11g_inputs_point_FIPS_04.zip

- [a] Electric Generating Units (1/29/15 update v1)
- [b] Oil and Gas facilities (2/3/15 update v4)
- [c] Refueling facilities (12/4/14 update v2)
- [d] Other non-integrated-planning-model point sources (2/9/15 update v2)

[7] 2008 INEM revised Mexican point source database (1/14/15 update v0)
ftp://ftp.epa.gov/EmisInventory/2011v6/v2platform/2011emissions/2011eh_v6_11g_inputs_oth.zip

ADEQ adjusted the coordinates for one of the points in the INEM; the Agua Prieta II Power Plant (listed in the INEM as "FUERZA Y ENERGIA DE NACO NOGALES S.A. DE C.V.") coordinates were adjusted to longitude 31.2672, latitude -109.5911, which is the approximate location of the largest release point at the plant.[29] The original coordinates in the INEM are in downtown Agua Prieta, possibly indicating the location of an office associated with the operation, but not the location of the plant itself.

All of the analyses in the following sections, using data sources [1] through [7], were performed in ArcMap 10.3. However, the analysis of crop and cropland acreages in Section A3.2.3.3 was performed in the *CropScape* web-based GIS using:

[8] the 2011 National Cropland Data Layer 30-meter digital raster (1/31/12 release)
https://nassgeodata.gmu.edu/CropScape/

ADEQ used *CropScape*'s Area of Interest Statistics tool to evaluate acreages of various land cover categories in Cochise County (per the *CropScape* Region/State/ASD/County tool) and in the MA (as described on the previous pages).

*CropScape* features a disclaimer indicating that the crop area estimates it produces may be biased downward when compared to the official estimates provided by USDA, and that bias correction should be performed. However, this downward bias is most pronounced in areas with higher proportions of cropland; in fact, areas with little cropland, such as the MA, may actually have an upward bias.[30] Therefore, the *CropScape* ratios per Equation A3-2 would tend to be overestimates, a priori. Since ADEQ ended up using an allocation factor which was higher than any *CropScape*-based factor, any such upward bias was ineffectual. Therefore ADEQ did not perform any corrections or fine-tuning of the acreages evaluated using *CropScape*.

[29] There are two release points slightly south of this one, but they appear to have much smaller plumes. See, e.g., photographs in the Feb. 29, 2016 article in *El Sol de Mexico* and the Jan. 13, 2016 article in *Noticias MVS*.
[30] See, e.g., R.L. Czaplewski: "Misclassification Bias in Areal Estimates," *Photogrammetric Engineering and Remote Sensing* volume 58, 1992.

# AI2 Land Area and 2010 Population Methodology

ADEQ analyzed the 2010 census block TIGER/Line shapefile [4] to evaluate both land area and 2010 population in Cochise County and in the MA. First, ADEQ added population data to the shapefile's attribute table. ADEQ used the U.S. Census American FactFinder Download Center (http://factfinder.census.gov/faces/nav/jsf/pages/download_center.xhtml) to retrieve:

[9] all Cochise County census block entries for "Table P1: TOTAL POPULATION" of "SF1 100%" (Summary File 1, 7/21/11 update v2) for the *2010 Decennial Census*.

Table P1 lists a unique 15-digit geoID for each census block in the field "GEO.id2" and lists the total population for each block in the field "D001." The Download Center also provided a list of revisions to the Cochise County portion of the table which were made *after* the July 21, 2011 update. Four census blocks in Cochise County had their 2010 population estimates revised on January 1, 2013, according to the revision list:

**Table AI-2. 2013 Revisions to the 2010 U.S. Census Population Totals in Cochise County**

| Revision ID | GeoID (State-County-Tract-Group-Block) | Old Estimate | Revised Estimate |
|---|---|---|---|
| r38344 | 04-003-0005-004-036 | 131 | 0 |
| r38857 | 04-003-0005-004-039 | 2,174 | 2,305 |
| r38852 | 04-003-0006-001-411 | 0 | 276 |
| r38854 | 04-003-0007-004-014 | 323 | 47 |

ADEQ edited the four relevant entries' "D001" values to reflect these revisions. ADEQ then joined the edited version of [9] to the attribute table for [4] according to the geoIDs (the attribute table for [4] lists these IDs in the field "GEOID10") in order to assign the population data to [4]. ADEQ copied the population values into a double-precision, floating-point-valued field called "POP10" in the attribute table for [4].

Next, ADEQ used the *Make Feature Layer* tool in the ArcMap 10.3 *Data Management* toolbox to create a layer from [4] with the ratio policies for the land area (as opposed to water area) field "ALAND10" and the 2010 population field "POP10" enabled. ADEQ tabulated the totals of these fields (using the *Statistics* utility in ArcMap 10.3) to evaluate land area (in $m^2$) and 2010 population (in persons), respectively, for Cochise County. ADEQ divided the land area value by 1,000,000 to convert its units to $km^2$, for readability.

Finally, ADEQ used the *Clip* tool in the ArcMap 10.3 *Analysis* toolbox to clip the feature layer down to the MA mask, reducing the "ALAND10" and "POP10" values according to the clipping ratio policy.[31] ADEQ tabulated the new totals of these fields (in the clipped layer) to evaluate land area and 2010 population, respectively, for the MA. ADEQ again converted the land area value to $km^2$.

[31] The ratio policy adjusts attributes by a feature-type-defined ratio. For polygon features, the ratio is of pre- and post-*Clip* areas. For instance, if 37 acres of a 52.5-acre census block were within the MA, the value of "POP10" in that block would be multiplied by the ratio 37/52.5. This policy corresponds to the assumption that the population in each block is uniformly distributed throughout the block. ADEQ does not claim that this assumption is sound for individual sub-block areas, but does assert that the resulting aggregate estimates for the MA are representative.

# AI3 Highway and Railroad Length Methodology

ADEQ analyzed the 2011 TIGER/Line shapefiles [2] and [3] to evaluate railroad and highway length, respectively. First, ADEQ used the *Clip* tool in the ArcMap 10.3 *Analysis* toolbox to clip the rail shapefile [2] down to the Cochise County mask [1]. ADEQ also used the *Select Layer by Attribute* tool in the ArcMap 10.3 *Data Management* toolbox to select the highway features from [3].[32] ADEQ then used the *Copy Features* tool from the same toolbox to create a new layer from the selection.

ADEQ then added a double-precision, floating-point-valued field named "km" to each of the attribute tables for the two new layers. ADEQ then used the *Calculate Geometry* utility to populate both "km" fields with each feature's length, measured as a planar distance (projected in UTM zone 12 north with the NAD of 1983) in km. ADEQ tabulated the totals of these fields (using the *Statistics* utility) to evaluate railroad and highway length, respectively, for Cochise County.

ADEQ then used the *Clip* tool again to clip both layers down to the MA mask. ADEQ recalculated the "km" fields in the resulting clipped layers, using the *Calculate Geometry* utility with the same settings as before. Finally, ADEQ tabulated the totals of these fields using the *Statistics* utility to evaluate railroad and highway length, respectively, for the MA.

ADEQ also calculated total road length, rather than highway length only, and obtained a corresponding allocation factor of 3.02% per Equation A3-2, as opposed to the highway-only allocation factor of 3.95%. ADEQ elected to present the larger of the two factors. Recall, however, that ADEQ did not end up using either road-based allocation factor; in Section A3.2.1, ADEQ elected to use the population allocation factor instead, since it was even larger.

[32] The "RTTYP" field in the attribute table for [3] indicates the road type of each feature: a value of "I" indicates an interstate; "S" indicates a state highway; "U" indicates a U.S. highway; "M" indicates a municipal road; "O" indicates restricted-access roads for official use; a blank indicates all other road types. ADEQ selected highways using the structured query language (SQL) condition **"RTTYP" IN ('I', 'S', 'U')** in the *Select Layer by Attribute* tool.

# Exhibit AII
# MOVES Modeling

The following is a detailed record of the model inputs that ADEQ used in the 12/1/15 release of MOVES2014a to evaluate the surrogate values in the last four columns of Table A4-1.

AII1 On-Road Run Specifications ..... AII-2
AII2 Non-Road Run Specifications ..... AII-6

# AII1 On-Road Run Specifications

Due to scheduling restrictions, ADEQ split the simulated years over multiple simulations. However, each simulation was run using the same effective specifications. Collectively, the following year key values were used to specify the timespan:

- "2011"
- "2015"
- "2020"
- "2025"
- "2030"

The complete specifications for the 2011 run are provided below. Fields that varied from run to run are highlighted in yellow.

```
<runspec version="MOVES2014a-20151028">
	<description>
		<![CDATA[Douglas SO2_National Defaults Allocated to Cochise_2011]]>
	</description>
	<models>
		<model value="ONROAD"/>
	</models>
	<modelscale value="Inv"/>
	<modeldomain value="NATIONAL"/>
	<geographicselections>
		<geographicselection type="COUNTY" key="4003" description="ARIZONA -
		   Cochise County"/>
	</geographicselections>
	<timespan>
		<year key="2011"/>
		<month id="1"/>
		<month id="2"/>
		<month id="3"/>
		<month id="4"/>
		<month id="5"/>
		<month id="6"/>
		<month id="7"/>
		<month id="8"/>
		<month id="9"/>
		<month id="10"/>
		<month id="11"/>
		<month id="12"/>
		<day id="2"/>
		<day id="5"/>
		<beginhour id="1"/>
		<endhour id="24"/>
		<aggregateBy key="Year"/>
	</timespan>
	<onroadvehicleselections>
		<onroadvehicleselection fueltypeid="3" fueltypedesc="Compressed Natural
		   Gas (CNG)" sourcetypeid="42" sourcetypename="Transit Bus"/>
		<onroadvehicleselection fueltypeid="2" fueltypedesc="Diesel Fuel"
		   sourcetypeid="62" sourcetypename="Combination Long-haul Truck"/>
```

(Continued on next page)

```
            <onroadvehicleselection fueltypeid="2" fueltypedesc="Diesel Fuel"
               sourcetypeid="61" sourcetypename="Combination Short-haul Truck"/>
            <onroadvehicleselection fueltypeid="2" fueltypedesc="Diesel Fuel"
               sourcetypeid="41" sourcetypename="Intercity Bus"/>
            <onroadvehicleselection fueltypeid="2" fueltypedesc="Diesel Fuel"
               sourcetypeid="32" sourcetypename="Light Commercial Truck"/>
            <onroadvehicleselection fueltypeid="2" fueltypedesc="Diesel Fuel"
               sourcetypeid="54" sourcetypename="Motor Home"/>
            <onroadvehicleselection fueltypeid="2" fueltypedesc="Diesel Fuel"
               sourcetypeid="21" sourcetypename="Passenger Car"/>
            <onroadvehicleselection fueltypeid="2" fueltypedesc="Diesel Fuel"
               sourcetypeid="31" sourcetypename="Passenger Truck"/>
            <onroadvehicleselection fueltypeid="2" fueltypedesc="Diesel Fuel"
               sourcetypeid="51" sourcetypename="Refuse Truck"/>
            <onroadvehicleselection fueltypeid="2" fueltypedesc="Diesel Fuel"
               sourcetypeid="43" sourcetypename="School Bus"/>
            <onroadvehicleselection fueltypeid="2" fueltypedesc="Diesel Fuel"
               sourcetypeid="53" sourcetypename="Single Unit Long-haul Truck"/>
            <onroadvehicleselection fueltypeid="2" fueltypedesc="Diesel Fuel"
               sourcetypeid="52" sourcetypename="Single Unit Short-haul Truck"/>
            <onroadvehicleselection fueltypeid="2" fueltypedesc="Diesel Fuel"
               sourcetypeid="42" sourcetypename="Transit Bus"/>
            <onroadvehicleselection fueltypeid="9" fueltypedesc="Electricity"
               sourcetypeid="32" sourcetypename="Light Commercial Truck"/>
            <onroadvehicleselection fueltypeid="9" fueltypedesc="Electricity"
               sourcetypeid="21" sourcetypename="Passenger Car"/>
            <onroadvehicleselection fueltypeid="9" fueltypedesc="Electricity"
               sourcetypeid="31" sourcetypename="Passenger Truck"/>
            <onroadvehicleselection fueltypeid="5" fueltypedesc="Ethanol (E-85)"
               sourcetypeid="32" sourcetypename="Light Commercial Truck"/>
            <onroadvehicleselection fueltypeid="5" fueltypedesc="Ethanol (E-85)"
               sourcetypeid="21" sourcetypename="Passenger Car"/>
            <onroadvehicleselection fueltypeid="5" fueltypedesc="Ethanol (E-85)"
               sourcetypeid="31" sourcetypename="Passenger Truck"/>
            <onroadvehicleselection fueltypeid="1" fueltypedesc="Gasoline"
               sourcetypeid="61" sourcetypename="Combination Short-haul Truck"/>
            <onroadvehicleselection fueltypeid="1" fueltypedesc="Gasoline"
               sourcetypeid="32" sourcetypename="Light Commercial Truck"/>
            <onroadvehicleselection fueltypeid="1" fueltypedesc="Gasoline"
               sourcetypeid="54" sourcetypename="Motor Home"/>
            <onroadvehicleselection fueltypeid="1" fueltypedesc="Gasoline"
               sourcetypeid="11" sourcetypename="Motorcycle"/>
            <onroadvehicleselection fueltypeid="1" fueltypedesc="Gasoline"
               sourcetypeid="21" sourcetypename="Passenger Car"/>
            <onroadvehicleselection fueltypeid="1" fueltypedesc="Gasoline"
               sourcetypeid="31" sourcetypename="Passenger Truck"/>
            <onroadvehicleselection fueltypeid="1" fueltypedesc="Gasoline"
               sourcetypeid="51" sourcetypename="Refuse Truck"/>
            <onroadvehicleselection fueltypeid="1" fueltypedesc="Gasoline"
               sourcetypeid="43" sourcetypename="School Bus"/>
            <onroadvehicleselection fueltypeid="1" fueltypedesc="Gasoline"
               sourcetypeid="53" sourcetypename="Single Unit Long-haul Truck"/>
            <onroadvehicleselection fueltypeid="1" fueltypedesc="Gasoline"
               sourcetypeid="52" sourcetypename="Single Unit Short-haul Truck"/>
            <onroadvehicleselection fueltypeid="1" fueltypedesc="Gasoline"
               sourcetypeid="42" sourcetypename="Transit Bus"/>
      </onroadvehicleselections>
```


