# FINAL

# SAN MANUEL

# SULFUR DIOXIDE NONATTAINMENT AREA

# STATE IMPLEMENTATION
# AND
# MAINTENANCE PLAN

## AIR QUALITY DIVISION

**ARIZONA DEPARTMENT OF ENVIRONMENTAL QUALITY**

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## 1.0 INTRODUCTION

### 1.1 Executive Summary

This document includes an attainment demonstration and formal request to the United States Environmental Agency (EPA) to redesignate the San Manuel, Arizona area, a nonattainment area for sulfur dioxide ($SO_2$), to attainment for the health-based 24-hour average and annual average $SO_2$ National Ambient Air Quality Standards (NAAQS). It summarizes the progress of the area in attaining the $SO_2$ standard, demonstrates that all Clean Air Act (CAA) requirements for attainment have been adopted, and includes a maintenance plan to assure continued attainment after redesignation.

The air quality record included in Chapter 3 of this document shows that ambient air quality monitors located in the San Manuel nonattainment area have recorded no violations of the primary $SO_2$ NAAQS since 1979 or secondary $SO_2$ NAAQS since 1985. This meets the EPA requirement for demonstrating a minimum of eight consecutive quarters of ambient air quality measurements that are below the $SO_2$ NAAQS.

This document also demonstrates that the emission reduction control measures responsible for the air quality improvement are both permanent and enforceable. Based on state point source and EPA National Emissions Trends (NET) mobile and area source emissions inventories, the primary source of $SO_2$ in the nonattainment area is the copper smelter located near San Manuel, Arizona. The 1998 base-year San Manuel nonattainment area emissions inventory, presented in Chapter 4, lists the sources in the nonattainment area and their $SO_2$ emissions. Details of the of the updated modeling demonstration are contained in Chapter 5. Chapter 6 describes the primary control measures implemented to achieve attainment. These measures include implementation of reasonably available control measures (RACM) to reduce emissions from the smelter near San Manuel.

Chapter 7 describes in detail measures designed to ensure continued maintenance of the $SO_2$ NAAQS for at least ten years after redesignation of the area to attainment.

The clean air quality record, enforceable control measures, and projections of future emissions presented in this document, all demonstrate that the area has attained and will continue to maintain the $SO_2$ air quality standards. With this submittal, ADEQ requests that EPA approve this attainment demonstration and maintenance plan for the San Manuel $SO_2$ nonattainment area and redesignate the area to attainment for the 24-hour and annual NAAQS.

### 1.2 Regulatory Background

The federal air quality standards for $SO_2$ were established to identify maximum ambient concentrations above which adverse effects on human health and welfare may occur. Accordingly, the $SO_2$ standards are divided into two types: primary and secondary. The primary standards are based on the protection of public health and the secondary standard is based on protection of the environment, including protection against damage to animals, vegetation, buildings, and decreased visibility. The original national primary and secondary NAAQS for $SO_2$ were codified in Volume 42 of the Code of Federal Regulations, Part 410 (42 CFR 410) on April 30, 1971, (36 FR 81875) and recodified to 40 CFR 50.4 and 50.5 on November 25, 1971 (36 FR 22384). On May 22, 1996, the EPA promulgated the current primary and secondary NAAQS for $SO_2$ (61 FR 25566) as follows:[1]

| Standard [2] | Annual | 24-hour | 3-hour |
|---|---|---|---|
| Primary | 0.030 ppm (80 $\mu g/m^3$) | 0.14 ppm (365 $\mu g/m^3$) | |
| Secondary | | | 0.5 ppm (1300 $\mu g/m^3$) |

Areas that do not meet the NAAQS may be designated nonattainment for the respective standard. The San Manuel $SO_2$ nonattainment area initially comprised all of Pima and Pinal Counties (43 FR 8968, March 3, 1978) but at the request of the state of Arizona, the boundaries were subsequently reduced to eleven townships in and around San Manuel (44 FR 21261, April 10, 1979). In addition, four adjacent townships were designated as unclassified (See **Figure 1.1** for location map).

[1] Several technical changes were made at this time including stating the standards in parts per million (ppm) to make the $SO_2$ NAAQS consistent with those for other pollutants. The former standards, stated in micrograms per cubic meter (ug/m$^3$) are in parentheses.

[2] Violations of the primary and secondary standards are determined as follows: The annual arithmetic mean of measured hourly ambient $SO_2$ concentrations must not exceed the level of the annual standard in a calendar year. The 24-hour and 3-hour averages of measured concentrations must not exceed the level of the respective standard more than once per calendar year (two exceedances of the standard per year is a violation of that standard).

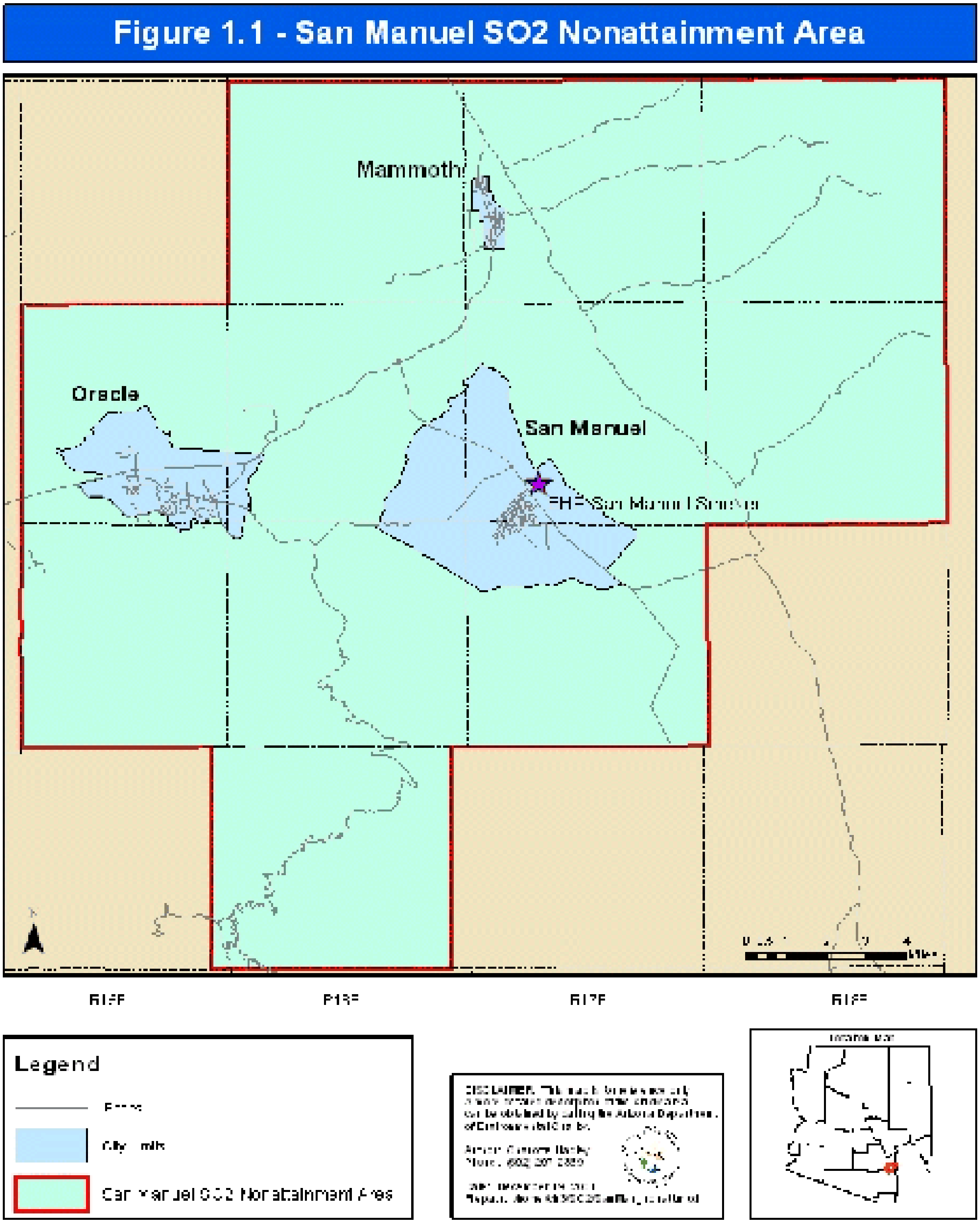


Figure 1.1 - San Manuel SO2 Nonattainment Area
Mammoth
Oracle
San Manuel
Legend

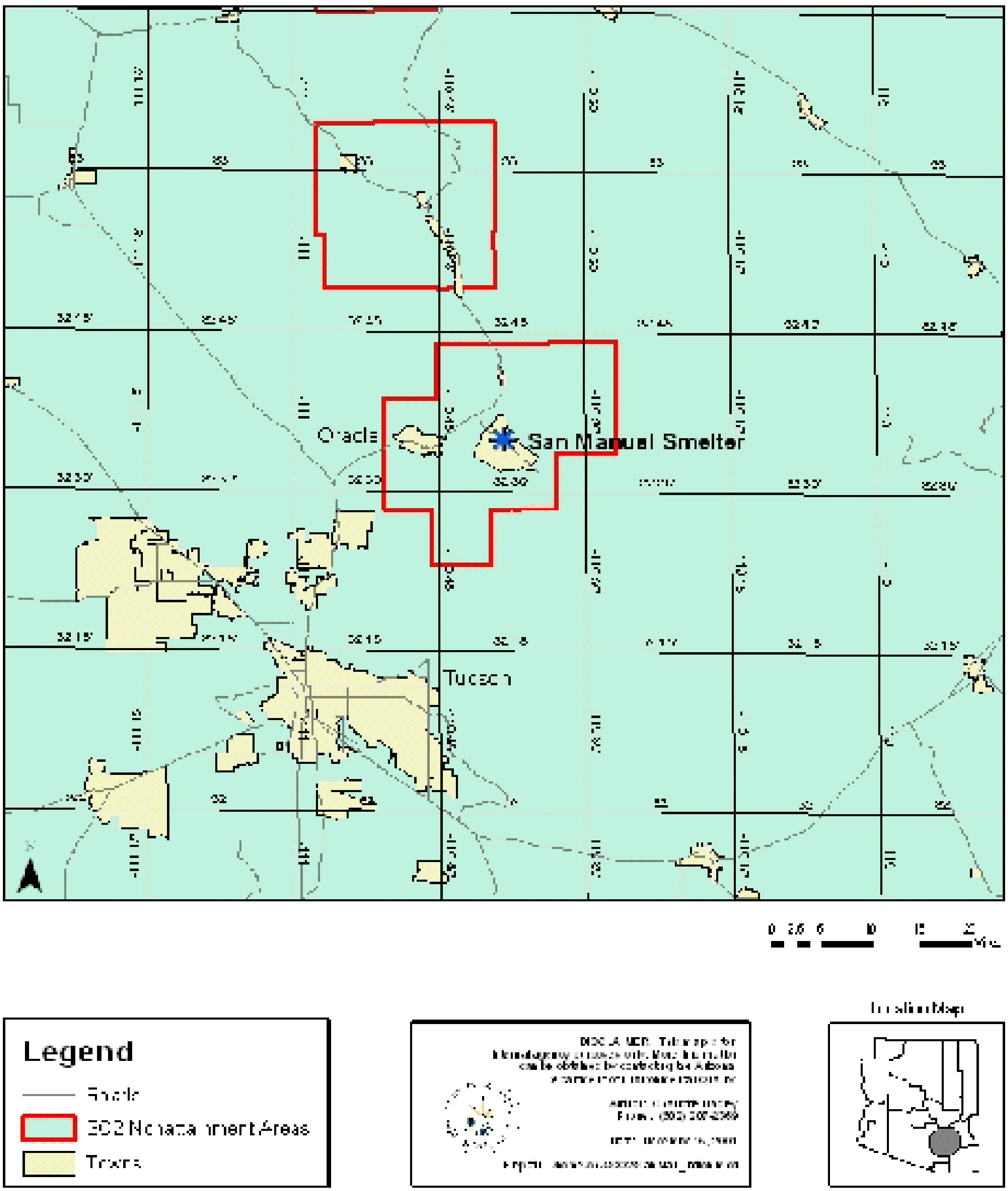
All but one of the townships that define the nonattainment area are located in southeastern Pinal County, with the remaining southernmost township located in neighboring Pima County. The current boundaries of the nonattainment and unclassified areas are codified at 40 CFR 81.303 and are defined by the following complete townships:

**Table 1.1 - Study Area Definition**

| San Manuel Area Description | Does Not Meet Primary Standards | Cannot Be Classified |
|---|---|---|
| T8S, R16E | X | |
| T8S, R17E | X | |
| T8S, R18E | X | |
| T9S, R15E | X | |
| T9S, R16E | X | |
| T9S, R17E | X | |
| T9S, R18E | X | |
| T10S, R15E | X | |
| T10S, R16E | X | |
| T10S, R17E | X | |
| T11S, R16E | X | |
| T10S, R18E | | X |
| T11S, R17E | | X |
| T12S, R16E | | X |
| T12S, R17E | | X |

The relationship between major $SO_2$ point sources and ambient air quality is relatively well-defined. Emissions inventories demonstrate that the BHP Copper (formerly Magma Copper Company) San Manuel smelter comprises 99 percent of total $SO_2$ emission in the nonattainment area (See **Chapter 4**). The primary copper smelter is located near the town of San Manuel, Pinal County, Arizona; at latitude 32° 36'58" N and longitude 110° 37'19" W, at an elevation of 3,208 feet above mean sea level (See **Figure 1.2**, on the next page). As required by the Clean Air Act (CAA), Arizona submitted a State Implementation Plan (SIP) for all major sources in the state in 1972. The portion of the SIP pertaining to attainment and maintenance of the NAAQS for $SO_2$ did not sufficiently define emissions limitations or require permanent control of emissions for existing copper smelters and was, therefore, disapproved on July 27, 1972 (37 FR 15081). On the same date, EPA proposed revised regulations for control of sulfur oxides emitted by all existing smelters in Arizona (37 FR 15096). These regulations were never finalized due to issues regarding the adequacy

**Figure 1.2 - San Manuel SO2 Nonattainment Area**



of the air quality data used to develop the limits. EPA subsequently established an $SO_2$ monitoring network around each smelter (June 1973 - October 1974) to gather air quality data upon which to base emissions limitations.