(Continued on next page)

```
<offroadvehicleselections>
</offroadvehicleselections>
<offroadvehiclesccs>
</offroadvehiclesccs>
<roadtypes separateramps="false">
      <roadtype roadtypeid="1" roadtypename="Off-Network"
         modelCombination="M1"/>
      <roadtype roadtypeid="2" roadtypename="Rural Restricted Access"
         modelCombination="M1"/>
      <roadtype roadtypeid="3" roadtypename="Rural Unrestricted Access"
         modelCombination="M1"/>
      <roadtype roadtypeid="4" roadtypename="Urban Restricted Access"
         modelCombination="M1"/>
      <roadtype roadtypeid="5" roadtypename="Urban Unrestricted Access"
         modelCombination="M1"/>
</roadtypes>
<pollutantprocessassociations>
      <pollutantprocessassociation pollutantkey="31" pollutantname="Sulfur
         Dioxide (SO2)" processkey="1" processname="Running Exhaust"/>
      <pollutantprocessassociation pollutantkey="31" pollutantname="Sulfur
         Dioxide (SO2)" processkey="2" processname="Start Exhaust"/>
      <pollutantprocessassociation pollutantkey="31" pollutantname="Sulfur
         Dioxide (SO2)" processkey="15" processname="Crankcase Running
         Exhaust"/>
      <pollutantprocessassociation pollutantkey="31" pollutantname="Sulfur
         Dioxide (SO2)" processkey="16" processname="Crankcase Start
         Exhaust"/>
      <pollutantprocessassociation pollutantkey="31" pollutantname="Sulfur
         Dioxide (SO2)" processkey="17" processname="Crankcase Extended Idle
         Exhaust"/>
      <pollutantprocessassociation pollutantkey="31" pollutantname="Sulfur
         Dioxide (SO2)" processkey="90" processname="Extended Idle Exhaust"/>
      <pollutantprocessassociation pollutantkey="31" pollutantname="Sulfur
         Dioxide (SO2)" processkey="91" processname="Auxiliary Power
         Exhaust"/>
      <pollutantprocessassociation pollutantkey="91" pollutantname="Total
         Energy Consumption" processkey="1" processname="Running Exhaust"/>
      <pollutantprocessassociation pollutantkey="91" pollutantname="Total
         Energy Consumption" processkey="2" processname="Start Exhaust"/>
      <pollutantprocessassociation pollutantkey="91" pollutantname="Total
         Energy Consumption" processkey="90" processname="Extended Idle
         Exhaust"/>
      <pollutantprocessassociation pollutantkey="91" pollutantname="Total
         Energy Consumption" processkey="91" processname="Auxiliary Power
         Exhaust"/>
</pollutantprocessassociations>
<databaseselections>
</databaseselections>
<internalcontrolstrategies>
      <internalcontrolstrategy
         classname="gov.epa.otaq.moves.master.implementation.ghg.internalcontr
         olstrategies.rateofprogress.RateOfProgressStrategy">
            <![CDATA[useParameters No]]>
      </internalcontrolstrategy>
</internalcontrolstrategies>
<inputdatabase servername="" databasename="" description=""/>
```


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```
<uncertaintyparameters uncertaintymodeenabled="false" numberofrunspersimulation="0"
                  numberofsimulations="0"/>
       <geographicoutputdetail description="COUNTY"/>
       <outputemissionsbreakdownselection>
              <modelyear selected="false"/>
              <fueltype selected="true"/>
              <fuelsubtype selected="false"/>
              <emissionprocess selected="false"/>
              <onroadoffroad selected="true"/>
              <roadtype selected="false"/>
              <sourceusetype selected="true"/>
              <movesvehicletype selected="false"/>
              <onroadscc selected="false"/>
              <estimateuncertainty selected="false" numberOfIterations="2"
                  keepSampledData="false" keepIterations="false"/>
              <sector selected="false"/>
              <engtechid selected="false"/>
              <hpclass selected="false"/>
              <regclassid selected="false"/>
       </outputemissionsbreakdownselection>
       <outputdatabase servername="" databasename="Douglas_SO2_National_2011"
                  description=""/>
       <outputtimestep value="Year"/>
       <outputvmtdata value="true"/>
       <outputsho value="false"/>
       <outputsh value="false"/>
       <outputshp value="false"/>
       <outputshidling value="false"/>
       <outputstarts value="false"/>
       <outputpopulation value="true"/>
       <scaleinputdatabase servername="" databasename="" description=""/>
       <pmsize value="0"/>
       <outputfactors>
              <timefactors selected="true" units="Years"/>
              <distancefactors selected="true" units="Miles"/>
              <massfactors selected="true" units="Pounds" energyunits="KiloJoules"/>
       </outputfactors>
       <savedata>
       </savedata>
       <donotexecute>
       </donotexecute>
       <generatordatabase shouldsave="false" servername="" databasename=""
                  description=""/>
       <donotperformfinalaggregation selected="false"/>
       <lookuptableflags scenarioid="" truncateoutput="true" truncateactivity="true"
                  truncatebaserates="true"/>
</runspec>
```

# AII2 Non-Road Run Specifications

ADEQ ran non-road emissions separately from on-road, but used the same general specifications. The effective differences are presented below. Other than the vehicle types and road types included, the key change was to split the output by sector, so that airport support vehicles and railroads could be separated from the remaining non-road sectors.

```
<runspec version="MOVES2014a-20151201">
        ⋮
        <onroadvehicleselections>
        </onroadvehicleselections>
        <offroadvehicleselections>
                <offroadvehicleselection fueltypeid="3" fueltypedesc="Compressed Natural
                   Gas (CNG)" sectorid="5" sectorname="Agriculture"/>
                <offroadvehicleselection fueltypeid="3" fueltypedesc="Compressed Natural
                   Gas (CNG)" sectorid="6" sectorname="Commercial"/>
                <offroadvehicleselection fueltypeid="3" fueltypedesc="Compressed Natural
                   Gas (CNG)" sectorid="2" sectorname="Construction"/>
                <offroadvehicleselection fueltypeid="3" fueltypedesc="Compressed Natural
                   Gas (CNG)" sectorid="3" sectorname="Industrial"/>
                <offroadvehicleselection fueltypeid="3" fueltypedesc="Compressed Natural
                   Gas (CNG)" sectorid="10" sectorname="Oil Field"/>
                <offroadvehicleselection fueltypeid="1" fueltypedesc="Gasoline"
                   sectorid="5" sectorname="Agriculture"/>
                <offroadvehicleselection fueltypeid="1" fueltypedesc="Gasoline"
                   sectorid="8" sectorname="Airport Support"/>
                <offroadvehicleselection fueltypeid="1" fueltypedesc="Gasoline"
                   sectorid="6" sectorname="Commercial"/>
                <offroadvehicleselection fueltypeid="1" fueltypedesc="Gasoline"
                   sectorid="2" sectorname="Construction"/>
                <offroadvehicleselection fueltypeid="1" fueltypedesc="Gasoline"
                   sectorid="3" sectorname="Industrial"/>
                <offroadvehicleselection fueltypeid="1" fueltypedesc="Gasoline"
                   sectorid="4" sectorname="Lawn/Garden"/>
                <offroadvehicleselection fueltypeid="1" fueltypedesc="Gasoline"
                   sectorid="7" sectorname="Logging"/>
                <offroadvehicleselection fueltypeid="1" fueltypedesc="Gasoline"
                   sectorid="10" sectorname="Oil Field"/>
                <offroadvehicleselection fueltypeid="1" fueltypedesc="Gasoline"
                   sectorid="11" sectorname="Pleasure Craft"/>
                <offroadvehicleselection fueltypeid="1" fueltypedesc="Gasoline"
                   sectorid="12" sectorname="Railroad"/>
                <offroadvehicleselection fueltypeid="1" fueltypedesc="Gasoline"
                   sectorid="1" sectorname="Recreational"/>
                <offroadvehicleselection fueltypeid="4" fueltypedesc="Liquefied Petroleum
                   Gas (LPG)" sectorid="5" sectorname="Agriculture"/>
                <offroadvehicleselection fueltypeid="4" fueltypedesc="Liquefied Petroleum
                   Gas (LPG)" sectorid="8" sectorname="Airport Support"/>
                <offroadvehicleselection fueltypeid="4" fueltypedesc="Liquefied Petroleum
                   Gas (LPG)" sectorid="6" sectorname="Commercial"/>
                <offroadvehicleselection fueltypeid="4" fueltypedesc="Liquefied Petroleum
                   Gas (LPG)" sectorid="2" sectorname="Construction"/>
                <offroadvehicleselection fueltypeid="4" fueltypedesc="Liquefied Petroleum
                   Gas (LPG)" sectorid="3" sectorname="Industrial"/>
```

(Continued on next page)

```
            <offroadvehicleselection fueltypeid="4" fueltypedesc="Liquefied Petroleum
               Gas (LPG)" sectorid="4" sectorname="Lawn/Garden"/>
            <offroadvehicleselection fueltypeid="4" fueltypedesc="Liquefied Petroleum
               Gas (LPG)" sectorid="12" sectorname="Railroad"/>
            <offroadvehicleselection fueltypeid="4" fueltypedesc="Liquefied Petroleum
               Gas (LPG)" sectorid="1" sectorname="Recreational"/>
            <offroadvehicleselection fueltypeid="24" fueltypedesc="Marine Diesel
               Fuel" sectorid="11" sectorname="Pleasure Craft"/>
            <offroadvehicleselection fueltypeid="23" fueltypedesc="Nonroad Diesel
               Fuel" sectorid="5" sectorname="Agriculture"/>
            <offroadvehicleselection fueltypeid="23" fueltypedesc="Nonroad Diesel
               Fuel" sectorid="8" sectorname="Airport Support"/>
            <offroadvehicleselection fueltypeid="23" fueltypedesc="Nonroad Diesel
               Fuel" sectorid="6" sectorname="Commercial"/>
            <offroadvehicleselection fueltypeid="23" fueltypedesc="Nonroad Diesel
               Fuel" sectorid="2" sectorname="Construction"/>
            <offroadvehicleselection fueltypeid="23" fueltypedesc="Nonroad Diesel
               Fuel" sectorid="3" sectorname="Industrial"/>
            <offroadvehicleselection fueltypeid="23" fueltypedesc="Nonroad Diesel
               Fuel" sectorid="4" sectorname="Lawn/Garden"/>
            <offroadvehicleselection fueltypeid="23" fueltypedesc="Nonroad Diesel
               Fuel" sectorid="7" sectorname="Logging"/>
            <offroadvehicleselection fueltypeid="23" fueltypedesc="Nonroad Diesel
               Fuel" sectorid="10" sectorname="Oil Field"/>
            <offroadvehicleselection fueltypeid="23" fueltypedesc="Nonroad Diesel
               Fuel" sectorid="12" sectorname="Railroad"/>
            <offroadvehicleselection fueltypeid="23" fueltypedesc="Nonroad Diesel
               Fuel" sectorid="1" sectorname="Recreational"/>
            <offroadvehicleselection fueltypeid="23" fueltypedesc="Nonroad Diesel
               Fuel" sectorid="9" sectorname="Underground Mining"/>
      </offroadvehicleselections>
      <offroadvehiclesccs>
      </offroadvehiclesccs>
      <roadtypes separateramps="false">
            <roadtype roadtypeid="100" roadtypename="Nonroad" modelCombination="M2"/>
      </roadtypes>
      <pollutantprocessassociations>
            <pollutantprocessassociation pollutantkey="31" pollutantname="Sulfur
               Dioxide (SO2)" processkey="1" processname="Running Exhaust"/>
      </pollutantprocessassociations>
```

⋮