EPA and State efforts to develop comprehensive emissions limits continued through the 1970s. In 1977, the State developed rules for the use of Supplementary Control Systems (SCS), whereby, based on ambient monitoring data, the smelters could intermittently curtail emissions to meet the $SO_2$ NAAQS. EPA disapproved this approach and required installation and operation of $SO_2$ emissions controls at all times to adequately to meet the NAAQS. Consequently, on January 4, 1978, EPA published final emissions limits for the Arizona smelters based on the 1973-1974 air quality data and the use of a proportional rollback model (43 FR 755). These regulations specified an emission rate and appropriate compliance test methods for each smelter. The 1977 Clean Air Act Amendments, however, modified smelter control requirements to allow the temporary use of SCS while the ultimate $SO_2$ emission limits were developed and also allowed certain smelters additional time for emissions control technology to be installed. In response to this action, Arizona began development of new regulations and on September 20, 1979, submitted Multi-point Rollback (MPR) rules as a proposed revision to the Arizona SIP.[3]

The use of MPR to establish emissions limits in the rules addressed the problem of inherently variable $SO_2$ emissions from smelting operations by correlating the frequency of emissions at various levels with the probability of violating the ambient standards. This technique, "rolled back" a yearly emission profile to a level protective of the standards. The new regulations also set requirements for analyzing the impact of smelter $SO_2$ fugitive emissions on ambient air quality and the implementation of any necessary fugitive controls. The San Manuel area was subsequently classified by operation of law as nonattainment for the primary $SO_2$ standards by EPA following the enactment of the 1990 Clean Air Act Amendments. The nonattainment designation became effective on November 15, 1990.

The MPR rules, which established stack emission limits for the smelters, were approved by EPA on January 14, 1983 (48 FR 1717). Following EPA's approval of the rule, a consent decree between EPA, ADEQ and Magma Copper Company, now owned by BHP, (#CIV 87-106-TUC-WBD, dated September 28, 1987) was agreed to and required implementation of improved control technology, including replacement of reverberatory furnaces with a flash furnace, installation of converter secondary hoods for capture and venting of gases to the stack, and a double absorption acid plant retrofit. These controls significantly reduced emissions and allowed the smelter to come into compliance with the emissions limits in the MPR rules. The San Manuel smelter came into full compliance with the MPR regulations in November 1988. Additional consent decree requirements to install and operate fugitive capture systems on the new flash furnace, as well as the existing copper converters, also reduced smelter fugitive emissions.

On April 3, 1986, BHP submitted to the State [Arizona Department of Health Services

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[3] Arizona Code of Rules and Regulations (ACRR): Rule (R)9-3-515 (recodified as Arizona Administrative Code (AAC) R18-2-715, Standards of Performance for Existing Primary Copper Smelters; Site-specific Requirements)

(ADHS)] a plan describing $SO_2$ fugitive emission units, its evaluation, and a demonstration study, to partially fulfill outstanding SIP commitments for analysis of fugitive emissions. The results of a fugitive $SO_2$ emissions study of the launders (where slag and matte tapping operations occur) was submitted on November 18, 1989. A Differential $SO_2$ Ambient Impact Assessment Report was completed and submitted on January 28, 1993. Subsequently, on March 24, 1998, BHP was issued a Significant Permit Revision (Permit Number 1000681) that allowed the company to perform multiple equipment upgrades for certain smelter equipment. These upgrades were completed during a 45-day shutdown beginning in May 1999. Although the upgraded smelter was functionally ready to operate at the end of June 1999, BHP made a decision to temporarily cease operations due to low copper prices. In 2001, BHP anticipated restarting smelting operations. However, since the smelter was shut down for more than two years, BHP was required to perform an air quality impact analysis pursuant to Arizona Administrative Code (AAC) Title 18, Chapter 2, Article 4 (R18-2-411) prior to resumption of operations and demonstrate that the startup would not cause or contribute to a violation of the national ambient air quality standards for $SO_2$.[4] BHP conducted the ambient impact analysis at much lower emissions limits than those stated in the MPR SIP rules. The demonstration analyzed maximum actual stack and fugitive emissions, in relation to resulting ambient concentrations. Based on this analysis, BHP applied for and received a permit revision in 2001 to incorporate these more stringent emission limits in the permit. A 2001 rulemaking revised R18-2-715 to new incorporate the new emissions limits. The revisions further reduced the smelter's stack emissions limits and added new limits for converter roof fugitive emissions (See **Appendix A**). The new limits provide a considerable margin of safety to ensure protection of the $SO_2$ NAAQS throughout the maintenance period to year 2015, thus allowing the state to request the area be redesignated to attainment for $SO_2$.

## 1.3 Physical, Demographic, and Economic Description of the San Manuel Area

### 1.3.1 Climate and Physiography

Both desert terrain and mountain ranges are found within Pinal County's landscape. Elevations range from near 2,000 to more than 6,000 feet above sea level in the nonattainment area with the town of San Manuel situated at an elevation near 3,400 feet. This unique environment experiences both warm desert and cool alpine climates. In San Manuel, the hottest month of the year is July, when the average daily maximum temperature is 97° Fahrenheit (F). January is the coolest month with an average daily minimum temperature of 35° F.

Precipitation generally occurs in two seasons. The wettest month in San Manuel is July when monsoonal thunderstorms produce an average monthly total of 2.67" (inches) of rain. Pacific winter storms moving across the area in December produce an average of 1.51" monthly precipitation in the form of rain or snow. The driest month is June, with an average of 0.25" of rain. The average

[4] See Appendix A for all pertinent sections of Arizona Administrative Code in this document.

yearly precipitation is 14.59".

### 1.3.2 Population

San Manuel is located in the broad San Pedro River Valley of southeastern Pinal County. Mammoth and Oracle are located within a ten-mile radius. Florence, located in the central Pinal County, is the county seat.

Although the growth rate of the San Manuel census designated place (CDP) exceeded 25 percent during the 1970s, by 1990 it lost 30 percent more inhabitants than it gained during the 1970s.[5] The 2000 Census showed that San Manuel grew at a rate of 9 percent during the 1990s. In comparison, Mammoth continued to lose population during each of the three decades. The Oracle CDP gained more than 22 percent and 17 percent during the 1980s and 1990s, respectively.

During the 1970s when rural counties outpaced the growth of urban counties in the U.S., Pinal County grew by more than 32 percent. The county's growth was 28 percent during the 1980s, but it sharply increased to 54 percent during the 1990s. The state grew at 40 percent during the 1990s. Decennial census data for San Manuel CDP, Mammoth, Oracle CDP, and Pinal County are shown in Table 1.2.

**Table 1.2 - Decennial Census Population of San Manuel CDP, Mammoth, Oracle CDP, and Pinal County: 1970-2000**

| Year | April 1, 1970 | April 1, 1980 | April 1, 1990 | April 1, 2000 |
|---|---|---|---|---|
| San Manuel CDP | 4,332 | 5,443 | 4,009 | 4,375[6] |
| San Manuel's decennial change | | 25.6% | -26.3% | 9.1% |
| Mammoth | 1,953 | 1,906 | 1,845 | 1,762 |
| Mammoth's decennial change | | -2.4% | -3.2% | -4.5% |
| Oracle CDP[7] | | 2,484 | 3,043 | 3,563 |
| Oracle's decennial change | | | 22.5% | 17.1% |
| Pinal County | 68,579 | 90,918 | 116,397 | 179,727 |

[5] Census Designated Places (CDPs) are delineated for decennial censuses. CDPs are places that are not legally incorporated and represent the statistical counterparts of incorporated places.

[6] The 2000 Census shows a population of 4,375 with 1,832 housing units of which 1,458 are occupied (20.4 percent vacant). The number of occupied housing units equals the number of households residing in San Manuel with 3.0 persons per household. San Manuel has no group quarters population.

[7] No data available for 1970.

| Table 1.2 - Decennial Census Population of San Manuel CDP, Mammoth, Oracle CDP, and Pinal County: 1970-2000 | | | | |
|---|---|---|---|---|
| **Year** | **April 1, 1970** | **April 1, 1980** | **April 1, 1990** | **April 1, 2000** |
| Pinal's decennial change | | 32.6% | 28.0% | 54.4% |

Source: U.S. Bureau of the Census, decennial census counts.

Arizona Department of Economic Security (DES) population estimates are the official statistics for the State and differ slightly from the 2000 Census population counts. Table 1.3 portrays the DES projected growth of San Manuel CDP, Mammoth, Oracle CDP, and Pinal County in five-year increments from 2000 to 2015. Projected populations by the DES for Pinal County for 2000 is ten percent lower than the 2000 Census population. The Oracle CDP and Mammoth, however, have DES projected populations for 2000 that are higher than the 2000 Census populations by about 37 percent and 15 percent, respectively. According to the Arizona Department of Economic Security, Oracle CDP and Mammoth are projected to grow about 44 percent and 6 percent, respectively, between 2000 and 2015. San Manuel CDP is projected to grow 7 percent during this same time period.

| Table 1.3 - Population Projections for San Manuel CDP, Mammoth, Oracle CDP, and, Pinal County: 2000-2015 | | | | |
|---|---|---|---|---|
| **Year** | **July 1, 2000** | **July 1, 2005** | **July 1, 2010** | **July 1, 2015** |
| San Manuel CDPP | 4,392 | 4,503 | 4,604 | 4,698 |
| Mammoth | 2,020 | 2,066 | 2,108 | 2,146 |
| Oracle CDP | 4,909 | 5,687 | 6,402 | 7,048 |
| Pinal County | 161,630 | 181,487 | 199,715 | 216,215 |

Source: Arizona Department of Economic Security, August 1, 1997.

### 1.3.3 Economy

Pinal County was created in 1875 from portions of Maricopa and Pima Counties by the eighth territorial legislature. The county covers 5,371 square miles. The State of Arizona is the county's largest landholder with 35.3 percent. Individual and corporate ownership accounts for 25.7 percent of the land area. Indian reservations cover 20.3 percent; the US Forest Service and Bureau of Land Management hold 17.5 percent; and other public lands comprise the remaining 1.2 percent. Pinal County is a great source of mineral wealth. Silver originally attracted settlers to the area, but as the silver resources were depleted, copper was mined. In 1944, Magma Copper Company purchased existing mining claims in the eastern portion of the county and launched a development and exploration program. In 1996, Magma was purchased by BHP Copper, which in 2001 became known as BHP Billiton.

According to the most recent publication of *County Business Patterns*, economic sectors with more than 3,000 employees in Pinal County include: mining (3,214), manufacturing (4,151), retail trade (4,532), health care and social assistance (3,022), and accommodation and food services (3,653).[8] Data exclude agricultural production employees and most government employees, as well as self-employed, employees of private households, and railroad employees.

Table 1.4 contains employment, expressed as percentages of total nonfarm employees, for Pinal County for 1994, 1997, and 2000. This table also includes labor force data. Table 1.4 is included to demonstrate the decline in mining and quarrying activities and the relatively consistent proportions of the other economic activities in the county.

The major local employer in San Manuel has been BHP Copper Smelting and Refining Company that operated underground and open pit copper mines and associated activities. However, the operations were temporarily stopped in June of 1999.

According to Arizona Department of Commerce, smaller mines and quarries, as well as cattle ranches, in this area provide employment opportunities. Table 1.5 shows a selected time series of civilian labor force data for San Manuel.

[8] U.S. Department of Commerce, U.S. Census Bureau, Table 6, "Counties_Employees, Payroll, and Establishments by Industry: 1999," issued April 2001. Data represent the number of employees for the week including March 12.

| Table 1.4 - EconomicActivity in Pinal County by Number of Employees: 1994, 1997, and 2000 | | | |
|---|---|---|---|
| **Economic activity**[9] | **1994** | **1997** | **2000** |
| Civilian labor force | 48,950 | 54,450 | 59,425 |
| Unemployment | 2,800 | 2,725 | 2,475 |
| Unemployment rate | 5.7% | 5.0% | 4.2% |
| Total employment | 46,150 | 51,725 | 56,950 |
| Non-farm employment | 36,100 | 39,775 | 36,525 |
| Mining and quarrying | 10.8% | 13.1% | 3.7% |
| Construction | 3.3% | 4.5% | 3.8% |
| Manufacturing | 11.9% | 7.6% | 8.6% |
| TCPU | 1.9% | 2.0% | 2.3% |
| Trade | 19.9% | 19.0% | 21.0% |
| FIRE | 1.7% | 2.1% | 2.3% |
| Services and misc. | 16.1% | 18.1% | 20.3% |
| Government | 33.2% | 33.2% | 38.0% |

Source: Derived from Arizona Department of Economic Security data. Totals may not add to 100 percent.

| Table 1.5 - Civilian Labor Force Data for San Manuel CDP: Selected Years | | | | | |
|---|---|---|---|---|---|
| **Year** | **1990** | **1995** | **1998** | **1999** | **2000** |
| Civilian Labor Force | 1,704 | 1,943 | 2,113 | 2,252 | 2,225 |
| Number Unemployed | 77 | 47 | 44 | 63 | 47 |
| Unemployment Rate | 4.5% | 5.9% | 5.1% | 6.8% | 5.2% |

Source: Arizona Department of Economic Security. Data represent annual averages. Numbers for 1999 and 2000 are preliminary.

## 1.4 General SIP Approach

In November 1990, the United States Congress enacted a series of amendments to the Clean Air Act (CAA) intended to improve air quality across the nation. One of the primary goals of this

[9] TCPU = Transportation, Communication, and Public Utilities; FIRE = Finance, Insurance, and Real Estate.

comprehensive revision to the CAA was to expand and clarify the planning provisions for those areas not currently meeting the NAAQS. The CAA as amended identifies specific emission reduction goals, requires both a demonstration of reasonable further progress and attainment, and incorporates more stringent sanctions for failure to attain or to meet interim milestones.

CAA, Title I, Part A, and Title I Part D, Subparts 1 and 5 are applicable to this SIP and maintenance plan. Sections 172, 175(A), 191, and 192, in the following section, set forth the following requirements for $SO_2$ nonattainment areas.

### 1.4.1 CAA Section 172(c), Nonattainment Plan Provisions

**172(c)(1) - In General: "...implementation of all reasonably available control measures (RACM) as expeditiously as practicable (including such reductions in emissions for existing sources in the area as may be obtained through the adoption, at a minimum, of reasonably available control technology (RACT)) and provide for attainment of the national primary ambient air quality standards."**

BHP Copper, the primary source of $SO_2$ emissions in the San Manuel nonattainment area, succeeded in implementing RACM/RACT at the smelter sufficient to attain the NAAQS for $SO_2$ and went beyond the required technology to increase the facility's efficiency in capturing and treating $SO_2$. RACT for $SO_2$ emission controls for a flash smelting furnace include:

1. Dust Collection Equipment (removes dust for better gas treatment),
2. Wet Scrubber,
3. Minimization of Leaks,
4. Hooding and venting of gases to the stack, and
5. Contact Sulfuric Acid Plant.

Chapter 6 contains further explanation of applicable RACM/RACT for the BHP smelting facility and other $SO_2$ point sources in the nonattainment area.

**172(c)(2) - Reasonable Further Progress (RFP): "...plan provisions shall demonstrate reasonable further progress such that annual incremental reductions in emissions ensure attainment of the national ambient air quality standards by the applicable date."**

This submittal demonstrates that the San Manuel nonattainment area has obtained and will maintain the $SO_2$ NAAQS with current control measures (See **Chapter 6**).

**172(c)(3) - Inventory: "...the plan shall include a comprehensive inventory of actual emissions from all sources of relevant pollutant(s)."**

ADEQ maintains a historical and current database of actual emissions from State-permitted point and area sources. The Pinal County Air Quality Control District maintains a similar database of actual emissions from County-permitted sources. All non-permitted source emissions data (ie: mobile sources) is obtained from EPA's national emissions inventory.[10] Base-year (1998) emissions and projected 2015 emissions are contained in Chapter ~~3~~ 4.

**172(c)(5) - Permits for New and Modified Major Stationary Sources: "...the plan shall require permits for the construction and operation of new and modified major stationary sources throughout the nonattainment area."**

All new sources and modifications to existing sources in Arizona are subject to state requirements for preconstruction review and permitting pursuant to AAC, Title 18, Chapter 2, Articles 3 and 4. All new major sources and major modifications to existing major sources in Arizona are subject to the New Source Review (NSR) provisions of these rules or Prevention of Significant Deterioration (PSD) for maintenance areas. The State NSR program was conditionally approved by EPA in 1992, and is pending final approval. It should be noted that ADEQ currently has full approval of its Title V permit program.

**172(c)(6) - Other Measures: "...the Plan shall include enforceable emissions limitations and such other control measures, means or techniques, as well as schedule and timetables for compliance, as may be necessary or appropriate to provide for attainment of such standard in such area by the applicable attainment date."**

AAC R18-2-715, Standards of Performance Primary Copper Smelters, Site Specific Requirements, contains the required annual average emission limitations and number of three-hour average emission limits for the BHP smelter.[11] AAC R18-715.01 (Standards of Performance for Existing Primary Copper Smelters; Compliance and Monitoring), set forth the compliance date of January 14, 1986, for monitoring, calibration, measurement system performance requirements, record keeping, bypass operation, and issuance of notices of violation. Details regarding emissions limitations and control measures for all $SO_2$ sources in the nonattainment area may be found in Chapter 4.

**172(c)(7) - Compliance with Section 110(a)(2): "...the Plan shall be in compliance with Section 110 (a)(2) (Implementation Plans) of CAA."**

Section 110(a)(2)(A) of CAA requires that states provide for enforceable emission limitations

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[10] AIR*Data* provides access to air pollution data for the entire United States and can be found at http://www.epa.gov/air/data/index.html

[11] Standards of Performance for Existing Primary Copper Smelters; Site-specific Requirements, AAC R18-2-515, renumbered AAC R18-2-715 (1993).

and other control measures, means, or techniques, as well as schedules for compliance. Chapter 4 includes the list of control measures utilized to bringthis area into attainment and future maintenance of the $SO_2$ NAAQS.

Section 110(a)(2)(B) of CAA requires that states provide for establishment and operation of appropriate devices, methods, systems, and procedures necessary to monitor, compile, and analyze data on ambient air quality. Under ADEQ's air quality assessment program, ambient monitoringnetworks for air quality are established to sample pollution in a variety of representative settings, to assess the health and welfare impacts and to assist in determining air pollution sources. The monitoringsites are combined into networks, operated by a number of government agencies and regulated companies. Each network is comprised of one or more monitoring sites, whose data are compared to the NAAQS, as well as statistically analyzed in a variety of ways. The agency or company operating a monitoring network also tracks data recovery, quality control, and quality assurance parameters for the instruments operated at their various sites.

The collected data are summarized into the appropriate quarterly or annual averages. The samplers are certified by Federal Reference or Equivalent Methods. Regular checks of the stability, reproducibility, precision, and accuracy of the samplers and laboratory procedures areconducted by either the agency or company network operators. The protocol for $SO_2$ monitoring used by the State, local agencies, and companies was established by EPA in the following sections of the Code of Federal Regulations (CFR):

1. 40 CFR Part 50, Appendix A, Reference Method for the Determination of Sulfur Dioxide in the Atmosphere;
2. 40 CFR Part 53, Subpart B, Procedures for Testing Performance Characteristics of Automated Methods for $SO_2$, CO, $O_3$, and $NO_2$; and
3. 40 CFR Part 58, Subpart A, B, and C, Ambient Air Quality Surveillance.

(Chapter 2 includes monitoring network information and data for the San Manuel area.)

Section 110(a)(2)(C), Section 110 (a)(2)(E), Section 110 (a)(2)(F), and Section 110 (a)(2)(L) of CAA require states to have permitting, compliance, and source reporting authority. Arizona Revised Statutes (ARS) § 49-402 establishes ADEQ's permitting and enforcement authority. As authorized under ARS 49-402, ADEQ retains adequate funding and employs adequate personnel to administer the air quality program. Appendix A includes the organization chart for ADEQ's Air Quality Division.

Under ADEQ's air permits program, stationary sources that emit regulated pollutants are required to obtain a permit before constructing, changing, replacing, or operating any equipment or process which may cause air pollution. This includes equipment designed to reduce air pollution. Permits are also required if an existing business that causes air pollution transfers ownership, relocates, or otherwise changes operations. Additionally, ADEQ is responsible for assessingannual fees to recoup the costs of administering a permit pursuant to AAC R18-2-326.

AAC R18-2-327 requires that any source subject to a permit must complete and submit to the Director their responses to an annual emissions inventory questionnaire. A current air pollutant emissions inventory of both permitted and non-permitted sources within the state is necessary to properly evaluate the air quality program effectiveness, as well as determine appropriate emission fees for major sources. This inventory encompasses those sources under state jurisdiction emitting 1 ton per year or more of any individual regulated air pollutant, or 2.5 tons per year (tpy) or more of any combination of regulated air pollutants.[12] ADEQ is responsible for the preparation and submittal of an emissions inventory report to EPA for major sources and emission points prescribed in 40 CFR 51.322, and for sources that require a permit under ARS §49-426 for criteria pollutants.

Under ADEQ's air quality compliance program, scheduled and unscheduled inspections are conducted at the major sources annually. ADEQ's Air Compliance Section also implements compliance assistance initiatives to address non-compliance issues (i.e., seminars and workshops for the regulated community explaining the general permit requirements, individual inspections of all portable sources within a geographical area, mailings, etc.). In addition, compliance initiatives are developed to address upcoming or future requirements (i.e., new general permits) and include such actions as training for inspectors; development of checklists and other inspection tools for inspectors; public education workshops; targeted inspections; mailings, etc. ADEQ's Air Compliance Section also has an internal performance measure to respond to all complaints as soon as possible, but within five working days.

Section 110(a)(2)(G) of CAA requires that states provide for authority to establish emergency powers and authority and contingency measures to prevent imminent endangerment. AAC R18-2-220 prescribes the procedures the Director of ADEQ shall implement in order to prevent the occurrence of ambient air pollution concentrations which would cause significant harm to the public health. As authorized by ARS §49-426.07, ADEQ may seek injunctive relief upon receipt of evidence that a source or combination of sources is presenting an imminent and substantial endangerment to public health or the environment.

**172(c)(8) - Equivalent Techniques: "...the Plan may use equivalent techniques such as equivalent modeling, emission inventory, and planning procedures allowed by the administrator, upon application by any state."**

Multi-Point Rollback modeling was used with EPA's concurrence to establish emissions limits for the BHP Copper smelter and updated as part of the current SIP process. Modeling for the fugitive emissions study at this facility was conducted with models from EPA's "Guideline on Air Quality Models."

**172(c)(9) - Contingency Measures: "...the Plan shall provide for the implementation**

[12] "Regulated air pollutant" is defined in AAC R18-2-101 as any of the following: (a) Any conventional air pollutant as defined in ARS §49-401.01; (b) Nitrogen oxides and volatile organic compounds; (c) Any air contaminant that is subject to a standard contained in Article 9 of Chapter 2; (d) Any hazardous air pollutant as defined in ARS §49-401.01; (e) Any Class I or II substance listed in Section 602 of the Act.