```
      <outputemissionsbreakdownselection>
```

⋮

```
            <sector selected="true"/>
```

⋮

```
      </outputemissionsbreakdownselection>
```

⋮

```
</runspec>
```

ADEQ
Arizona Department of Environmental Quality

# Appendix B
# 2015-2030 Douglas, AZ Sulfur Dioxide Emissions Modeling

*Air Quality Division*
*November 3, 2016 Proposed*

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# Glossary of Terms and Unit Symbols

| | |
|---|---|
| **ADEQ** | Arizona Department of Environmental Quality |
| **EPA** | U.S. Environmental Protection Agency |
| **INEM** | *Inventario Nacional de Emisiones de México*; Mexican National Emissions Inventory |
| **ISCC** | Integrated Solar and Combined Cycle natural gas power plant |
| **MA** | Maintenance Area; herein, the Douglas Sulfur Dioxide Maintenance Area |
| **NAAQS** | National Ambient Air Quality Standard(s) |
| **NEI** | National Emissions Inventory |
| **PTE** | Potential to Emit |
| **SIP** | State Implementation Plan |
| **$SO_2$** | Sulfur Dioxide |
| **TSD** | Technical Support Document |
| **°C** | Degrees Celsius |
| **°F** | Degrees Fahrenheit |
| **Btu; MMbtu** | British thermal units; millions of British thermal units |
| **g; µg** | Grams; micrograms |
| **gal** | Gallons |
| **hp** | Boiler horsepower (Section B2.5); mechanical horsepower (all other sections) |
| **K** | Kelvins |
| **kPa** | Kilopascals |
| **kW** | Kilowatts |
| **lb; lbs** | Pound; pounds |
| **m; km** | Meters; kilometers |
| **mol** | Moles |
| **ppm** | Parts per million (parts are measured by volume for gaseous mixtures like air; parts are measured by mass for aqueous solutions like fuel oil) |
| **s** | Seconds |
| **scf** | Standard cubic feet |
| **tpy** | U.S. short tons per year |

# B1 Introduction

This Technical Support Document (TSD) is an appendix to a 2016 revision[1] to the Arizona air quality State Implementation Plan (SIP), revising the portion of the SIP which addresses the 1971 Sulfur Dioxide ($SO_2$) primary National Ambient Air Quality Standards (NAAQS). This TSD investigates the air quality in and around the Douglas $SO_2$ Maintenance Area (MA) with respect to the 1971 $SO_2$ NAAQS. The simulation modeling and other calculations discussed in this TSD provide estimates of the upper limits of $SO_2$ concentrations in the ambient air in the MA.

## B1.1 Purpose

Part (b) of §175A of the Clean Air Act requires states to demonstrate continued attainment of the NAAQS for ten years beyond the initial maintenance period for a MA (throughout a *second maintenance period*). Since no ambient air quality monitors are currently measuring $SO_2$ in the MA, the Arizona Department of Environmental Quality (ADEQ) performed air quality modeling for this demonstration.[2] ADEQ's modeling methodology and results are documented herein.

## B1.2 Regulatory Background

On December 14, 2001, ADEQ submitted the *Douglas Sulfur Dioxide Nonattainment Area State Implementation and Maintenance Plan* and requested that the U.S. Environmental Protection Agency (EPA) redesignate the area as attaining the 1971 NAAQS. On April 2, 2004 and September 16, 2005, ADEQ submitted to the EPA packages of supplemental information to demonstrate that the area continued to attain the 1971 $SO_2$ standard.[3] In its direct final rule, effective May 1, 2006, EPA approved the 2001 Douglas $SO_2$ plan and redesignated the area as attainment for the 1971 primary $SO_2$ NAAQS.[4]

## B1.3 $SO_2$ Emissions Impacting the MA

In another TSD in this SIP revision package[5] (hereafter referred to as "Appendix A"), ADEQ identified the sources of $SO_2$ emissions which may impact ambient air quality in the MA. Appendix A documents emissions inventories (EIs) representing these sources every five years up through the end of the second maintenance period.

ADEQ took two distinct approaches to estimating $SO_2$ emissions in future years. For each facility which individually emitted a significant quantity of $SO_2$, ADEQ made the conservative

[1] *Maintenance Plan Renewal, 1971 Sulfur Dioxide National Ambient Air Quality Standards, Douglas Maintenance Area*. Arizona Department of Environment Quality. Proposed November 7, 2016.
[2] Per the October 18, 2000 guidance memo from John S. Seitz, "Redesignation of Sulfur Dioxide Nonattainment Areas in the Absence of Monitored Data," commonly referred to as the "Seitz Memo."
[3] Each of these documents is available in docket EPA-R09-OAR-2005-AZ-0008-0002.
[4] 71 FR 9941, Feb. 28, 2006 (effective May 1, 2006).
[5] "Appendix A: 2011-2030 Douglas, AZ Sulfur Dioxide Modeling" to the *supra* 2016 SIP revision.

assumption that the facility would attain its permitted maximum potential to emit (PTE) $SO_2$ in all future years. This method covered not only facilities in the MA, but also those within 50 km of the MA. In the case of significant emitters with no explicit permitted PTEs— facilities in the Mexican portion of the 50 km annular buffer around the MA—ADEQ estimated the theoretical maximum quantity of $SO_2$ that a facility could emit using its permitted equipment.

For all other sources of $SO_2$ emissions (including, for example, mobile source emissions, which have no theoretical limit on their PTE), ADEQ projected a likely growth trajectory in order to produce unbiased estimates of future year emissions.

## B1.4 Methodology Overview

ADEQ's modeling approaches were split in a similar way to the inventory approaches described above. ADEQ regarded a facility as *individually significant* if its facility-wide $SO_2$ emissions were projected to total at least half a ton per year (tpy) in any future year. Table B1-1 lists the significant facilities that ADEQ identified. Figure B1-1 shows their locations relative to the MA.

**Table B1-1: Individually Significant $SO_2$ Point Sources in the MA and 50-km Buffer**

| Facility Type | Facility Name | PTE (tpy) |
|---|---|---|
| Power Plant | Fairview Generating Station | 69.54 |
| Mine/Lime Plant | Douglas Chemical Lime Plant | 4,420.66 |
| Mine | Copper Queen Branch | 3.79 |
| Power Plant | Agua Prieta II | 30.30 |
| Mine/Lime Plant | Mexicana de Cobre | 1,852.22 |

For each such facility, ADEQ performed air dispersion modeling to determine the facility's maximum impact on the air quality of the MA during a worst-case hour. "Worst case," in this context, means all $SO_2$-emitting processes at the facility emitting at full capacity while meteorological conditions minimize ventilation. ADEQ used EPA's AERSCREEN application to estimate these maximum one-hour impacts. From each simulation, AERSCREEN extrapolated each facility's maximum impacts on 24-hour and annual average $SO_2$ concentrations.

For facilities emitting less than 0.5 tpy of $SO_2$ (*de minimis* sources) ADEQ did not perform dispersion modeling. Instead, ADEQ estimated the collective impacts of all such sources—plus nonpoint, mobile, and biogenic sources—based on actual concentrations of $SO_2$ observed by ambient air monitors. ADEQ identified monitored datasets which might reflect "background" concentrations of $SO_2$ (that is, concentrations which are not greatly impacted by the modeled facilities, but which would adequately represent all other influences). In keeping with the goal of estimating upper bounds on ambient $SO_2$ concentration, ADEQ selected the highest 24-hour and annual average concentrations from among these datasets. ADEQ projected the average concentrations to future years based on the projected changes in the relevant inventories.

Finally, for each future year, ADEQ combined the impacts of all emissions sources and compared the resulting estimate to the relevant NAAQS. ADEQ concluded that, even under worst-case conditions, the MA would continue to meet both the 24-hour and annual primary 1971 $SO_2$ NAAQS throughout the second maintenance period.

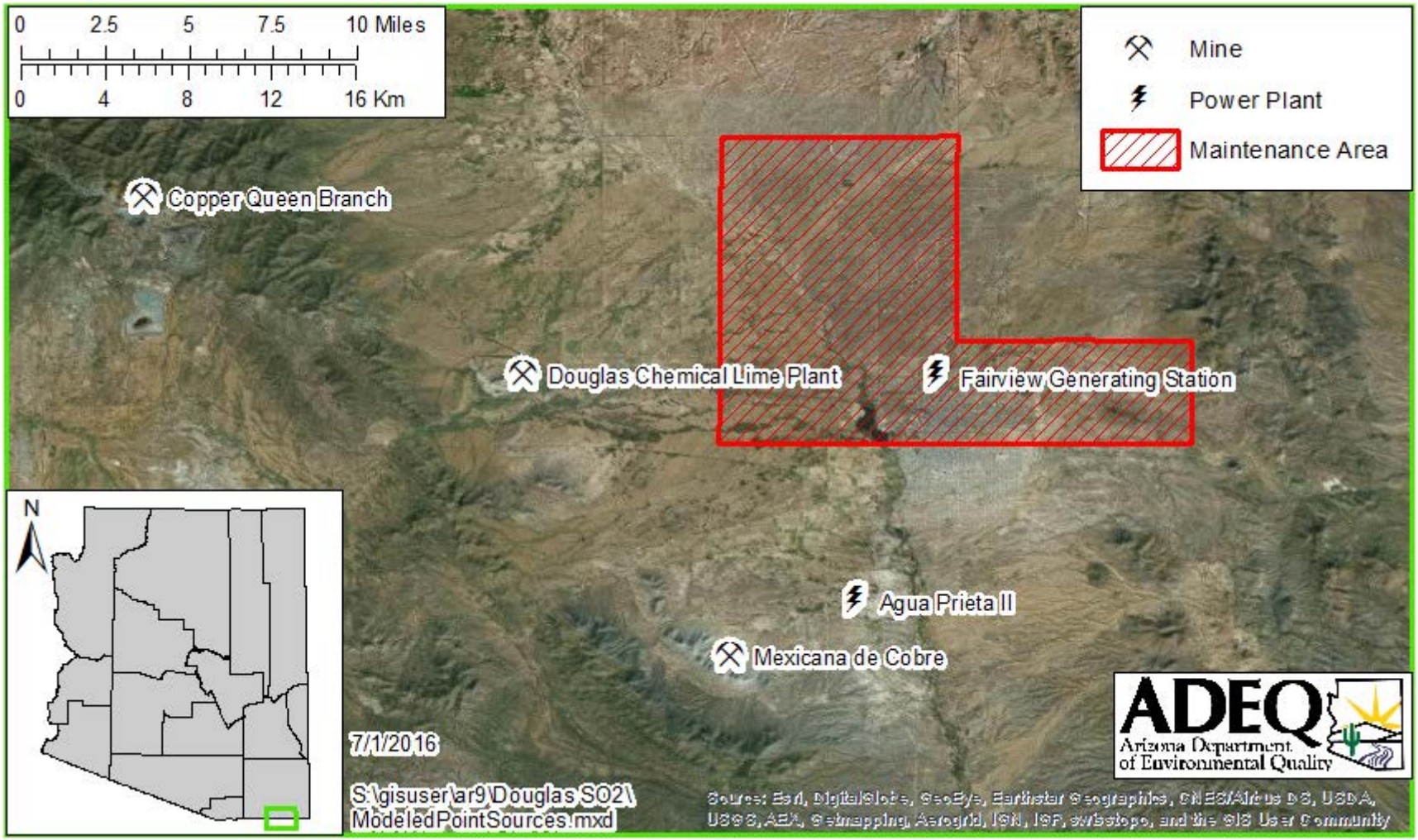


**Figure B1-1: Modeled Sources of $SO_2$ in the MA and 50-km Buffer**

# B2 Model Parameters

Screen modeling is typically performed to determine whether or not a given simulation needs to be run in a more sophisticated model. In order to make sure that no potentially significant impacts slip through the cracks, an effective screen model only makes conservative and/or representative assumptions. AERSCREEN is EPA's recommended screening model. It uses AERMOD, EPA's regulatory Gaussian plume dispersion model, to estimate concentrations. Unlike the full version of AERMOD, however, AERSCREEN requires no detailed meteorological data. Instead, it uses the MAKEMET program to impose a meteorological scenario whose influence maximizes pollutant concentrations for the given simulation. ADEQ ran all simulations described below using version 15181 of AERSCREEN, AERMOD, and MAKEMET.

Section A2.1 of Appendix A to this SIP revision characterizes the area around Douglas as experiencing a "warm/temperate desert climate." In each simulation described below, ADEQ set AERSCREEN to generate MAKEMET scenarios ranging over the default ambient temperature interval (between -10 and 100 °F) and wind speed range (at least 0.5 m/s at an anemometer height of 10 m) with surface characteristics representing desert shrubland under dry conditions.

Rather than using discrete receptors to measure the impact of the sources at specific locales in the MA, ADEQ set AERSCREEN to probe concentrations in ambient air at ground level up to 50 km from each source, identifying the point of maximum impact. Other model options that ADEQ set uniformly across all simulations are as follows:

- all sources were characterized as rural, rather than urban,
- NOx and $O_3$ chemical modeling were disabled,
- stack tip and building downwash were disabled,
- terrain heights were disregarded, and
- fumigation modeling was disabled.

The parameters that varied from simulation to simulation,

- pollutant emission rate,
- stack height and diameter,
- effluent gas temperature and velocity/flow rate, and
- [lateral] distance from stack to ambient air,

are discussed in the following sections.

## B2.1 Fairview Generating Station

The Arizona Public Service Company (APS) Fairview Generating Station is an electric generating unit located within the MA. It vents the exhaust from a single diesel combustion turbine through a single release point. Although this point is about 50 lateral feet from the facility fence line, ADEQ used the minimum "distance to ambient air" value in AERSCREEN, to avoid missing any maximal impact points near the fenceline. However, as shown in Section B4, AERSCREEN found the maximal impact point 69 meters away (approximately 226 feet, well outside of the actual fenceline).

ADEQ calculated the worst-case emission rate based on several figures provided in the facility's supporting permit application materials.[6] The turbine has a maximum generating capacity of 20.950 kilowatts (kW), and a net heat rate topping out at 14,125 British thermal units (btu) per kW-hour. ADEQ assumed that the low-sulfur diesel fuel that the unit burns has a density of 7.157 lbs per gallon (gal)[7], a heat content of 133,333 btu/gal, and the maximum allowable sulfur content (500 ppm, by mass). ADEQ also assumed that all of that sulfur (whose atomic weight is 32.065) is converted to $SO_2$ (whose molecular weight is 64.064), resulting in a maximum emission rate of

$$\frac{20{,}950\ \text{kW} \cdot 14{,}125\ \frac{\text{btu}}{\text{kW-hour}} \cdot 7.157\,\frac{\text{lbs}}{\text{gal}}}{133{,}333\,\frac{\text{btu}}{\text{gal}}} \cdot \frac{500}{1{,}000{,}000} \cdot \frac{64.064}{32.065} \approx 15.867\,\frac{\text{lbs}}{\text{hour}}$$

The remaining stack parameters are provided in version 6 of the 2011 National Emissions Inventory (NEI) Modeling Platform:[8]

- release height, 32 ft;
- stack diameter, 13.5 ft or 162 in;
- exit temperature, 890°F; and
- exit velocity, 47.5 ft/s.

## B2.2 Copper Queen Branch

Freeport-McMoran's Copper Queen Branch mine is located near the City of Bisbee, AZ, just under 23.6 km west of the MA (about 77,395 feet). The mine has two emergency diesel generators (830 and 1515 horsepower, or hp) permitted to run on diesel fuel whose sulfur content must not exceed 0.8%.[9] Since each engine exceeds 600 hp, ADEQ calculated an emission factor from the "Large Stationary Diesel…" section of EPA's AP-42 *Compilation of Air Pollutant Emission Factors*.[10] AP-42 provides a multiplier, 0.00809 lbs/hp-hour, to be applied to the fuel sulfur percentage. ADEQ therefore estimated a maximum combined emission rate of

$$(0.00809 \cdot 0.8)\,\frac{\text{lbs}}{\text{hp-hour}} \cdot (830\ \text{hp} + 1515\ \text{hp}) \approx 15.177\,\frac{\text{lbs}}{\text{hour}}$$

assuming that both generators were running at full capacity at the same time. The remaining parameters, which ADEQ assumed were identical for both generators' exhaust systems, are:[11]

[6] Renewal Permit #61353, Oct. 20, 2014. Permit application supporting materials, PTE calculation workbook, "Maximum Values" and "Fuel Oil Data." Available via public records request to ADEQ.
[7] Equivalent to a specific gravity of 33.5, which is assumed in the *idem* workbook's "Fuel Oil Data" section.
[8] Arizona point source database. Retrieved on June 24, 2016 from ftp://ftp.epa.gov/EmisInventory/2011v6/v2platform/2011emissions/point_by_state/2011eh_v6_11g_inputs_point_FIPS_04.zip
[9] Minor permit revision #62505 to Permit #53591. July 10, 2015. Available via public records request to ADEQ.
[10] Table 3.4-1, "GASEOUS EMISSION FACTORS FOR LARGE STATIONARY DIESEL AND ALL STATIONARY DUAL-FUEL ENGINES", from AP-42 Chapter 3, Section 4. Supplement B, Oct. 1996.
[11] *Supra* Arizona point source database from the 2011 NEI modeling platform.

- release height, 11 ft;
- stack diameter, 6 in;
- exit temperature, 935°F; and
- exit velocity, 227 ft/s.

## B2.3 Douglas Chemical Lime Plant

Although Lhoist North America of Arizona are currently letting the Douglas Chemical Lime Plant lie dormant, they do maintain an operating permit which would allow them to resume operation during the second maintenance period. The supporting materials for that permit application[12] provide $SO_2$ emissions figures for 3 lime kilns, pony motors for 2 of the kilns, and for explosive blasting. The facility is just over 8 km west of the MA (about 26,373 feet).

For the motors (41.9 and 81.8 hp), ADEQ used the same stack parameters as the motors in the previous section, except for emission rate. Since these engines are under 600 hp, ADEQ referred to the "…Diesel Industrial Engines" section of AP-42.[13] AP-42 provides a default brake-specific fuel consumption of 7,000 btu/hp-hour and a diesel heat content of 19,300 btu/lb. The permit application support materials specify a fuel sulfur content of 15 ppm, the maximum allowable for ultra-low-sulfur diesel. Assuming that both motors were running simultaneously, at capacity, for an entire hour, ADEQ estimated a combined emission rate of

$$\frac{7{,}000\ \frac{\text{btu}}{\text{hp-hour}} \cdot (41.9\ \text{hp} + 81.8\ \text{hp})}{19{,}300\,\frac{\text{btu}}{\text{lb}}} \cdot \frac{15}{1{,}000{,}000} \cdot \frac{64.064}{32.065} \approx 0.001345\,\frac{\text{lbs}}{\text{hour}}$$

where the final fraction gives full conversion from sulfur to $SO_2$, as discussed in Section B2.1.

For the lime kilns, ADEQ considered a variety of data points provided in the permit application support materials. Two of the kilns run on a combination of coal and coke, with 90% of the overall heat input for each coming from coke, and the remaining 10% from coal. Assuming full conversion from sulfur to $SO_2$, a minimum heat content of 8,000 btu/lb of coal and 12,500 btu/lb of coke, and a maximum sulfur content of 1.4% for coal and 5.9% for coke, the maximum uncontrolled emission factor for this fuel mix is

$$\left(\frac{0.9 \cdot 0.059}{12{,}500\,\frac{\text{btu}}{\text{lb}}} + \frac{0.1 \cdot 0.014}{8{,}000\,\frac{\text{btu}}{\text{lb}}}\right) \cdot \frac{64.064}{32.065} \cdot \frac{1{,}000{,}000\ \text{btu}}{1\ \text{MMbtu}} \approx 8.837\,\frac{\text{lbs}}{\text{MMbtu}}$$

where *MMbtu* are millions of btu. The third kiln runs on natural gas. With a minimum heat content of 1,030 btu per standard cubic foot (scf) and a maximum sulfur content of 2000 grains per million scf (at 7000 grains to the pound) the uncontrolled maximum emission factor for natural gas is

[12] Renewal Permit #61785, Feb. 2015. Permit application supporting materials, Inventory calculation workbook, "Gas - EF" and "Gas - Hourly." Available via public records request to ADEQ.
[13] AP-42 Chapter 3, Section 3. Supplement B, Oct. 1996.

$$\frac{1\text{ scf}}{1{,}030\text{ btu}}\cdot\frac{2{,}000\text{ grains}}{1{,}000{,}000\text{ scf}}\cdot\frac{1\text{ lb}}{7{,}000\text{ grain}}\cdot\frac{64.064}{32.065}\cdot\frac{1{,}000{,}000\text{ btu}}{1\text{ MMbtu}}\approx 0.000554\frac{\text{lbs}}{\text{MMbtu}}.$$

For each kiln, the permit application support materials provide maximum activity levels, worst-case heating needs, and efficiency with which the lime in each kiln absorbs $SO_2$. These figures are presented in Table B2-1. ADEQ calculated the $SO_2$ emission rate for each kiln as

$$EF\frac{\text{lbs SO}_2}{\text{MMbtu}}\cdot A\frac{\text{tons lime}}{\text{hour}}\cdot k\frac{\text{MMbtu}}{\text{ton lime}}\cdot\left(1-\frac{C}{100}\right)=ER\frac{\text{lbs SO}_2}{\text{hour}}$$

where $EF$ is the emission factor for the specified fuel type, $A$ is the maximum activity level in terms of lime throughput, $k$ is the maximum heat required per unit of throughput, $C$ is the control efficiency as a percentage of $SO_2$ absorbed, and $ER$ is the emission rate.

**Table B2-1: Lhoist Lime Kiln Emission Rates**

| Kiln ID | Fuel type and emission factor (lbs $SO_2$/ MMbtu) | Maximum lime throughput (tons/hour) | Maximum heat needed (MMbtu/ ton lime) | Absorption Efficiency (%) | Emission Rate (lbs $SO_2$/hour) |
|---|---|---|---|---|---|
| K4 | Coal/coke: 8.837 | 8.33 | 9 | 25 | 496.875 |
| K5 | Coal/coke: 8.837 | 22.92 | 6.6 | 61.3 | 517.330 |
| K6 | Gas: 0.000554 | 38.34 | 3.9 | 0 | 0.082869 |

Table B2-2 presents the remaining stack parameters for the kilns.

**Table B2-2: Lhoist Lime Kiln Stack Parameters**

| Kiln ID | Release height (ft) | Stack diameter (in) | Exit temperature (°F) | Exit velocity (ft/s) |
|---|---|---|---|---|
| K4 | 44 | 42 | 340 | 176 |
| K5 | 50 | 78 | 350 | 48 |
| K6 | 132 | 50.4 | 110 | 132 |

The final $SO_2$ emission source is not attached to the plant. A blasting agent consisting in 94% ammonium nitrate and 6% fuel oil (diesel), abbreviated "ANFO", is detonated intermittently at the limestone quarry. Up to 2.37 tons of ANFO may be detonated in a worst-case hour at the quarry.[14] ADEQ assumed that the ultra-low-sulfur diesel used to make the ANFO contained the maximum allowable sulfur (15 ppm, as in the discussion of the pony motors), 100% of which was converted to $SO_2$, yielding a worst-case emission rate of

$$2.37\frac{\text{tons}}{\text{hour}}\cdot\frac{6}{100}\cdot\frac{15}{1{,}000{,}000}\cdot\frac{2{,}000\text{ lbs}}{\text{ton}}\cdot\frac{64.064}{32.065}\approx 0.008523\frac{\text{lbs}}{\text{hour}}.$$

Because the plume created by a blast would not have meaningful linear velocity, ADEQ modeled it as a volume source rather than a stack-type point source. Whereas the explosive

[14] Blasting model parameters were supplied to ADEQ by a contractor at Stantec on behalf of Lhoist. The email exchange (Oct 7-Nov 7, 2014) between Steve Calderon and Ahmed Abdullah at ADEQ, Edward Barry at Lhoist, and Stephanie French at Stantec is partially available via public records request to ADEQ, although key parts of the conversation are marked "confidential" and so may be unavailable.

plume is reported to reach 30 meters high and cover a lateral area of 6,400 square feet, ADEQ estimated an average release height of $\frac{30\text{ m}}{2} \cdot \frac{3.28\text{ ft}}{1\text{ m}} \approx 49\text{ft}$ and a lateral square side length of $\sqrt{6{,}400\text{ ft}^2} = 80\text{ ft}$. However, AERSCREEN (and AERMOD) require volume source parameters describing the "initial vertical dimension" and "initial lateral dimension" of the plume. Using the EPA-recommended methods for a surface-based volume source,[15] ADEQ estimated:

- initial vertical dimension, $30\text{ m} \cdot \frac{3.28\text{ ft}}{\text{m}} \cdot \frac{1}{2.15} \approx 45.6\text{ ft}$ ; and
- initial lateral dimension, $80\text{ ft} \cdot \frac{1}{4.3} \approx 18.6\text{ ft}$.

## B2.4 Agua Prieta II

The Agua Prieta II integrated solar/combined-cycle natural gas (ISCC) power plant, operated by Fuerza y Energia de Naco Nogales (a subsidiary of Unión Fenosa), is located about 7.4 km south of the MA (24,321 feet), in the Mexican state of Sonora. Appendix A to this SIP revision estimates that the plant has an overall PTE of 30.031 tpy of $SO_2$. ADEQ distributed those emissions uniformly over the course of a year, yielding an average emission rate of

$$30.031\text{ tpy} \cdot \frac{1\text{ year}}{365\text{ days}} \cdot \frac{1\text{ day}}{24\text{ hours}} \cdot \frac{2{,}000\text{ lbs}}{1\text{ ton}} \approx 6.856\frac{\text{lbs}}{\text{hour}}.$$

The remaining stack parameters were adapted from the 2008 *Inventario Nacional de Emisiones de México* (INEM; the Mexican counterpart to the NEI) for inclusion in the 2011 NEI Modeling Platform: [16]

- release height, 125 ft;
- stack diameter, 21.32 ft or 255.8 in;
- exit temperature, 204.8°F; and
- exit velocity, 54.5 ft/s.

## B2.5 Mexicana de Cobre

Mexicana de Cobre, a property of Unión Fenosa's Southern Copper brand, operates a chemical lime plant 10 km south of the MA (32,822 feet). The $SO_2$ emissions units at the plant include two rotary kilns with identical operational characteristics as well as two 250 hp boilers. All of these units are capable of running on residual fuel oil, which would result in higher $SO_2$ emissions than either a higher purity diesel fuel or natural gas. Therefore, ADEQ assumed that during a worst-case hour, all units would be simultaneously operating at capacity, using residual fuel oil.

[15] EPA. "User's Guide for the AMS/EPA Regulatory Model – AERMOD" EPA-454/B-03-001, Sept. 2004. Table 3-1.
[16] Eastern Research Group, Inc. "Database of point source annual emissions, *2008 INEM ANNUAL MEXICO NEI*." Retrieved on May 13, 2016 from ftp://ftp.epa.gov/EmisInventory/2011v6/v2platform/2011emissions/2011eh_v6_11g_inputs_oth.zip.

Attachment 1 to the 2005 SIP revision supplement described in Section B1.2 provides operational details for each unit. Assigning the residual fuel oil a heating value of 150,000 btu/gal and a density of 7.88 lbs/gal, with a sulfur content of 3.6%, and assuming 100% conversion of sulfur to $SO_2$, ADEQ estimated emission factors of

$$\frac{7.88\ \frac{\text{lbs}}{\text{gal}}}{150{,}000\ \frac{\text{btu}}{\text{gal}}} \cdot \frac{3.6}{100} \cdot \frac{64.064}{32.065} \cdot \frac{1\ \frac{\text{btu}}{\text{hour}}}{0.000029856\ \text{hp}} \approx 0.1265\ \frac{\text{lbs}}{\text{hp-hour}}$$

and

$$\frac{7.88\ \frac{\text{lbs}}{\text{gal}}}{3.7854\ \frac{\text{liters}}{\text{gal}}} \cdot \frac{3.6}{100} \cdot \frac{64.064}{32.065} \approx 0.1497\ \frac{\text{lbs}}{\text{liter}}$$

where the conversion rate from 1 btu/hour to 0.000029856 boiler horsepower is given in Appendix A to AP-42.[17]

For both boilers running simultaneously, the combined emission rate is

$$(250\ \text{hp} + 250\ \text{hp}) \cdot 0.1265\ \frac{\text{lbs}}{\text{hp-hour}} \approx 63.188\ \frac{\text{lbs}}{\text{hour}}.$$

The remaining stack parameters were not provided in the 2008 INEM, and so ADEQ recycled the stack parameters used in Attachment 1 to the 2005 supplement:

- release height, 24.9 ft;
- stack diameter, 16.1 in;
- exit temperature, 360°F; and
- exit velocity, 28.2 ft/s.

Each kiln has a fuel throughput limit of 4,000 liters per hour, and the lime in each kiln absorbs about 70% of the $SO_2$ generated. Then the combined emission rate for both kilns is

$$\left(4{,}000\ \frac{\text{liter}}{\text{hour}} + 4{,}000\ \frac{\text{liter}}{\text{hour}}\right) \cdot 0.1497\ \frac{\text{lbs}}{\text{liter}} \cdot \left(1 - \frac{70}{100}\right) \approx 359.342\ \frac{\text{lbs}}{\text{hour}}.$$

The remaining stack parameters were provided in the 2008 INEM:

- release height, 88.6 ft;
- stack diameter, 106.3 in;
- exit temperature, 212°F; and
- exit velocity, 32.8 ft/s.