**of specific measures to take effect without further action by the state or the Administrator in the event the area fails to make reasonable further progress (RFP) or to attain the primary national ambient air quality standards (NAAQS).”**

As noted in 172(c)(2) above, this submittal includes monitoring data and source permit information that demonstrate that the applicable area has obtained, and will maintain, the $SO_2$ NAAQS with control measures currently fully implemented. As such, the RFP requirement is met.

1.4.2 CAA Section 175(A) - Maintenance Plans

**175(A)(a) - Plan Revisions: “...each state which submits a request for redesignation of a nonattainment area shall also submit a revision of the applicable SIP to provide for the maintenance of the NAAQS for at least ten years after the redesignation.”**

As documented in Chapter 7, this submittal shows attainment through 2015.

**175(A)(b) - Subsequent Plan Revisions: “...eight years after redesignation as an attainment area, the State shall submit 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).”**

ADEQ commits to submit an additional SIP revision eight years after redesignation.

**175(A)(c) - Nonattainment Requirements Applicable Pending Plan Approval: “...until such plan revision is approved and an area is redesignated as attainment for any area designated nonattainment, the requirements of this part shall continue in force and effect.”**

ADEQ commits to keeping all applicable measures in place.

**175(A)(d) - Contingency Provisions: “...each plan revision submitted under this section shall contain such contingency provisions 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 before redesignation.”**

ADEQ commits to implementing all identified measures as necessary (See **Chapter 7**).

1.4.3 CAA Section 191 and 192 - Plan Submission and Attainment Dates

This document fulfills all outstanding implementation plan requirements for the San Manuel $SO_2$ nonattainment area. With the submittal of this SIP and Maintenance Plan, ADEQ requests redesignation of the San Manuel nonattainment area to attainment.

### 1.4.4 Conformity Provisions

Section 176(c)(1)(A) of CAA requires SIPs to contain information regarding the State's compliance with conformity requirements. As stated in 40 CFR 93.153(a), "Conformity determinations for Federal actions related to transportation plans, programs and projects developed, funded, or approved under title 23 U.S.C. or the Federal Transit Act (40 U.S.C. 1601 et seq.) must meet the procedures and criteria of 40 CFR part 51, subpart T, in lieu of the procedures set for in this subpart." 40 CFR 93.103(b) waives transportation conformity for $SO_2$ nonattainment areas, but general conformity for the San Manuel, Pinal County area must still be addressed to assure $SO_2$ emissions from any Federal actions or plans do not exceed the rates outlined in 40 CFR 93.153(b)(1) for nonattainment areas or 40 CFR 93.153(b)(2) for maintenance areas. Criteria for making determinations and provisions for general conformity as outlined in 40 CFR 93.153 can be located in R18-2-1438 of the Arizona Administrative Code. There are no federal plans or actions affecting air quality currently in the San Manuel, Pinal County area, nor are any foreseen through the year 2015.

## 2.0 COMPLIANCE WITH OTHER FEDERAL REGULATIONS

The provisions of 40 CFR 60 Subpart P (§§60.160 - 60.166) Standards of Performance for Primary Copper Smelters are applicable to dryer, roaster, smelting furnace, and copper converter equipment in primary copper smelters.[13] Any facility that commences construction or modification after October 16, 1974, is subject to the requirements of this subpart. The San Manuel smelter was modified in 1988 when the Outokumpu flash furnace, converter secondary hoods, retrofit of the acid plant, and a flux processing unit were installed, per the 1987 Consent Decree, and again in 1992 when the #3 converter was replaced. ADEQ compliance, permit, monitoring, technical, and correspondence files indicate that the facility has complied with all the requirements of this subpart.

[13] Source: 41 FR 2338, Jan. 15, 1976, unless otherwise noted.

## 3.0 $SO_2$ MONITORING NETWORK

Monitoring began in the San Manuel area as early as 1969 by the State of Arizona.[14] BHP began continuous ambient $SO_2$ air quality monitoring in the San Manuel area in 1973. An extensive monitoring network was established with sufficient spatial and temporal coverage to comprehensively evaluate the ambient impact of smelter emissions. More than eighteen stationary and mobile monitoring sites were established throughout the area with as many as ten monitors operating concurrently (See **Table 3.1** and **Figure 3.1**).[15] This ambient $SO_2$ network, comprised of EPA, state, and BHP monitors, was developed as the result of extensive efforts to identify maximum ambient impact areas using diffusion modeling, monitored atmospheric dispersion parameters, citizen observations, and ambient $SO_2$ monitoring.

Stanford Research Institute (SRI), a facility contractor, was engaged to study the effects of $SO_2$ emissions from the San Manuel smelter on the surrounding environment. Criteria for determining ambient $SO_2$ and meteorological monitoring locations under SRI's recommendation, "Environmental Studies at San Manuel, 1972," included consideration of public health, areas of frequent high $SO_2$ concentrations and relatively high long-term average concentrations. A gaussian diffusion model and meteorological records from the Tucson National Weather Service were employed in the study to predict $SO_2$ dispersion patterns in the San Manuel area. In addition, forty-seven sulfation plate monitoring sites were utilized to characterize ambient $SO_2$ over 500 square miles surrounding the area.

The studies contributed to the subsequent expansion of the monitoring network including installation of seven of the initial stationary sites (Mammoth Courthouse, Minesite, Oracle Courthouse, Golf Course, Peppersauce, and Redington) and implementation of a mobile analyzer. Installation of additional meteorological instrumentation at the network sites, measuring wind speed and direction, temperature, and humidity parameters helped to further define airflow and pollutant transport in the region. Utilization of mobile monitors allowed evaluation and verification of ambient $SO_2$ concentrations over a greater area. Numerous sites were monitored and subsequently relocated under the direction of state meteorologists when no significant impacts were observed. All monitoring for $SO_2$ was performed with guidance and dispersion modeling analysis from the Arizona Department of Health Services, Bureau of Air Quality Control.

The monitoring network was also developed in accordance with Supplementary Control Systems (SCS). Prior to implementation of continuous control technology, SCS utilized analysis of atmospheric conditions and monitored ambient concentrations to vary the rate of smelter emissions to avoid any exceedance of the NAAQS. In 1977, the state adopted rules that codified requirements for concurrent operation of at least eight ambient monitors, including a mobile monitor placed at points representative of observed maximum concentrations. Relocation of a stationary monitor was

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[14] *Sulfur Dioxide Monitoring Network Study*, Arizona State Department of Health, Environmental Health Services, Division of Air Pollution Control, 1969.

[15] Protocols for $SO_2$ monitoring established by EPA are found in 40 CFR Part 50, Appendix A, *Reference Method for the Determination of Sulfur Dioxide in the Atmosphere,* Part 58, Subpart B, §58.14, *Special Purpose Monitors,* Subpart C, §58.20, *State and Local Air Monitoring Stations, Air Quality Surveillance: Plan Content,* and Subpart D, §58.30, *National Air Monitoring Stations (NAMS).*

allowed only when:

1. There were no ambient $SO_2$ violations recorded;
2. No SCS curtailment actions were implemented due to data recorded at that monitor;

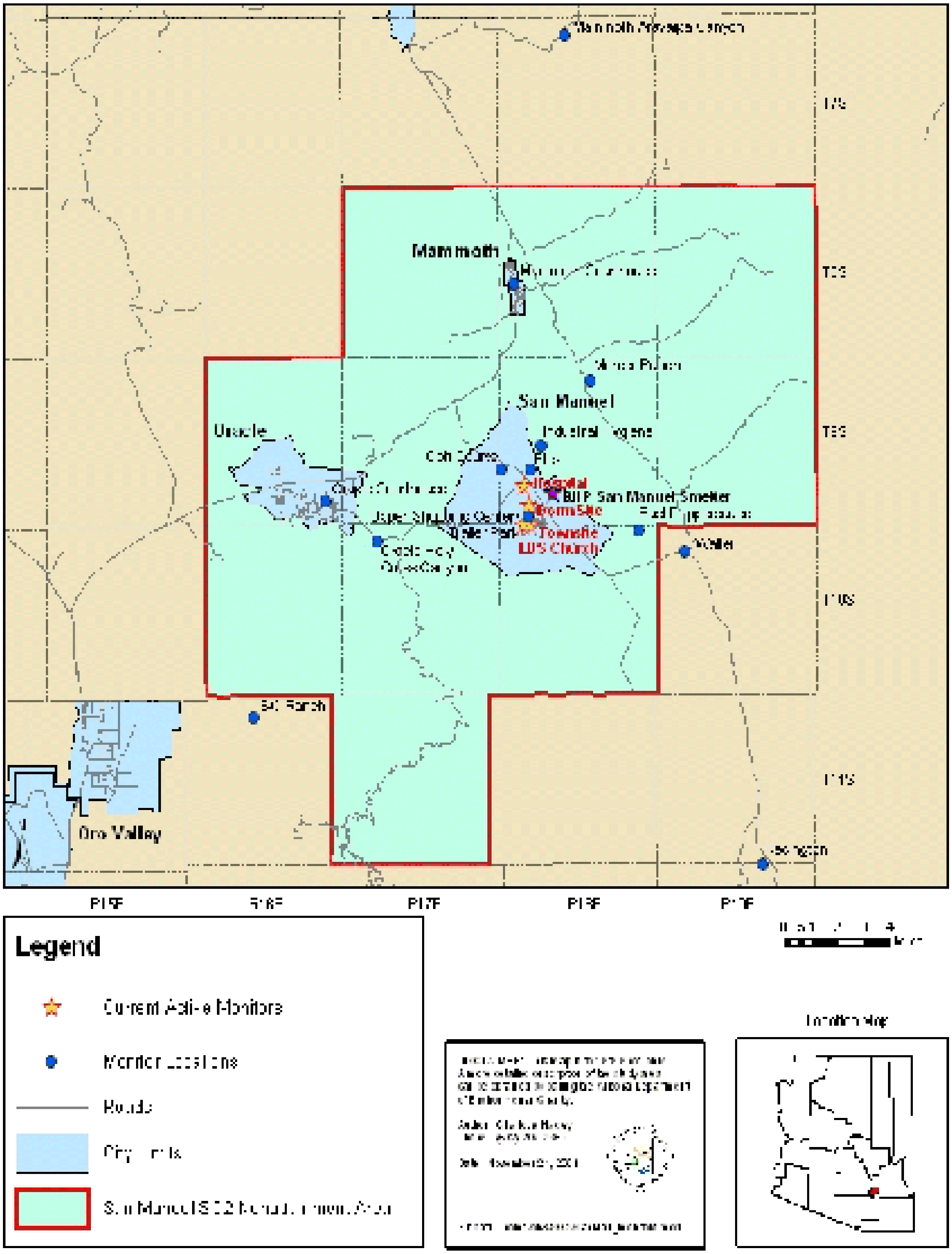
| Table 3.1 - Ambient Monitoring Network | |
|---|---|
| **Monitor Site** | **Period of Operation** |
| **Townsite** | 1969-1974 and 1979-present |
| **Hospital** | 1987-present |
| **LDS Church**[16] | 1975-1999 |
| **Dorm Site** | 1978-present |
| **Elks** | 1987-1994 |
| **Industrial Hygiene** | 1981 |
| **Upper Shopping Center** | 1975-1978 |
| **Golf Course** | 1974-1997 |
| **Trailer Park** | 1974-1975 |
| **Minesite** | 1974-1994 |
| **Mercer Ranch** | 1979-1980 |
| **East Peppersauce Wash** | 1974-1978 |
| **Oracle Courthouse** | 1975-1994 |
| **Oracle Holy Cross Canyon** | 1978-1979 |
| **3-C Ranch** | 1981-1982 and 1987-1994 |
| **Mammoth Courthouse** | 1974-1987 |
| **Mammoth Aravaipa Canyon** | 1980-1981 |
| **Redington** | 1976-1985 |
| **Mobile I** | 1977-1978 |
| **EPA**[17] | 1973-1974 |

[16] The LDS Church monitor was removed in June 1999, due to the temporary closure of the BHP smelter. ADEQ commits to reestablishing this monitoring station by February 2002.

[17] Three EPA established monitoring sites were operated during this period.

SOURCE: Locations compiled from BHP San Manuel operations and ADEQ archives. The 1977/1978 Operations and Mantenance Manual notes eleven experimental mobile monitoring locations to date.

# Figure 3.1 - San Manuel SO2 Monitor Locations



3. The foregoing conditions were due to implementation of improved emissions control techniques or other permanent modifications; and
4. A new site was shown to be more representative of the ambient air quality of the area.

Historic ambient $SO_2$ monitoring site locations and periods of operation are provided in Table 3.1, and Figure 3.1 and 3.2.