[17] "Appendix A: Miscellaneous Data and Conversion Factors" appendix to AP-42, *supra*. Reformatted Jan. 1995. Conversion Factors table, page A-12, under "Energy".

## B2.6 Summary of Parameters

Table B2-3 gathers the figures from the previous sections of this chapter, except for the volume source at the Douglas Chemical Lime Plant, which is in Table B2-4.

**Table B2-3: Summary of Point Source Parameters**

| Facility | Distance to MA (ft) | Emissions Unit | Emission rate (lbs/hour) | Release height (ft) | Stack diameter (in) | Exit temperature (°F) | Exit velocity (ft/s) |
|---|---|---|---|---|---|---|---|
| APS Fairview | 0[18] | Turbine | 15.867 | 32 | 162 | 890 | 47.5 |
| Copper Queen | 77,395 | Generators | 15.177 | 11 | 6 | 935 | 277 |
| Lhoist Douglas Chemical Lime Plant | 26,373 | Pony motors | 0.001345 | 11 | 6 | 935 | 277 |
| | | Kiln 4 | 496.875 | 44 | 42 | 340 | 176 |
| | | Kiln 5 | 517.330 | 50 | 78 | 350 | 48 |
| | | Kiln 6 | 0.082869 | 132 | 50.4 | 110 | 132 |
| Agua Prieta II | 24,321 | Turbines | 6.856 | 125 | 255.8 | 204.8 | 54.5 |
| Mexicana de Cobre | 32,822 | Kilns | 359.342 | 88.6 | 106.3 | 212 | 32.8 |
| | | Boilers | 63.188 | 24.9 | 16.1 | 360 | 28.2 |

**Table B2-4: Summary of Volume Source Parameters**

| Facility | Distance to MA (ft) | Emissions Process | Emission rate (lbs/hour) | Release height (ft) | Initial lateral dimension (ft) | Initial vertical dimension (ft) |
|---|---|---|---|---|---|---|
| Lhoist Douglas Chemical Lime Plant | 26,373 | Blasting | 0.008523 | 49 | 18.6 | 45.6 |

Sample input files for a point source and the volume source are presented in Exhibit BI.

[18] Due to AERMOD's minimum receptor distance requirements, AERSCREEN bumps all "distance to ambient air" inputs up to at least 1 meter (about 3.3 feet).

# B3 Background Concentration

In each future year inventory developed in Appendix A, the PTE of the APS Fairview Generating Station dominated the MA's annual $SO_2$ emissions inventory. However, other sources accounted for about 4-7% of each inventory. In order to capture the impact of these remaining sources (as well as any transport from *de minimis* sources in the 50-km buffer or any sources further than 50 km from the MA) ADEQ examined air quality monitor data.

The last regulatory[19] ambient $SO_2$ monitor in the MA stopped operation in the mid-1980s, and the last regulatory ambient $SO_2$ monitor in Cochise County stopped operation in the mid-1990s. Because of the significant diesel sulfur content regulations that have become effective since then, ADEQ determined that these observations were too outdated to represent the MA in the base inventory year of 2011.

ADEQ therefore considered the data record for the neighboring counties of Pima, Santa Cruz, Graham, and Greenlee in Arizona and Hidalgo in New Mexico. Among all of these, the only monitors that were active since the mid-2000s were located in and around Tucson, in Pima County. The relevant statistics from these monitors' data records are presented in Table B3-1.

**Table B3-1: Tucson $SO_2$ Monitor Data, 2006-2016[20]**

| Year | Annual avg. (parts per million; ppm) | | Annual max 24-hour avg. (ppm) | |
|---|---|---|---|---|
| | 22nd & Craycroft | Children's Park | 22nd & Craycroft | Children's Park |
| 2006 | 0.00062 | | 0.0033 | |
| 2007 | **0.00093** | | 0.0029 | |
| 2008 | 0.00087 | | **0.0039** | |
| 2009 | 0.00052 | | 0.0019 | |
| 2010 | 0.00053 | 0.00022 | 0.0018 | 0.0011 |
| 2011 | | 0.00028 | | 0.0014 |
| 2012 | | 0.00020 | | 0.0009 |
| 2013 | | 0.00024 | | 0.0011 |
| 2014 | | 0.00020 | | 0.0011 |
| 2015 | | 0.00016 | | 0.0008 |
| 2016 | | 0.00014 | | 0.0004 |

The maximum values for each statistic, 0.00093 ppm for the annual average and 0.0039 ppm for the maximum 24-hour average, were measured in 2007 and 2008, respectively. Because the

[19] Although visibility monitors or intermittent special study monitors may have operated in the MA after the 1990s, none of them operated according to federal reference (or equivalent) methods. In particular, no such monitor reported $SO_2$ observations to EPA's Air Quality System (AQS) database.

[20] Statistics retrieved using the AQS criteria pollutant "Quick Look Report (AMP450)" on July 7, 2016. Note that the 2016 statistics actually represent only the first calendar quarter, January-March, 2016. Similarly, the 2010 statistics for the Children's Park monitor (AQS site ID 04-019-1028) only represent the 4th calendar quarter, October-December. The "22nd & Craycroft" monitor (site ID 04-019-1011) statistics for 2010 represent the entire year.

population of Cochise County did not change substantially between 2008 and 2011[21], and because of the economic downturn during the intervening years, ADEQ felt that the 2007 and 2008 statistics would be representative of 2011, or else that any bias would be towards over-representing $SO_2$ levels.

In order to roll these figures forward to 2015, 2020, 2025, and 2030, ADEQ developed scaling factors based on the emissions inventories developed for the MA in Appendix A. Table B3-2 presents the inventory totals for each year, excluding the contributions of APS Fairview Generating Station, since it was already accounted for in modeling.

**Table B3-2. Background $SO_2$ Emissions Estimates for the MA**

| Source Category | | Maintenance Area Emissions (tpy) | | | | |
|---|---|---|---|---|---|---|
| | | 2011 | 2015 | 2020 | 2025 | 2030 |
| On-road Mobile | | 2.9386 | 2.9476 | 1.3520 | 1.3030 | 1.2770 |
| Non-road Mobile | | 0.2460 | 0.1265 | 0.0797 | 0.0846 | 0.0897 |
| Nonpoint | Railroads | 1.0885 | 0.4208 | 0.4089 | 0.4234 | 0.4394 |
| | Fuel Combustion | 0.6027 | 0.5962 | 0.6120 | 0.6327 | 0.6516 |
| | Agricultural Burning | 0.3095 | 0.3095 | 0.3095 | 0.3095 | 0.3095 |
| | Open Burning | 0.3895 | 0.3853 | 0.3955 | 0.4089 | 0.4211 |
| | Cremation | 0.0090 | 0.0089 | 0.0092 | 0.0095 | 0.0098 |
| Airports | | 0.1945 | 0.1924 | 0.1975 | 0.2042 | 0.2103 |
| Wildfires | | 0.0178 | 0.0178 | 0.0178 | 0.0178 | 0.0178 |
| **Total** | | **5.7962** | **5.0050** | **3.3821** | **3.3936** | **3.4261** |

Expressed as percentages of the 2011 total, these totals yield the following scaling factors, and subsequently, the following scaled background concentrations:

**Table B3-3. Background $SO_2$ Concentration Estimates for the MA**

| Year | Annual emission total (tpy) | Scaling factor | Background concentration (ppm) | |
|---|---|---|---|---|
| | | | Max 24-hour avg. | Annual average |
| 2011 | 5.7962 | 100.00% | 0.0039 | 0.00093 |
| 2015 | 5.0050 | 86.35% | 0.0033676 | 0.0008031 |
| 2020 | 3.3821 | 58.35% | 0.0022756 | 0.0005427 |
| 2025 | 3.3936 | 58.55% | 0.0022834 | 0.0005445 |
| 2030 | 3.4261 | 59.11% | 0.0023053 | 0.0005497 |

[21] According to Arizona Department of Administration population estimates, the population of Cochise County was 130,567 on July 1, 2008 and was 130,537 on July 1, 2011.

# B4 Results and Analysis

The concentrations estimated by AERSCREEN are presented in Table B4-1. Note that the 1-hour concentrations are the only actual simulation results; AERSCREEN scales each 1-hour figure to obtain 24-hour and annual averages, using scaling factors of 60% and 10%, respectively.

**Table B4-1: Summary of AERSCREEN Results**

| Facility | Distance of max. impact point from source (m) | Emissions Unit/Process | Modeled concentration (µg/m³) | | |
|---|---|---|---|---|---|
| | | | 1-hour | 24-hour | Annual |
| APS Fairview | 69 | Turbine | 87.9600 | 52.7800 | 8.7960 |
| Copper Queen | 23,590 | Generators | 9.0360 | 5.4220 | 0.9036 |
| Lhoist Douglas Chemical Lime Plant | 8,038.49 | Blasting | 0.0437 | 0.0262 | 0.0044 |
| | | Pony motors | 0.0021 | 0.0013 | 0.0002 |
| | | Kiln 4 | 101.8000 | 61.0500 | 10.1800 |
| | | Kiln 5 | 107.9000 | 64.7100 | 10.7900 |
| | | Kiln 6 | 0.0225 | 0.0135 | 0.0022 |
| Agua Prieta II | 7,413 | Turbines | 0.5658 | 0.3395 | 0.0566 |
| Mexicana de Cobre | 10,004.15 | Kilns | 64.0500 | 38.4300 | 6.4050 |
| | | Boilers | 82.0800 | 49.2500 | 8.2080 |

ADEQ converted these µg/m³ concentrations to ppm (in parts by volume) using the conversion factor

$$0.00831446\,\frac{\text{m}^3\text{-kPa}}{\text{mol-K}}\cdot\frac{1\text{ mol}}{64.064\text{ g}}\cdot\frac{(25+273.15)\text{ K}}{101.32\text{ kPa}}\cdot 10^6\text{ ppm}\cdot\frac{1\text{ g}}{10^6\text{ µg}}\approx 0.0003819\,\frac{\text{ppm}}{\text{µg/m}^3}$$

where *K* are kelvin, *kPa* are kilopascals, *mol* are moles of $SO_2$, and

- $0.00831446\,\frac{\text{m}^3\text{-kPa}}{\text{mol-K}}$ is a point estimate of the universal gas constant,
- 273.15 K is equivalent to 0°C, and
- 25°C and 101.32 kPa are the reference conditions specified for µg/m³ measurements in 40 CFR 50.3.

ADEQ multiplied each modeled concentration by the conversion factor to obtain the values presented on the next page.

Per the worst-case methodology described in this document, those values represent either fair or else conservative (upward-biased) estimates of the facility's impacts on $SO_2$ concentrations. Moreover, each impact is measured at a point in the MA where its impact is maximized. By adding the impacts, we assume that these points coincide. However, for most of the facilities, the points are distinct. Therefore, adding the impacts (essentially superimposing the points) introduces an additional conservative bias.

For example, the impact of the APS Fairview Generating Station would be considerably lower than 0.003359 ppm if, instead of being measured just 69 meters from the stack, it was measured at the same point as Lhoist's maximal impact, nearly 7 miles away from the APS stacky. Therefore, when measured at that point, their combined impact would be less than 0.003359 + 0.008011 ppm. It is unrealistically conservative to combine their maximal impacts directly; there is no single point where the maximum impacts could coincide, and so no single point where their sum could be observed. Nevertheless, ADEQ added together the maximal impacts (and background concentrations) as shown in the tables below. Each total is comfortably smaller than the applicable 1971 standard (0.14 ppm for the 24-hour averages and 0.03 ppm for the annual averages). ADEQ therefore concluded that the MA would continue to attain the 1971 SO2 NAAQS throughout the second maintenance period.

Figure B4-1 provides comparisons for both standards.

**Table B4-2: Estimated Worst Case 24-hour Average $SO_2$ Concentrations in the MA**

| Source | Worst case 24-hour average concentrations (ppm) | | | |
|---|---|---|---|---|
| | 2015 | 2020 | 2025 | 2030 |
| APS Fairview | 0.020157 | 0.020157 | 0.020157 | 0.020157 |
| Lhoist Lime Plant | 0.048044 | 0.048044 | 0.048044 | 0.048044 |
| Copper Queen | 0.002071 | 0.002071 | 0.002071 | 0.002071 |
| Agua Prieta II | 0.000130 | 0.000130 | 0.000130 | 0.000130 |
| Mexicana de Cobre | 0.033486 | 0.033486 | 0.033486 | 0.033486 |
| Background | 0.003900 | 0.003368 | 0.002276 | 0.002283 |
| **Total** | **0.107788** | **0.107255** | **0.106163** | **0.106171** |

**Table B4-3: Estimated Worst Case Annual Average $SO_2$ Concentrations in the MA**

| Source | Worst case annual average concentrations (ppm) | | | |
|---|---|---|---|---|
| | 2015 | 2020 | 2025 | 2030 |
| APS Fairview | 0.003359 | 0.003359 | 0.003359 | 0.003359 |
| Lhoist Lime Plant | 0.008011 | 0.008011 | 0.008011 | 0.008011 |
| Copper Queen | 0.000345 | 0.000345 | 0.000345 | 0.000345 |
| Agua Prieta II | 0.000022 | 0.000022 | 0.000022 | 0.000022 |
| Mexicana de Cobre | 0.005581 | 0.005581 | 0.005581 | 0.005581 |
| Background | 0.000930 | 0.000803 | 0.000543 | 0.000545 |
| **Total** | **0.018248** | **0.018121** | **0.017861** | **0.017863** |

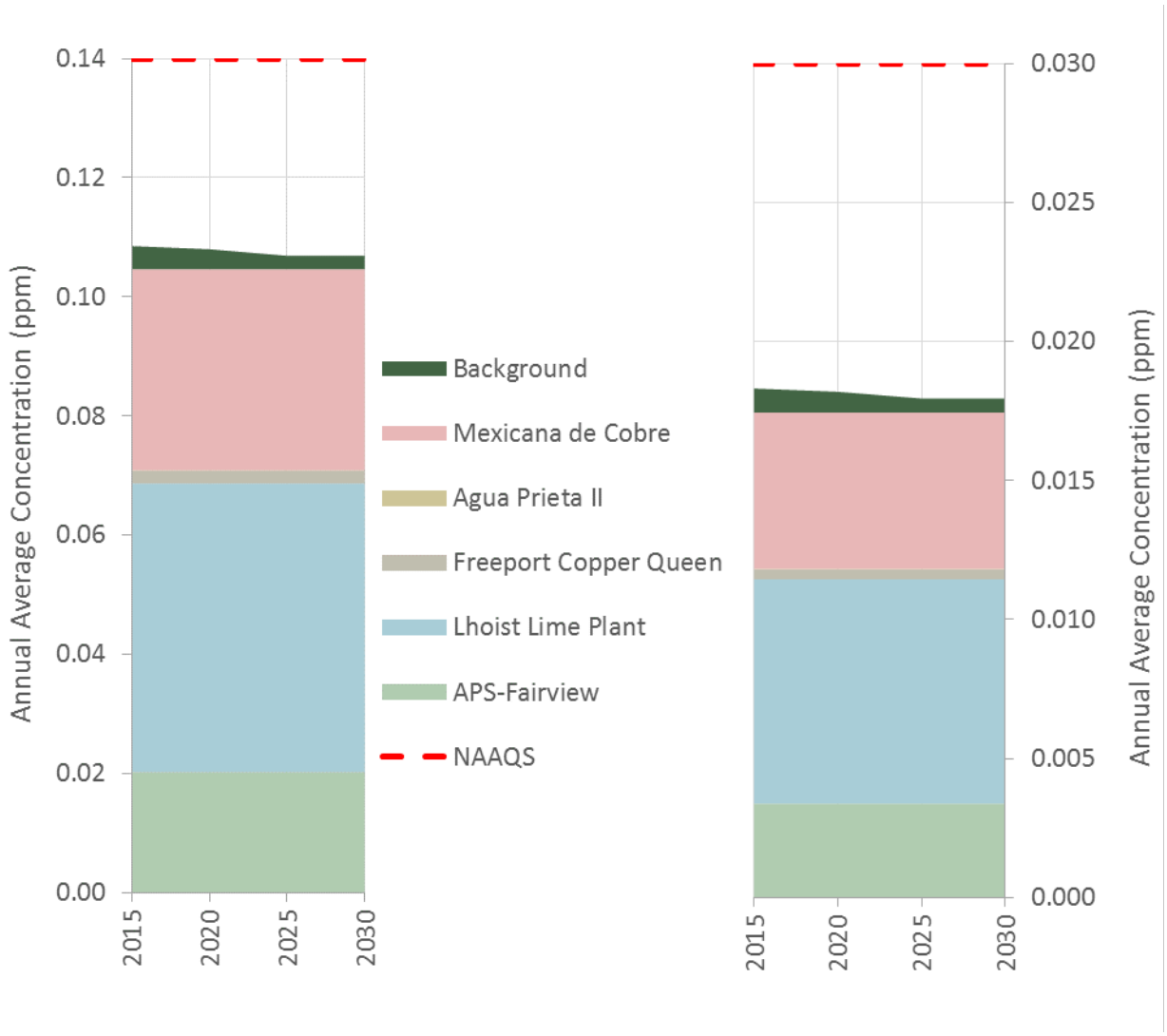


**Figure B4-1: Estimated Worst Case $SO_2$ Concentrations in the MA**

# Exhibit BI
# Sample AERSCREEN Input Files

The following pages present the AERMOD runstreams generated by AERSCREEN for the blasting and pony motor emissions described in Section B2.3. A portion of the receptor (RE) card is omitted from each file, due to its length. The PFL and SFC files generated by MAKEMET are not included below, but their scope is described in the "MAKEMET DATA" comments in the header of each file.

BI1 Blasting (Volume Source) ..... BI-2
BI2 Pony Motor Exhaust (Point Source) ..... BI-4

# BI1 Blasting (Volume Source)