Further refinement of the monitoring network was required by the adoption of the MPR rule that established stack emissions limits for the smelter in 1979 based on permanent controls. Placement of additional monitors were established with EPA to further evaluate ambient impacts.

Following BHP's compliance with emissions limits as defined in AAC R18-2-715(F), and based on continuous emissions control technology, the number of permanent monitors was gradually reduced to the current network of four. These are all high impact ambient monitor sites found to be representative of air quality for the area. These monitoring site decisions were made by ADEQ and BHP concurrence and in accordance with EPA guidance.

## 3.1 Current Sampler Type and Siting

The three monitoring units operated by BHP are Thermo Electron pulsed fluorescent (TECO) Model 40 $SO_2$ analyzers. All of these $SO_2$ analyzers are interfaced to BHP's data acquisition system by telemetry. The TECO analyzers measure in the 0-2 ppm range. Redundant recording systems are operated for all of the BHP analyzers. The samplers are connected to strip chart recorders for backup and analyzed by planimeter as necessary for validation of recorded concentrations. The ADEQ $SO_2$ analyzer is also a TECO analyzer, measuring in the 0-2 ppm range (**Figure 3.1** illustrates the current monitor locations and proximity to the BHP smelter). The BHP and ADEQ monitors are operated and maintained in accordance with federal regulations as described in 40 CFR parts 58.13 and 58.22 as well as Appendices A and E of part 58**.**

**Table 3.2 - Current Monitoring Network**

| Unit[18] | Location | Elevation (feet) | Operator |
|---|---|---|---|
| LDS Church | 1.75 miles southwest of BHP | 3570 | ADEQ |
| Townsite[19] | 1.24 miles southwest of BHP | 3480 | BHP |

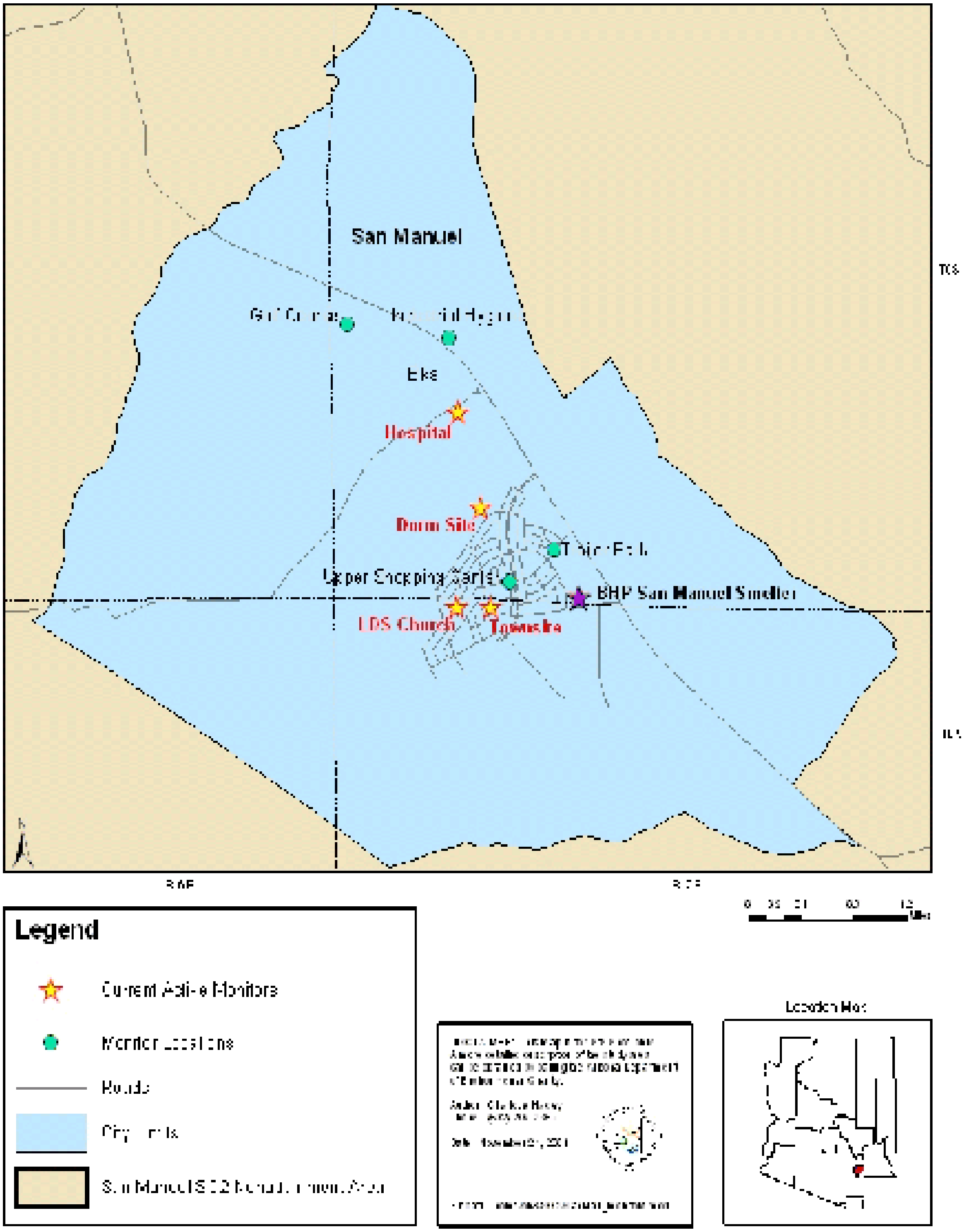
[18] The Dorm Site and Hospital monitors are primarily fugitive emissions impact sites. Townsite and the LDS site are primarily stack impact sites.

[19] The location of the Townsite monitor remains the same as in 1974. This monitor was the "limiting site" for the original MPR analysis ("*Ultimate Sulfur Dioxide Limits for Arizona Copper Smelters,"* Moyers and Peterson, September 14, 1979).

| | | | |
|---|---|---|---|
| Dorm Site[20] | 0.7 miles northwest of BHP | 3400 | BHP |
| Hospital[20] | 0.5 miles southwest of BHP | 3440 | BHP |

[20] EPA required monitoring site per 1987 consent decree.

**Figure 3.2 - San Manuel SO2 Monitor Locations**



## 3.2 Ambient Data Analysis

A review of the $SO_2$ monitoring data in the San Manuel nonattainment area verifies that:

1. There have been no recorded exceedances of the annual NAAQS for $SO_2$ since 1974 and annual averages are generally 17.5 percent of the NAAQS;
2. There have been no recorded exceedances of the 24-hour NAAQS for $SO_2$ since 1994 and maximum 24-hour average $SO_2$ levels are generally 57 percent of the NAAQS; and,
3. There have been no recorded exceedances of the 3-hour NAAQS for $SO_2$ since 1996 and maximum 3-hour averages are generally below 50 percent of the NAAQS.

The nonattainment area has recorded more than eight current, consecutive quarters of quality assured, violation-free data from May 1997 through April, 1999.[21] Data for the current monitoring network is presented in Table 3.3, on the following pages.

| Table 3.3 - $SO_2$ Ambient Air Quality Monitoring Data ($\mu g/m^3$) | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Year** | **Annual Ave.** | **24-Hour Max** | **3-Hour Max** | **Number of Exceedances** | | | **No. of 1-hr. Samples** |
| | | | | **Annual** | **24-hr.** | **3-hr.** | |
| **LDS Church** | | | | | | | |
| **1999** | 9 | 65 | 220 | 0 | 0 | 0 | 6121 |
| **1998** | 8 | 102 | 707 | 0 | 0 | 0 | 8494 |
| **1997** | 8 | 60 | 291 | 0 | 0 | 0 | 8626 |
| **1996** | 11 | 338 | 1758* | 0 | 0 | 1 | 8183 |
| **1995** | 8 | 55 | 362 | 0 | 0 | 0 | 8491 |
| **1994** | 10 | 466* | 720 | 0 | 1 | 0 | 7857 |
| **1993** | 16 | 94 | 721 | 0 | 0 | 0 | 8696 |
| **1992** | 10 | 121 | 519 | 0 | 0 | 0 | 7794 |
| **1991** | 3 | 367 | 1242 | 0 | 1 | 0 | 8091 |
| **1990** | 13 | 139 | 1053 | 0 | 0 | 0 | 8668 |
| **1989** | 21 | 267 | 631 | 0 | 0 | 0 | 8434 |
| **1988** | 13 | 125 | 793 | 0 | 0 | 0 | 7944 |

[21] The two year period of record prior to the temporary cessation of smelter operations.

| Table 3.3 - $SO_2$ Ambient Air Quality Monitoring Data ($\mu g/m^3$) | | | | | | | |
|---|---|---|---|---|---|---|---|
| Year | Annual Ave. | 24-Hour Max | 3-Hour Max | Number of Exceedances | | | No. of 1-hr. Samples |
| | | | | Annual | 24-hr. | 3-hr. | |
| **1987** | 42 | 191 | 866 | 0 | 0 | 0 | 8737 |
| **1986** | 44 | 282 | 1499 | 0 | 0 | 1 | 8449 |
| **LDS Church con't** | | | | | | | |
| **1985** | 56 | 388 | 1601 | 0 | 1 | 3 | 8667 |
| **1984** | 41 | 236 | 1185 | 0 | 0 | 0 | 8704 |
| **1983** | 34 | 224 | 1243 | 0 | 0 | 0 | 8412 |
| **1982** | 47 | 303 | 1064 | 0 | 0 | 0 | 8058 |
| **1981** | 66 | 284 | 1602 | 0 | 0 | 1 | 8130 |
| **1980** | 32 | 295 | 1953 | 0 | 0 | 2 | 8227 |
| **1979** | 58 | 524 | 2024 | 0 | 1 | 5 | 7403 |
| **1978** | 53 | 509 | 2476 | 0 | 1 | 2 | 6733 |
| **1977** | 58 | 435 | 1820 | 0 | 1 | 2 | 7308 |
| **1976** | 42 | 471 | 3117 | 0 | 1 | 2 | 8002 |
| **1975** | 43 | 563 | 3517 | 0 | 1 | 1 | 3880 |
| **Townsite** | | | | | | | |
| **1999** | 4 | 69 | 290 | 0 | 0 | 0 | N/A |
| **1998** | 8 | 105 | 570 | 0 | 0 | 0 | 8656 |
| **1997** | 33 | 95 | 374 | 0 | 0 | 0 | 8725 |
| **1996** | 18 | 167 | 1068 | 0 | 0 | 0 | 8765 |
| **1995** | 11 | 71 | 372 | 0 | 0 | 0 | 8753 |
| **1994** | 15 | 121 | 410 | 0 | 0 | 0 | 8740 |
| **1993** | 28 | 166 | 919 | 0 | 0 | 0 | 8751 |
| **1992** | 26 | 197 | 923 | 0 | 0 | 0 | 8773 |
| **1991** | 18 | 180 | 1064 | 0 | 0 | 0 | 8752 |
| **1990** | 20 | 222 | 1257 | 0 | 0 | 0 | 8746 |
| **1989** | 42 | 272 | 1294 | 0 | 0 | 0 | 8744 |
| **1988** | 25 | 167 | 1062 | 0 | 0 | 0 | 8771 |
| **1987** | 51 | 276 | 999 | 0 | 0 | 0 | 8723 |

| Table 3.3 - $SO_2$ Ambient Air Quality Monitoring Data ($\mu g/m^3$) | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Year** | **Annual Ave.** | **24-Hour Max** | **3-Hour Max** | **Number of Exceedances** | | | **No. of 1-hr. Samples** |
| | | | | **Annual** | **24-hr.** | **3-hr.** | |
| **1986** | 57 | 291 | 1772 | 0 | 0 | 1 | 8719 |
| **1985** | 61 | 311 | 1514 | 0 | 0 | 2 | 8709 |
| **Townsite Con't** | | | | | | | |
| **1984** | 50 | 337 | 1224 | 0 | 0 | 0 | 8712 |
| **1983** | 49 | 264 | 1484 | 0 | 0 | 1 | 8703 |
| **1982** | 59 | 364 | 1265 | 0 | 0 | 0 | 8680 |
| **1981** | 42 | 312 | 1641 | 0 | 0 | 1 | 8663 |
| **1980** | 32 | 273 | 1283 | 0 | 0 | 0 | 8677 |
| **1979** | 73 | 611 | 3014 | 0 | 2 | 4 | 8554 |
| **Dorm Site** | | | | | | | |
| **1999** | 4 | 54 | 311 | 0 | 0 | 0 | N/A |
| **1998** | 8 | 135 | 262 | 0 | 0 | 0 | 8714 |
| **1997** | 11 | 75 | 220 | 0 | 0 | 0 | 8751 |
| **1996** | 15 | 101 | 415 | 0 | 0 | 0 | 8777 |
| **1995** | 16 | 96 | 317 | 0 | 0 | 0 | 8746 |
| **1994** | 13 | 113 | 766 | 0 | 0 | 0 | 6857 |
| **1993** | 29 | 172 | 930 | 0 | 0 | 0 | 8751 |
| **1992** | 32 | 189 | 783 | 0 | 0 | 0 | 8774 |
| **1991** | 22 | 246 | 855 | 0 | 0 | 0 | 8750 |
| **1990** | 16 | 96 | 763 | 0 | 0 | 0 | 8753 |
| **1989** | 39 | 359 | 2704* | 0 | 0 | 1 | 8749 |
| **1988** | 32 | 193 | 766 | 0 | 0 | 0 | 8772 |
| **1987** | 56 | 268 | 1179 | 0 | 0 | 0 | 8734 |
| **1986** | 59 | 256 | 971 | 0 | 0 | 0 | 8715 |
| **1985** | 67 | 265 | 1280 | 0 | 0 | 0 | 8699 |
| **1984** | 58 | 332 | 1353 | 0 | 0 | 1 | 8745 |
| **1983** | 51 | 295 | 1288 | 0 | 0 | 0 | 8711 |
| **1982** | 73 | 387 | 1701 | 0 | 1 | 4 | 8646 |

| Table 3.3 - $SO_2$ Ambient Air Quality Monitoring Data ($\mu g/m^3$) | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Year** | **Annual Ave.** | **24-Hour Max** | **3-Hour Max** | **Number of Exceedances** | | | **No. of 1-hr. Samples** |
| | | | | **Annual** | **24-hr.** | **3-hr.** | |
| **1981** | 74 | 275 | 1656 | 0 | 0 | 1 | 8679 |
| **1980** | 58 | 340 | 2415 | 0 | 0 | 4 | 8534 |
| **Dorm Site con't** | | | | | | | |
| **1979** | 74 | 412 | 1869 | 0 | 1 | 4 | 8521 |
| **1978** | N/A | 254 | 1085 | N/A | 0 | 0 | 2181 |
| **1999** | 8 | 214 | 433 | 0 | 0 | 0 | N/A |
| **1998** | 11 | 154 | 712 | 0 | 0 | 0 | 8642 |
| **1997** | 32 | 208 | 705 | 0 | 0 | 0 | 8742 |
| **Hospital** | | | | | | | |
| **1995** | 18 | 141 | 593 | 0 | 0 | 0 | 8752 |
| **1994** | 23 | 223 | 1632* | 0 | 0 | 1 | 8746 |
| **1993** | 33 | 170 | 1248 | 0 | 0 | 0 | 8752 |
| **1992** | 38 | 242 | 1179 | 0 | 0 | 0 | 8768 |
| **1991** | 31 | 284 | 2175* | 0 | 0 | 1 | 8751 |
| **1990** | 33 | 60 | 916 | 0 | 0 | 0 | 8751 |
| **1989** | 42 | 279 | 1881* | 0 | 0 | 1 | 8747 |
| **1988** | 41 | 261 | 928 | 0 | 0 | 0 | 8770 |
| **1987** | 54 | 224 | 695 | 0 | 0 | 0 | 1017 |

* - The exceedance was determined to be due to a process/equipment malfunction.

## 4.0 $SO_2$ EMISSIONS INVENTORY FOR POINT, AREA AND MOBILE SOURCES

Emissions inventories from all sources in the San Manuel nonattainment area indicate that although there are other sources of $SO_2$ emissions, the BHP Copper smelter is the primary source for $SO_2$ emissions and comprise more than 99 percent of total emissions in the area. Data shows that no other point, area or mobile sources have contributed, or contribute to the same levels of $SO_2$ in the San Manuel nonattainment area. Emissions units and rates, and derivation of mobile and area source emissions for the nonattainment area are described in Section 4.1 through Section 4.3 below.

### 4.1 $SO_2$ Point Sources

Three point sources are located within the San Manuel nonattainment area. Point source locations are illustrated in Figure 4.1, on the following page. The most current inventories for these sources are presented in Table 4.1.

**Table 4.1 - $SO_2$ Emissions for San Manuel Nonattainment Area - Point Sources**

| Source Name | | 1997 | 1998 | 1999 |
|---|---|---|---|---|
| Oracle Compressor Station | 24 Hr. (tpd) | 0 | 0 | 0 |
| | Annual (tpy) | 0 | 0 | 0 |
| BHP Copper smelting operations[22] | 24 Hr. (tpd) | 32 | 29 | 30 |
| | Annual (tpy) | 11,482 | 10,409 | 3,622[23] |
| BHP Copper mining and milling operations | 24 Hr. (tpd) | <1 | <1 | <1 |
| | Annual (tpy) | <1 | <1 | <1 |
| **24 Hour Total (tpd):** | | **32** | **29** | **30** |
| **Annual Total (tpy):** | | **11,482** | **10,409** | **3,622** |

#### 4.1.1 Oracle Compressor Station

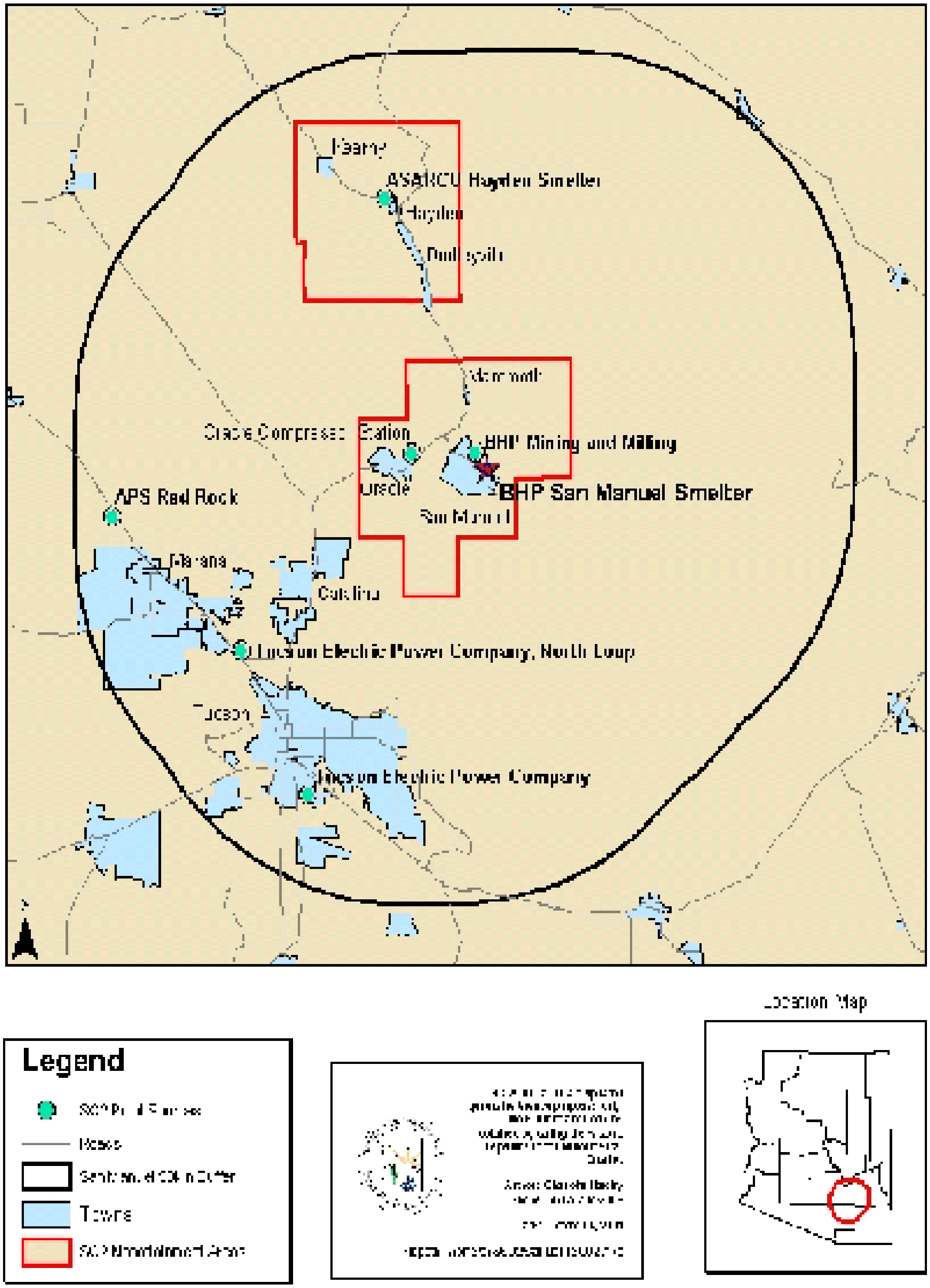
This source is a natural gas transport facility that utilizes a natural gas powered turbine to compress the natural gas for transmission through a pipeline. The facility did not operate from 1997 through 1999. When operating, the Oracle Compressor Station is a very low contributor to ambient

[22] 24-hour inventories are a ton per day (tpd) average calculated by dividing the annual facility emissions by the number of operating days for each year.

[23] Smelting operations were temporarily suspended beginning May 1999.

$SO_2$ levels with total permitted emissions from existing equipment limited to 0.6 tpy.

**Figure 4.1 - Point Sources Within the San Manuel SO2 Nonattainment Area and Major Point Sources Within the 50 Kilometer Buffer**



### 4.1.2 BHP Copper San Manuel Smelter

Smelting and refining of copper ore at BHP's primary copper smelter operations produces copper cathode and copper rod as well as byproducts of the smelting process (molybdenum concentrate, sulphuric acid, and gold and silver) for sale to customers. More than 99 percent of all $SO_2$ emissions in the nonattainment area are generated by this facility when it is operating. Based on 1998 emissions data, the majority of this facility's emissions are from the following stack and fugitive units: flash furnace fugitive stack, acid plant II tail stack, acid plant III tail stack, converter secondary and flash emergency vent stack, concentrate dryer stack, and fugitive emissions from the converter building roof vents. The maximum allowable annual average $SO_2$ emission rate for stacks was reduced from 18,275 lbs/hr to 1,742 lbs/hr with recent revisions to AAC R18-2-715(F)(1) and (G). The revisions also limited fugitive emissions from the converter building roof vents to 715 lbs/hr. The combined limit for the stack and fugitive emissions units is currently 2,457 lbs/hr (10,762 tpy). Permit #1000681 issued March 24, 1998, further limits $SO_2$ emissions from the concentrate dryer to a maximum 2,073 tpy, based on a 12-month rolling monthly average.

Additional de minimis units include emissions from the anode and utility vessel roof vent. Emissions from these units at 1998 operating levels were estimated to be 59 tpy. In addition, the permit limits sulfur content and usage rates for fuel used in all fuel burning equipment. Actual emissions from fuel burning equipment, are minimal, at less than 2.5 tpy. Emissions units and rates for the BHP smelter are detailed in Appendix B.

### 4.1.3 BHP Copper Mining and Milling Operations

This source is a mining and copper ore processing facility where copper sulphide ore is prepared for smelting and refining at the BHP smelter. The primary source of emissions from these minimal $SO_2$ sources are natural gas and diesel burning equipment that include concentrate dryers, generators, and boilers. Permits for the mine and mill require the use of low sulfur natural gas and propane in the generators and limits the potential to emit (PTE) from all existing equipment to 0.38 tpy of $SO_2$. Actual emissions, are minimal, at 0.03 tpy.