```
** Input units switched from English to metric
** VOLUME DATA        Rate    Height    Syinit    Szinit
**              0.1074E-02   14.9352    5.6693   13.8989

** BUILDING DATA   BPIP    Height  Max dim.  Min dim.   Orient.   Direct.    Offset
**                   N      0.0000    0.0000    0.0000    0.0000    0.0000    0.0000

** MAKEMET DATA    MinT    MaxT Speed   AnemHt Surf Clim  Albedo   Bowen  Length  SC FILE
**               249.82  310.93   0.5   10.000    8    3   0.4500  10.0000   0.1500  "NA"

** TERRAIN DATA   Terrain    UTM East   UTM North  Zone  Nada     Probe     PROFBASE  Use AERMAP elev
**                   N            0.0         0.0     0     0      50000.0           0.00         N

** DISCRETE RECEPTORS  Discflag   Receptor file
**                      N        "NA"

** UNITS/POPULATION   Units   R/U  Population      Amb. dist.   Flagpole    Flagpole height
**                      M     R            0.        8038.491       N         0.00

** FUMIGATION        Inversion Break-up  Shoreline  Distance    Direct  Run AERSCREEN
**                        N                  N         0.00     -9.0     Y

** DEBUG OPTION      Debug
**                     N

** OUTPUT FILE "LhoistBlasting.out"

** Temporal sector: Winter, spatial sector:  1
```

(Continued on next page)

```
CO STARTING
   TITLEONE Lhoist blasting
**            REFINE STAGE 3
   MODELOPT CONC SCREEN  FLAT
   AVERTIME 1
   POLLUTID OTHER
   RUNORNOT RUN
CO FINISHED

SO STARTING
   LOCATION SOURCE VOLUME       0.0     0.0
   SRCPARAM SOURCE   0.1074E-02   14.935    5.669   13.899

   SRCGROUP  ALL

SO FINISHED

RE STARTING
** Fence line receptor
   DISCCART       8038.49         0.00
** Refined receptors
   DISCCART       8043.00         0.00
   DISCCART       8048.00         0.00
   DISCCART       8053.00         0.00
```

⋮

```
   DISCCART      10278.00         0.00
   DISCCART      10283.00         0.00
   DISCCART      10288.00         0.00

RE FINISHED

ME STARTING
   SURFFILE  aerscreen_01_01.sfc  FREE
   PROFFILE  aerscreen_01_01.pfl  FREE
   SURFDATA  11111   2010  SCREEN
   UAIRDATA  22222   2010  SCREEN
   PROFBASE    0.0 METERS
ME FINISHED

OU STARTING
   RECTABLE 1  FIRST
   MAXTABLE  ALLAVE  50

   FILEFORM  EXP
   RANKFILE  1 10 AERSCREEN.FIL
   PLOTFILE  1 ALL  FIRST  AERSCREEN.PLT
OU FINISHED
```

# BI2 Pony Motor Exhaust (Point Source)

```
** Input units switched from English to metric
** STACK DATA         Rate    Height     Temp.  Velocity     Diam.     Flow
**              0.1695E-03    3.3528  774.8167  227.0000    0.1524     8774.

** BUILDING DATA   BPIP    Height  Max dim.  Min dim.   Orient.   Direct.    Offset
**                   N      0.0000    0.0000    0.0000    0.0000    0.0000    0.0000

** MAKEMET DATA    MinT    MaxT Speed   AnemHt Surf Clim  Albedo   Bowen  Length  SC FILE
**               249.82  310.93   0.5   10.000    8    3   0.4500  10.0000   0.1500  "NA"

** TERRAIN DATA   Terrain    UTM East   UTM North  Zone  Nada     Probe     PROFBASE  Use AERMAP elev
**                   N            0.0         0.0     0     0      50000.0           0.00         N

** DISCRETE RECEPTORS  Discflag   Receptor file
**                       N        "NA"

** UNITS/POPULATION   Units   R/U  Population      Amb. dist.   Flagpole    Flagpole height
**                       M     R            0.        8038.491       N         0.00

** FUMIGATION        Inversion Break-up  Shoreline  Distance    Direct  Run AERSCREEN
**                         N                  N         0.00     -9.0     Y

** DEBUG OPTION      Debug
**                     N

** OUTPUT FILE "LhoistPonyMotors.out"

** Temporal sector: Winter, spatial sector:  1
```

(Continued on next page)

```
CO STARTING
   TITLEONE Lhoist pony motors
**            REFINE STAGE 3
   MODELOPT CONC SCREEN  FLAT
   AVERTIME 1
   POLLUTID OTHER
   RUNORNOT RUN
CO FINISHED

SO STARTING
   LOCATION SOURCE POINT        0.0     0.0
   SRCPARAM SOURCE   0.1695E-03    3.353  774.817  227.000    0.152

   SRCGROUP  ALL

SO FINISHED

RE STARTING
** Fence line receptor
   DISCCART       8038.49         0.00
** Refined receptors
   DISCCART       8043.00         0.00
   DISCCART       8048.00         0.00
   DISCCART       8053.00         0.00
```

⋮

```
   DISCCART      10278.00         0.00
   DISCCART      10283.00         0.00
   DISCCART      10288.00         0.00

RE FINISHED

ME STARTING
   SURFFILE  aerscreen_01_01.sfc  FREE
   PROFFILE  aerscreen_01_01.pfl  FREE
   SURFDATA  11111   2010  SCREEN
   UAIRDATA  22222   2010  SCREEN
   PROFBASE    0.0 METERS
ME FINISHED