## 4.2 Major Point Sources within the 50 km Buffer Area

In addition to the sources located within the nonattainment area, there are several point sources within 50 kilometers of the San Manuel nonattainment area. There is no information to suggest that emissions from these sources have contributed to the same levels of $SO_2$ in the nonattainment area as are demonstrated by the BHP smelter or that emissions from these sources could cause violations in the San Manuel nonattainment area. Attainment year inventories are provided in Table 4.2.

| Table 4.2 - $SO_2$ Emissions within 50km of the San Manuel Nonattainment Area - Point Sources | | | | |
|---|---|---|---|---|
| **Source Name:** | | **1997** | **1998** | **1999** |
| **APS (Red Rock)[24]** | **24 Hr. (tpd)** | <1 | <1 | <1 |
| | **Annual (tpy)** | 1 | 8 | 8 |
| **TEP (Irvington)[24]** | **24 Hr. (tpd)** | 8 | 7 | 9 |
| | **Annual (tpy)** | 2,597 | 1,731 | 2,862 |
| **TEP (North Loop)[24]** | **24 Hr. (tpd)** | N/A | 0 | <1 |
| | **Annual (tpy)** | N/A | 0 | <1 |
| **ASARCO Hayden Smelter[25]** | **24 Hr. (tpd)** | 79 | 66 | 58 |
| | **Annual (tpy)** | 27,533 | 22,077 | 21,081 |
| **24 Hour Total (tpd):** | | **87** | **73** | **67** |
| **Annual Total (tpy):** | | **30,131** | **23,816** | **23,951** |

### 4.2.1 Arizona Public Service (APS) - Red Rock

The APS Red Rock electric generating station operates two steam turbine units, two gas turbine units, and associated auxiliary equipment. The source's permit limits $SO_2$ emissions from combustion of fuel in the existing equipment to 15,051 tpy. This station was formerly a "peaking" plant providing increased electricity generation during periods of high demand. Commencement of full time operations began in 2000.

### 4.2.2 Tucson Electric Power Co. Irvington

Production of electricity at this generating station is accomplished by combustion of fuels in four steam turbine and three gas turbine units. The facility's operating permit limits allowable $SO_2$ emissions from the existing equipment to 20,150 tpy. Actual emissions, however, are less than 3,000 tpy.

### 4.2.3 Tucson Electric Power Co. North Loop

[24] Daily inventories for the electric facilities were calculated by dividing the annual emissions by the number of operating hours for each year and multiplied by a factor of 24 to obtain the 24-hour value. These inventories are based on the conservative assumption of 24 hours of operation for each calculated operating day.

[25] 24-hour inventories are a ton per day (tpd) average calculated by dividing the annual facility emissions by the number of operating days for each year.

The Tucson Electric Power Company North Loop station currently operates four simple cycle combustion turbine generators for the production of electricity. The turbines are primarily used as "peaking" units and are only fired when electrical demand requires their use. The permit lists potential to emit at 4,718 tons of $SO_2$ per year. Actual emissions for this facility are minimal at less than 1 tpy in 1999.

4.2.4 ASARCO Hayden Smelter

The Hayden primary copper smelter operates a flash furnace, converters, and other auxiliary equipment for smelting and refining of copper sulfide ore. The permit limits smelter process $SO_2$ emissions to 41,702 tpy. Actual emissions, however, are less than 23,000 tpy. In addition, the permit limits sulfur content and usage rates for fuel used in all fuel burning equipment. The Hayden smelter is located in the Hayden $SO_2$ nonattainment area. A separate state implementation plan (SIP) is being developed for this area and ADEQ anticipates submittal of the SIP to EPA in 2002.

## 4.3 Area, Mobile, and Total Sources

Emissions for the nonattainment area were derived from EPA NET area and mobile source inventories for Pinal County based on the assumption that area and mobile source emissions are proportionate to population levels. The San Manuel $SO_2$ nonattainment area population is estimated to be seven percent of the Pinal County population based on the aggregate population centers of San Manuel CDP, Mammoth, and Oracle CDP. The remainder of the nonattainment area has a very low population density with low traffic levels and minimal commercial or industrial development. Data shows that there are no urban areas that might be significant area or mobile sources located within the San Manuel nonattainment area as illustrated in Table 4.3. Area and mobile sources combined were less than one percent of the total emissions during the period of BHP smelter operations in 1997, 1998, and 1999.

**Table 4.3 - $SO_2$ Emissions for the San Manuel Nonattainment Area - All Sources**

| Source Type:[26] | | 1997 | 1998 | 1999 |
|---|---|---|---|---|
| Area and Mobile[27] | 24 Hr. (tpd) | <1 | <1 | <1 |
| | Annual (tpy) | 83 | 84 | 86 |
| Point | 24 Hr. (tpd) | 32 | 29 | 30 |

26 Area and mobile source estimates are based on EPA's AIR*Data* for Pinal County. Point source estimates are based on ADEQ annual emissions inventory data.

27 24-hour inventories are averages based on a 365 day distribution of emissions from these sources.

| Table 4.3 - $SO_2$ Emissions for the San Manuel Nonattainment Area - All Sources | | | | |
|---|---|---|---|---|
| | **Annual (tpy)** | 11,482 | 10,409 | 3,622 |
| **24 Hour Total (tpd):** | | **32** | **29** | **30** |
| **Annual Total (tpy):** | | **11,565** | **10,493** | **3,708** |

## 4.4 Emissions Projections

### 4.4.1 Point Source Projections

Arizona does not anticipate any substantial increase in existing point source emissions between 1999 and 2015 for the nonattainment area. Should any growth occur due to construction of additional $SO_2$ point sources, ADEQ's permit program limits all emissions as part of the construction of new point sources or the upgrading of existing sources.

Projections for copper smelters are based on growth rates contained in the Western Regional Air Partnership (WRAP), *Annex to the Report of the Grand Canyon Visibility Transport Commission*, October 16, 2000. This report notes that downward pressure on copper prices resulting from international competition have produced a consolidation of the copper industry in the Southwestern United States. Consequently, no expansion of the industry is expected though 2015. Emissions projection estimates for electric utilities are based on an anticipated industry growth rate of 2.6 percent per year contained in the WRAP report. These estimates are predicated, in part, on existing capacity and future demand for generation.

The remaining minor sources (Oracle Compressor Station, BHP Mine and Milling Operations) have existing permits limiting their potential to emit to less than one tpy. Table 4.4 and Table 4.5 present projected emissions for point sources within the nonattainment area and major point sources within 50 km of the nonattainment boundary.

| Table 4.4 - $SO_2$ Emissions Projections for the San Manuel Nonattainment Area - Point Sources | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Source Name:** | | **1997** | **1998** | **1999** | **2005** | **2010** | **2015** |
| **Oracle Compressor Station** | **24 Hr. (tpd)** | 0 | 0 | 0 | <1 | <1 | <1 |
| | **Annual (tpy)** | 0 | 0 | 0 | 1 | 1 | 1 |

| Table 4.4 - $SO_2$ Emissions Projections for the San Manuel Nonattainment Area - Point Sources | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Source Name:** | | **1997** | **1998** | **1999** | **2005** | **2010** | **2015** |
| **BHP smelter[28,29]** | **24 Hr. (tpd)** | 32 | 29 | 30 | 30 | 30 | 30 |
| | **Annual (tpy)** | 11,482 | 10,409 | 3,622 | 10,900 | 10,900 | 10,900 |
| **BHP mine and milling operations** | **24 Hr. (tpd)** | <1 | <1 | <1 | <1 | <1 | <1 |
| | **Annual (tpy)** | <1 | <1 | <1 | <1 | <1 | <1 |
| **24 Hour Total (tpd):** | | **32** | **29** | **30** | **30** | **30** | **30** |
| **Annual Total (tpy):** | | **11,482** | **10,409** | **3,622** | **10,901** | **10,901** | **10,901** |

| Table 4.5 - $SO_2$ Projected Emissions within 50km of the San Manuel Nonattainment Area - Major Point Sources | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Source Name:** | | **1997** | **1998** | **1999** | **2005** | **2010** | **2015** |
| **Electric Utilities[30]** | **24 Hr. (tpd)** | 8 | 7 | 9 | 10 | 12 | 14 |
| | **Annual (tpy)** | 2,598 | 1,739 | 2,870 | 3,892 | 4,424 | 5,031 |
| **ASARCO Hayden Smelter[31]** | **24 Hr. (tpd)** | 79 | 66 | 58 | 66 | 66 | 66 |
| | **Annual (tpy)** | 27,533 | 22,077 | 21,081 | 23,000 | 23,000 | 23,000 |
| **24 Hour Total (tpd):** | | **87** | **73** | **67** | **76** | **78** | **80** |

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28 Projections for the BHP smelter assumes resumption of smelting operations.

29 The annual number of operating days used to calculate the projected 24-hour inventories for 2005 through 2015 (annual emissions divided by the number of operating days) were based on average operating conditions. The average number of operating days for the period 1997 through 1999 were assumed to represent typical operating rates.

30 Projections for electric utilities are based on the assumption of continued full time operation of the APS (Red Rock) generating station and were calculated using emissions from the most recent year of full time operations at this facility (497 tons of $SO_2$ emissions were recorded in 2001, the first year of full time operations).

31 The annual number of operating days used to calculate the projected 24-hour inventories for 2005 through 2015 (annual emissions divided by the number of operating days) were based on average operating conditions. The average number of operating days for the period 1997 through 1999 were assumed to represent typical operating rates.

| Annual Total (tpy): | 30,131 | 23,816 | 23,951 | 26,892 | 27,424 | 28,031 |
|---|---|---|---|---|---|---|

4.4.2 Area, Mobile, and Total Source Projections

ADEQ projects emissions of $SO_2$ from area and mobile sources to grow proportionately with the population of the nonattainment area. Appendix B describes the source category emissions projections in greater detail. Table 4.6 presents projected area and mobile, and total source emissions for the San Manuel nonattainment area.

**Table 4.6 - $SO_2$ Emissions Projections for the San Manuel Nonattainment Area - All Sources**

| Source Type: | | 1997 | 1998 | 1999 | 2005 | 2010 | 2015 |
|---|---|---|---|---|---|---|---|
| Area and Mobile | 24 Hr. (tpd) | <1 | <1 | <1 | <1 | <1 | <1 |
| | Annual (tpy) | 83 | 84 | 86 | 94 | 101 | 107 |
| Point | 24 Hr. (tpd) | 32 | 29 | 30 | 30 | 30 | 30 |
| | Annual (tpy) | 11,482 | 10,409 | 3,622 | 10,901 | 10,901 | 10,901 |
| **24 Hour Total (tpd):** | | **32** | **29** | **30** | **30** | **30** | **30** |
| **Annual Total (tpy):** | | **11,565** | **10,493** | **3,708** | **10,995** | **11,002** | **11,008** |

## 5.0 MODELING DEMONSTRATION

Attainment is demonstrated through the clean ambient air quality record of more than ten years and use of Multi-point rollback (MPR) modeling. The improvement in air quality is due to continuous $SO_2$ emissions control technologies implemented by the San Manuel smelter to comply with the $SO_2$ emission limits regulations adopted for Arizona smelters in September 1979. MPR, which was approved by EPA in January 1983 as a modeling technique for Arizona smelters, was selected as the most precise and reliable method for then determining contemporary and future stack $SO_2$ emission limits.

MPR is a proportional rollback technique founded on the assumption that smelter emissions and ambient concentrations are proportional for a given set of dispersion conditions. Thus, a reduction in emissions results in a comparable reduction in ambient concentrations. Based on this assumption, the appropriate level of emission reductions to protect the NAAQS can be achieved if emissions are reduced by the ratio of the corresponding ambient concentrations to the air quality standard.

The use of MPR addresses the high variability of both smelter emissions patterns and meteorological conditions, in part, by rolling back an entire emissions curve rather than a single emissions measurement. A rollback factor is determined by fitting a concentration frequency distribution (from observed data) to an appropriate functional curve and calculating an expected once per year maximum (limiting) value. The rollback or reduction factor is defined as the ratio of the ambient standard to the limiting value. Rollback factors are calculated for all applicable NAAQS averaging periods. The largest calculated rollback factor is used to reduce each emission which occurred over the period of data accumulation (the emissions profile). The maximum rollback value is chosen to ensure that all primary and secondary standards are protected. In the case of the San Manuel smelter, the 3-hour standard was selected as the most conservative limiting standard which is also protective of the 24-hour and annual standards.[32]

Because hourly emissions were not available, the original MPR analysis used an estimate of hourly $SO_2$ emissions over the course of a year, based on knowledge of smelter operations and emissions variability, to construct an emissions curve. The entire curve was then “rolled-back” and the resultant distribution used directly to construct the original MPR cumulative occurrence and 3-hour average emissions limits tables for stacks. Hourly ambient $SO_2$ concentration data from the Townsite monitor (a stack impact site) for the period October 1973, through September 1974, were used and average emissions were calculated by sulfur balance.

### 5.1 Derivation of New Emissions Limits

Based on EPA’s approval as a model, ADEQ utilized MPR as a component of the current

[32] A detailed discussion of Multi-point Rollback methodology is contained in *Ultimate Sulfur Dioxide Emission Limits for Arizona Copper Smelters, September, 1979.*

attainment demonstration, BHP performed a further MPR analysis of stack and fugitive emissions and resultant ambient impacts based on current operating levels. This analysis utilized data from the two most recent years of operation (May 1997 through April 1999), and included continuous measurement data for stack and converter fugitive $SO_2$ emissions and measured ambient concentrations. These data were used to establish new stack and converter fugitive emission limits in rule that will maintain emissions below attainment period levels (See **Appendix A**).