OU STARTING
   RECTABLE 1  FIRST
   MAXTABLE  ALLAVE  50

   FILEFORM  EXP
   RANKFILE  1 10 AERSCREEN.FIL
   PLOTFILE  1 ALL  FIRST  AERSCREEN.PLT
OU FINISHED
```

# Appendix C:

## Procedural Requirements and Authority

# Exhibit CI - Delegation of Authority

ARIZONA DEPARTMENT
OF
ENVIRONMENTAL QUALITY

Douglas A. Ducey
Governor

Misael Cabrera
Director

April 15, 2016

To: Timothy S. Franquist Jr.
Division Deputy Director
Air Quality Division

Under A.R.S. §49-104 (D) (2), I authorize you, Timothy S. Franquist Jr., Division Deputy Director, Air Quality Division, Arizona Department of Environmental Quality, to perform any act, including execution of any pertinent documents, which I as Director of the Arizona Department of Environmental Quality am authorized or required to do by law with respect to A.R.S. Title 49, chapters 1 and 2 and any other acts relating to air quality including personnel actions.

This authority shall remain in effect until it is revoked or upon your separation from the Arizona Department of Environmental Quality. You may further delegate this authority in the best interest of the agency, however, those delegations must be in writing and you must forward a copy of any further delegations to me.

This delegation is effective as of April 18, 2016 and revokes all earlier delegations. I ratify all acts performed by you as Air Quality Division Deputy Director concerning the duties and functions in this delegation letter.

Misael Cabrera
Director

# Exhibit CII - Authorizing Statutes

**A.R.S. § 49-104.** *Powers and duties of the department and director*

A. The department shall:

1. Formulate policies, plans and programs to implement this title to protect the environment.
2. Stimulate and encourage all local, state, regional and federal governmental agencies and all private persons and enterprises that have similar and related objectives and purposes, cooperate with those agencies, persons and enterprises and correlate department plans, programs and operations with those of the agencies, persons and enterprises.
3. Conduct research on its own initiative or at the request of the governor, the legislature or state or local agencies pertaining to any department objectives.
4. Provide information and advice on request of any local, state or federal agencies and private persons and business enterprises on matters within the scope of the department.
5. Consult with and make recommendations to the governor and the legislature on all matters concerning department objectives.
6. Promote and coordinate the management of air resources to assure their protection, enhancement and balanced utilization consistent with the environmental policy of this state.
7. Promote and coordinate the protection and enhancement of the quality of water resources consistent with the environmental policy of this state.
8. Encourage industrial, commercial, residential and community development that maximizes environmental benefits and minimizes the effects of less desirable environmental conditions.
9. Assure the preservation and enhancement of natural beauty and man-made scenic qualities.
10. Provide for the prevention and abatement of all water and air pollution including that related to particulates, gases, dust, vapors, noise, radiation, odor, nutrients and heated liquids in accordance with article 3 of this chapter and chapters 2 and 3 of this title.
11. Promote and recommend methods for the recovery, recycling and reuse or, if recycling is not possible, the disposal of solid wastes consistent with sound health, scenic and environmental quality policies. Beginning in 2014, the department shall report annually on its revenues and expenditures relating to the solid and hazardous waste programs overseen or administered by the department.
12. Prevent pollution through the regulation of the storage, handling and transportation of solids, liquids and gases that may cause or contribute to pollution.
13. Promote the restoration and reclamation of degraded or despoiled areas and natural resources.
14. Assist the department of health services in recruiting and training state, local and district health department personnel.
15. Participate in the state civil defense program and develop the necessary organization and facilities to meet wartime or other disasters.
16. Cooperate with the Arizona-Mexico commission in the governor's office and with researchers at universities in this state to collect data and conduct projects in the United States

and Mexico on issues that are within the scope of the department's duties and that relate to quality of life, trade and economic development in this state in a manner that will help the Arizona-Mexico commission to assess and enhance the economic competitiveness of this state and of the Arizona-Mexico region.

17. Unless specifically authorized by the legislature, ensure that state laws, rules, standards, permits, variances and orders are adopted and construed to be consistent with and no more stringent than the corresponding federal law that addresses the same subject matter. This provision shall not be construed to adversely affect standards adopted by an Indian tribe under federal law.

B. The department, through the director, shall:

1. Contract for the services of outside advisers, consultants and aides reasonably necessary or desirable to enable the department to adequately perform its duties.
2. Contract and incur obligations reasonably necessary or desirable within the general scope of department activities and operations to enable the department to adequately perform its duties.
3. Utilize any medium of communication, publication and exhibition when disseminating information, advertising and publicity in any field of its purposes, objectives or duties.
4. Adopt procedural rules that are necessary to implement the authority granted under this title, but that are not inconsistent with other provisions of this title.
5. Contract with other agencies, including laboratories, in furthering any department program.
6. Use monies, facilities or services to provide matching contributions under federal or other programs that further the objectives and programs of the department.
7. Accept gifts, grants, matching monies or direct payments from public or private agencies or private persons and enterprises for department services and publications and to conduct programs that are consistent with the general purposes and objectives of this chapter. Monies received pursuant to this paragraph shall be deposited in the department fund corresponding to the service, publication or program provided.
8. Provide for the examination of any premises if the director has reasonable cause to believe that a violation of any environmental law or rule exists or is being committed on the premises. The director shall give the owner or operator the opportunity for its representative to accompany the director on an examination of those premises. Within forty-five days after the date of the examination, the department shall provide to the owner or operator a copy of any report produced as a result of any examination of the premises.
9. Supervise sanitary engineering facilities and projects in this state, authority for which is vested in the department, and own or lease land on which sanitary engineering facilities are located, and operate the facilities, if the director determines that owning, leasing or operating is necessary for the public health, safety or welfare.
10. Adopt and enforce rules relating to approving design documents for constructing, improving and operating sanitary engineering and other facilities for disposing of solid, liquid or gaseous deleterious matter.
11. Define and prescribe reasonably necessary rules regarding the water supply, sewage disposal and garbage collection and disposal for subdivisions. The rules shall:

(a) Provide for minimum sanitary facilities to be installed in the subdivision and may require that water systems plan for future needs and be of adequate size and capacity to deliver specified minimum quantities of drinking water and to treat all sewage.
(b) Provide that the design documents showing or describing the water supply, sewage disposal and garbage collection facilities be submitted with a fee to the department for review and that no lots in any subdivision be offered for sale before compliance with the

standards and rules has been demonstrated by approval of the design documents by the department.

12. Prescribe reasonably necessary measures to prevent pollution of water used in public or semipublic swimming pools and bathing places and to prevent deleterious conditions at such places. The rules shall prescribe minimum standards for the design of and for sanitary conditions at any public or semipublic swimming pool or bathing place and provide for abatement as public nuisances of premises and facilities that do not comply with the minimum standards. The rules shall be developed in cooperation with the director of the department of health services and shall be consistent with the rules adopted by the director of the department of health services pursuant to section 36-136, subsection H, paragraph 10.

13. Prescribe reasonable rules regarding sewage collection, treatment, disposal and reclamation systems to prevent the transmission of sewage borne or insect borne diseases. The rules shall:

(a) Prescribe minimum standards for the design of sewage collection systems and treatment, disposal and reclamation systems and for operating the systems.

(b) Provide for inspecting the premises, systems and installations and for abating as a public nuisance any collection system, process, treatment plant, disposal system or reclamation system that does not comply with the minimum standards.

(c) Require that design documents for all sewage collection systems, sewage collection system extensions, treatment plants, processes, devices, equipment, disposal systems, on-site wastewater treatment facilities and reclamation systems be submitted with a fee for review to the department and may require that the design documents anticipate and provide for future sewage treatment needs.

(d) Require that construction, reconstruction, installation or initiation of any sewage collection system, sewage collection system extension, treatment plant, process, device, equipment, disposal system, on-site wastewater treatment facility or reclamation system conform with applicable requirements.

14. Prescribe reasonably necessary rules regarding excreta storage, handling, treatment, transportation and disposal. The rules shall:

(a) Prescribe minimum standards for human excreta storage, handling, treatment, transportation and disposal and shall provide for inspection of premises, processes and vehicles and for abating as public nuisances any premises, processes or vehicles that do not comply with the minimum standards.

(b) Provide that vehicles transporting human excreta from privies, septic tanks, cesspools and other treatment processes shall be licensed by the department subject to compliance with the rules. The department may require payment of a fee as a condition of licensure. After July 20, 2011, the department shall establish by rule a fee as a condition of licensure, including a maximum fee. As part of the rule making process, there must be public notice and comment and a review of the rule by the joint legislative budget committee. After September 30, 2013, the department shall not increase that fee by rule without specific statutory authority for the increase. The fees shall be deposited, pursuant to sections 35-146 and 35-147, in the solid waste fee fund established by section 49-881.

15. Perform the responsibilities of implementing and maintaining a data automation management system to support the reporting requirements of title III of the superfund amendments and reauthorization act of 1986 (P.L. 99-499) and article 2 of this chapter.

16. Approve remediation levels pursuant to article 4 of this chapter.
17. Establish or revise fees by rule pursuant to the authority granted under title 44, chapter 9, article 8 and chapters 4 and 5 of this title for the department to adequately perform its duties. All fees shall be fairly assessed and impose the least burden and cost to the parties subject to the fees. In establishing or revising fees, the department shall base the fees on:
(a) The direct and indirect costs of the department's relevant duties, including employee salaries and benefits, professional and outside services, equipment, in-state travel and other necessary operational expenses directly related to issuing licenses as defined in title 41, chapter 6 and enforcing the requirements of the applicable regulatory program.
(b) The availability of other funds for the duties performed.
(c) The impact of the fees on the parties subject to the fees.
(d) The fees charged for similar duties performed by the department, other agencies and the private sector.

C. The department may:
1. Charge fees to cover the costs of all permits and inspections it performs to ensure compliance with rules adopted under section 49-203, except that state agencies are exempt from paying the fees. Monies collected pursuant to this subsection shall be deposited, pursuant to sections 35-146 and 35-147, in the water quality fee fund established by section 49-210.
2. Contract with private consultants for the purposes of assisting the department in reviewing applications for licenses, permits or other authorizations to determine whether an applicant meets the criteria for issuance of the license, permit or other authorization. If the department contracts with a consultant under this paragraph, an applicant may request that the department expedite the application review by requesting that the department use the services of the consultant and by agreeing to pay the department the costs of the consultant's services. Notwithstanding any other law, monies paid by applicants for expedited reviews pursuant to this paragraph are appropriated to the department for use in paying consultants for services.

D. The director may:
1. If the director has reasonable cause to believe that a violation of any environmental law or rule exists or is being committed, inspect any person or property in transit through this state and any vehicle in which the person or property is being transported and detain or disinfect the person, property or vehicle as reasonably necessary to protect the environment if a violation exists.
2. Authorize in writing any qualified officer or employee in the department to perform any act that the director is authorized or required to do by law.

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# Authorizing Statute

## A.R.S. § 49-106

**A.R.S. § 49-106.** *Statewide application of rules*

The rules adopted by the department apply and shall be observed throughout this state, or as provided by their terms, and the appropriate local officer, council or board shall enforce them. This section does not limit the authority of local governing bodies to adopt ordinances and rules within their respective jurisdictions if those ordinances and rules do not conflict with state law and are equal to or more restrictive than the rules of the department, but this section does not grant local governing bodies any authority not otherwise provided by separate state law.

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**A.R.S. § 49-404.** *State implementation plan*

A. The director shall maintain a state implementation plan that provides for implementation, maintenance and enforcement of national ambient air quality standards and protection of visibility as required by the clean air act.

B. The director may adopt rules that describe procedures for adoption of revisions to the state implementation plan.

C. The state implementation plan and all revisions adopted before September 30, 1992 remain in effect according to their terms, except to the extent otherwise provided by the clean air act, inconsistent with any provision of the clean air act, or revised by the administrator. No control requirement in effect, or required to be adopted by an order, settlement agreement or plan in effect, before the enactment of the clean air act in any area which is a nonattainment or maintenance area for any air pollutant may be modified after enactment in any manner unless the modification insures equivalent or greater emission reductions of the air pollutant. The director shall evaluate and adopt revisions to the plan in conformity with federal regulations and guidelines promulgated by the administrator for those purposes until the rules required by subsection B are effective.

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**A.R.S. § 49-406.** *Nonattainment area plan*

A. For any ozone, carbon monoxide or particulate nonattainment or maintenance area the governor shall certify the metropolitan planning organization designated to conduct the continuing, cooperative and comprehensive transportation planning process for that area under 23 United States Code section 134 as the agency responsible for the development of a nonattainment or maintenance area plan for that area.

B. For any ozone, carbon monoxide or particulate nonattainment or maintenance area for which no metropolitan planning organization exists, the department shall be certified as the agency responsible for development of a nonattainment or maintenance area plan for that area.

C. For any ozone, carbon monoxide or particulate nonattainment or maintenance area, the department, the planning agency certified pursuant to subsection A of this section on behalf of elected officials of affected local government, the county air pollution control department or district, and the department of transportation shall, by November 15, 1992, and from time to time as necessary, jointly review and update planning procedures or develop new procedures.

D. In preparing the procedures described in subsection C of this section, the department, the planning agency certified pursuant to subsection A of this section on behalf of elected officials of affected local government, the county air pollution control department or district, and the department of transportation shall determine which elements of each revised implementation plan will be developed, adopted, and implemented, through means including enforcement, by the state and which by local governments or regional agencies, or any combination of local governments, regional agencies or the state.

E. The department, the planning agency certified pursuant to subsection A of this section on behalf of elected officials of affected local government, the county air pollution control department or district, and the department of transportation shall enter into a memorandum of agreement for the purpose of coordinating the implementation of the procedures described in subsection C and D of this section.

F. At a minimum, the memorandum of agreement shall contain:

1. The relevant responsibilities and authorities of each of the coordinating agencies.
2. As appropriate, procedures, schedules and responsibilities for development of nonattainment or maintenance area plans or plan revisions and for determining reasonable further progress.
3. Assurances for adequate plan implementation.
4. Procedures and responsibilities for tracking plan implementation.
5. Responsibilities for preparing demographic projections including land use, housing, and employment.
6. Coordination with transportation programs.
7. Procedures and responsibilities for adoption of control measures and emissions limitations.
8. Responsibilities for collecting air quality, transportation and emissions data.
9. Responsibility for conducting air quality modeling.
10. Responsibility for administering and enforcing stationary source controls.

11. Provisions for the timely and periodic sharing of all data and information among the signatories relating to:
    (a) Demographics.
    (b) Transportation.
    (c) Emissions inventories.
    (d) Assumptions used in developing the model.
    (e) Results of modeling done in support of the plan.
    (f) Monitoring data.

G. Each agency that commits to implement any emission limitation or other control measure, means or technique contained in the implementation plan shall describe that commitment in a resolution adopted by the appropriate governing body of the agency. The resolution shall specify the following:

1. Its authority for implementing the limitation or measure as provided in statute, ordinance or rule.
2. A program for the enforcement of the limitation or measure.
3. The level of personnel and funding allocated to the implementation of the measure.

H. The state, in accordance with the rules adopted pursuant to section 49-404, and the governing body of the metropolitan planning organization shall adopt each nonattainment or maintenance area plan developed by a certified metropolitan planning organization. The adopted nonattainment or maintenance area plan shall be transmitted to the department for inclusion in the state implementation plan provided for under section 49-404.

I. After adoption of a nonattainment or maintenance area plan, if on the basis of the reasonable further progress determination described in subsection F of this section or other information, the control officer determines that any person has failed to implement an emission limitation or other control measure, means or technique as described in the resolution adopted pursuant to subsection G of this section, the control officer shall issue a written finding to the person, and shall provide an opportunity to confer. If the control officer subsequently determines that the failure has not been corrected, the county attorney, at the request of the control officer, shall file an action in superior court for a preliminary injunction, a permanent injunction, or any other relief provided by law.

J. After adoption of a nonattainment or maintenance area plan, if, on the basis of the reasonable further progress determination described in subsection F of this section or other information, the director determines that any person has failed to implement an emission limitation or other control measure, means or technique as described in the resolution adopted pursuant to subsection G of this section, and that the control officer has failed to act pursuant to subsection I of this section, the director shall issue a written finding to the person and shall provide an opportunity to confer. If the director subsequently determines that the failure has not been corrected, the attorney general, at the request of the director, shall file an action in superior court for a preliminary injunction, a permanent injunction, or any other relief provided by law.

K. Notwithstanding subsections A and B of this section, in any metropolitan area with a metropolitan statistical area population of less than two hundred fifty thousand persons, the governor shall designate an agency that meets the criteria of section 174 of the clean air act and that is recommended by the city

that causes the metropolitan area to exist and the affected county. That agency shall prepare and adopt the nonattainment or maintenance area plan. If the governor does not designate an agency, the department shall be certified as the agency responsible for the development of a nonattainment or maintenance area plan for that area.

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# Authorizing Statute

## A.R.S. § 49-425

**A.R.S. § 49-425.** *Rules; hearing*

A. The director shall adopt such rules as he determines are necessary and feasible to reduce the release into the atmosphere of air contaminants originating within the territorial limits of the state or any portion thereof and shall adopt, modify, and amend reasonable standards for the quality of, and emissions into, the ambient air of the state for the prevention, control and abatement of air pollution. Additional standards shall be established for particulate matter emissions, sulfur dioxide emissions, and other air contaminant emissions determined to be necessary and feasible for the prevention, control and abatement of air pollution. In fixing such ambient air quality standards, emission standards or standards of performance, the director shall give consideration but shall not be limited to the relevant factors prescribed by the clean air act.

B. No rule may be enacted or amended except after the director first holds a public hearing after twenty days' notice of such hearing. The proposed rule, or any proposed amendment of a rule, shall be made available to the public at the time of notice of such hearing.

C. The department shall enforce the rules adopted by the director.

D. All rules enacted pursuant to this section shall be made available to the public at a reasonable charge upon request.

# Exhibit CIII - Public Notice and Affidavit of Publication of Notice

(This portion will be added once the Public Hearing has been conducted)

# Exhibit CIV -  Public Hearing Agenda

(This portion will be added once the Public Hearing has been conducted)

# Exhibit CV - Public Hearing Sign-In Sheet

(This portion will be added once the Public Hearing has been conducted)

# Exhibit CVI - Public Hearing Officer Certification

(This portion will be added once the Public Hearing has been conducted)

# Exhibit CVII - Public Hearing Transcript

(This portion will be added once the Public Hearing has been conducted)

# Exhibit CVIII - Compilation of Comments and State Responses.

(This portion will be added once the Public Hearing has been conducted)