The new $SO_2$ limits for stack and fugitive emissions at the San Manuel smelter maintain the basic MPR principles. Namely, that smelter emissions and meteorological conditions, which influence the impact of those emissions on air quality, are two highly variable but independent processes, and that emissions limits can be set that assure a high probability of attaining the applicable ambient air quality standards. The new limits are in the same format as the original MPR tables. However, the derivation of the new values differs from the original in two important aspects. First, the new limits are based on actual hourly $SO_2$ measurements. Second, these emissions required no reduction for compliance with the $SO_2$ air quality standards because those standards were met by a large margin during the two year period from which the emissions data were obtained (See **Section 3.1** and **3.2**). Accordingly, the new MPR limits did not require the complexity of calculation and assumptions as the original effort.

### 5.1.1 Stack Emissions Limits

Two years of data, based on actual emissions measurements from May 1997 through April 1999, were used in the current analysis to determine new 3-hour average emissions limits for stacks. The data for this period (17,520 hourly values) were ranked in descending numerical order. Each successive pair of ranked values were averaged to obtain a single representative profile consisting of 8,760 hourly values for the attainment period. Three-hour running averages were calculated creating a new database of 8,760 three-hour averages. As with the original MPR, the highest 26 percent or 2,240 hours of the resulting averages was then sorted into 24 categories of cumulative frequency of occurrence values identical to the occurrence limits in the original MPR tables (0 to 2,240). The emission limits were selected using the same conceptual method used in the original MPR where in each category of allowed emission occurrences, the lowest actual emissions value in that range was used to establish the new limits. For example, the **n** cumulative frequency of occurrence where **n = 7** in the new MPR table for stack emission corresponds to the emissions value **E** where **E = 5660**. The measured emissions values that occur in the frequency, where **n = 7**, are **5860, 5747,** and **5660** (See **Appendix C**). The selection of the lowest measured emissions value in each frequency of occurrence mimics the selection of the lowest calculated values of the original MPR analysis, which were all below the emissions profile or curve.

The annual average emissions limit for stacks was determined from the calculated numerical average of the combined hourly stack emission values (17,520 hourly values).

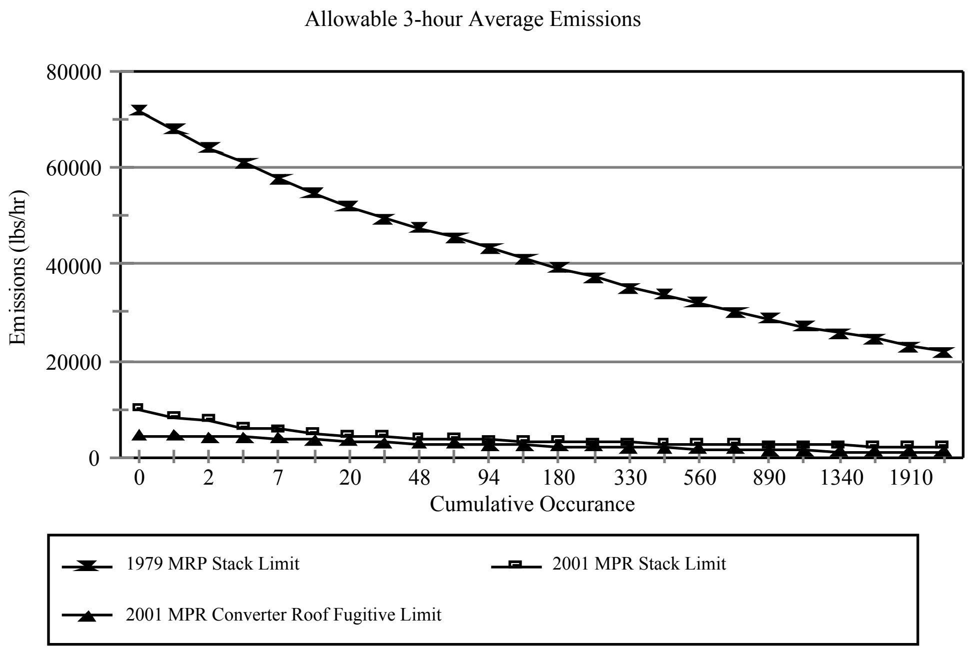
### 5.1.2 Fugitive Emissions Limits

The previous MPR limit was based on ambient impacts from stack sources. A similar MPR analysis was also performed for uncaptured converter fugitive emissions based on the proportional impacts of these emissions on ambient concentrations at fugitive impact sites (See **Section 3.1** and **3.2**). Two years of measured converter roof emissions from May 1997 though April 1999, were used to establish 3-hour average and annual emissions limits for this source. Details of the analysis are presented in Appendix C.

5.1.3 Emissions Reductions

The current rollback reduced allowable annual average stack emissions from 18,275 to 1,742 pounds per hour (lbs/hr). Fugitive $SO_2$ emissions as measured from the converter roof were reduced from the previous permit limit of 1,115 lbs/hr to 715 lbs/hr. Overall, allowable emissions from stack and fugitive sources were reduced from 84,928 tpy to 10,762 tpy providing a reduction of 74,166 tpy (approximately 87 percent). This reduction is illustrated in Figure 5.1.

**Figure 5.1 - Comparison of 1979 and 2001 MPR Limits**[33]



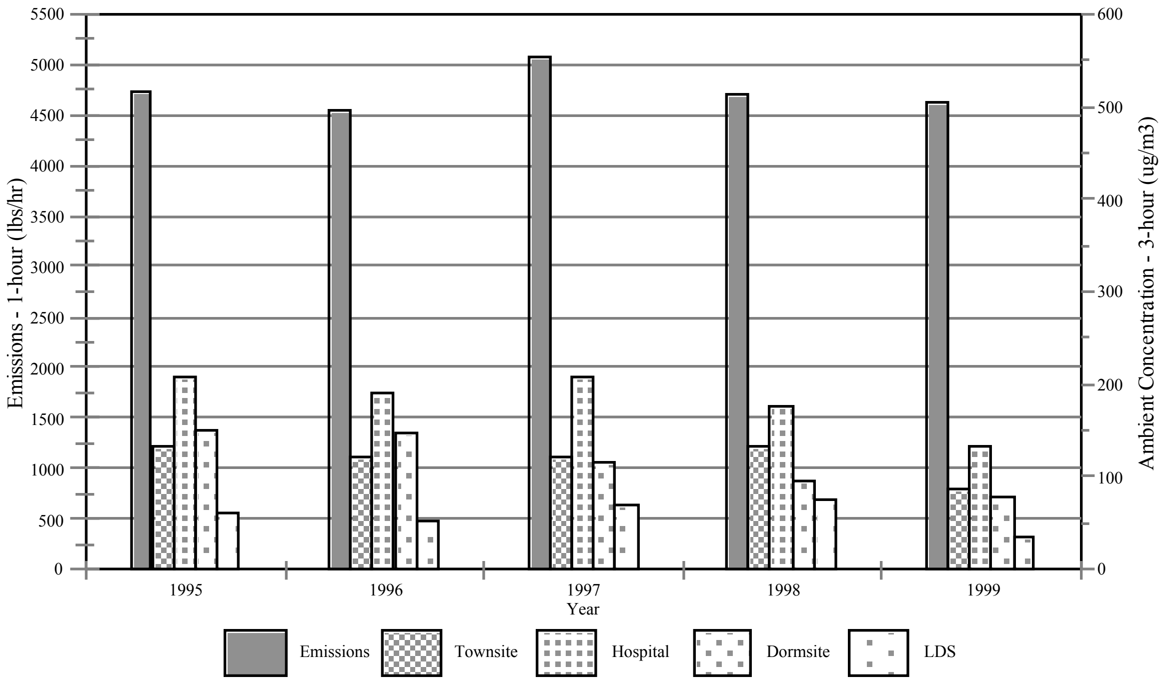

To ensure that the variety of possible meteorological conditions were represented over the analysis period and that favorable atmospheric dispersion did not influence the impact of emissions on ambient concentrations, the variation of emissions and ambient concentrations were compared from 1995 through 1999.

The upper distribution of short-term (1-hour) total smelter emissions and three-hour ambient $SO_2$ concentrations from all ambient monitors were determined for each of the five years. Review of the data demonstrates that emissions levels are relatively consistent throughout the MPR study period. The 99$^{th}$ percentile emissions values for the five year period differ by only 534 lbs/hr. The resulting annual values are presented in Figure 5.2. Emissions for the period preceding the 2001 MPR analysis were marginally higher than emissions recorded during the MPR study period. When adjusted for the difference in emissions between the two time periods (increased by the ratio of the

33 Limits contained in AAC R18-2-715(F)(1) and (G).

earlier to later emissions); however, ambient concentrations from the current MPR period do not vary significantly, and are less than five percent higher than the actual measured concentrations. The adjusted ambient values continue to demonstrate protection of the NAAQS. A five year period is considered to be long enough to experience potentially restrictive meteorological conditions. Nonetheless, Figure 5.2 shows that high concentrations varied little from year to year.

**Figure 5.2 - San Manuel Smelter**
99th Percentile Total Emissions and Ambient Concentrations




## 5.2 Smelter Configuration

Smelter configuration and in particular the location and height, of $SO_2$ releases was a critical consideration in finding the San Manuel smelter in compliance with the original MPR limits and for the current demonstration of attainment of the $SO_2$ NAAQS. The original MPR limits for the San Manuel smelter were based on 1973-1974 records of $SO_2$ emissions and ambient concentrations. The smelter achieved compliance with MPR emission limits in 1987 and remained in compliance through shutdown in 1999. Although the smelter underwent major modifications and emission reductions over the years, the location and heights of $SO_2$ releases have changed only slightly. Basically, emissions can be grouped into two categories based on the height of release. Low level emissions at heights less than 200 feet include fugitive and dryer stack emissions. High level emissions are predominantly from the reverberatory and converter stacks which are over 500 feet and include minor emissions form the 250 foot acid tail gas stacks. **Table 5.1** and **Table 5.2** show the release heights and SO2 emissions for 1974 compared to the most recent years of operation 1997-1999.

**Table 5.3** shows the distances of the individual emission points to the facility property boundary.

Thus the ambient $SO_2$ network established in the 1970's and refined in the 1980's, including extensive sampling and testing for fugitive $SO_2$ impact sites, occurred at a time with quite consistent

| Table 5.1 - San Manuel Smelter Configuration 1974 to Present | | | | |
|---|---|---|---|---|
| **Emissions Source** | **1974 Height (ft)** | **Present Height (ft)** | **1974 Process Emission Source** | **Present Process Emission Source** |
| **High Level** | | | | |
| **Reverb Stack** | 509 | 509 | Reverberatory Furnace process gases | Flash furnace captured and vented fugitive gases |
| **Converter Stack** | 530 | 530 | Converter process gases | Converter secondary hood and flash emergency vent gases |
| **Tail I** | NA | NA | NA | Constructed in 1975; decommissioned May, 1996 |
| **Tail II** | NA | 250 | NA | Constructed in 1975 (converted to double contact in 1987, upgraded in 1994) |
| **Tail III** | NA | 250 | NA | Constructed and upgraded in 1994 |
| **Low Level** | | | | |
| **Dryer Stack** | NA | 144 | NA | Concentrate dryer gases(constructed in 1987) |
| **Converter Fugitives** | 106 | 106 | Direct Converter fugitive gases | Converter gases not captured by primary or secondary hood systems |

| Table 5.2 - San Manuel Smelter $SO_2$ Emissions 1974 to 1999 (tpy) | | | | | |
|---|---|---|---|---|---|
| **Emissions Source** | **1974[34]** | **1997** | **1998** | **1999** | **Attainment Period Average[35]** |
| **High Level** | | | | | |
| **Reverberatory Stack** | 28,300 | 1,690 | 1,612 | 519 | 1,620 |
| **Converter Stack** | 39,600 | 2,436 | 2,249 | 969 | 2,531 |
| **Tail II Stack** | NA | 186 | 220 | 69 | 204 |
| **Tail III Stack** | NA | 538 | 400 | 101 | 414 |
| **Tall Stack Total** | 67,900 | 4,850 | 4,481 | 1,658 | 4,768 |
| **Low Level** | | | | | |
| **Dryer Stack[36]** | NA | 3,494 | 3,018 | 593 | 2,764 |
| **Fugitive** | 26,400 | 3,003 | 2,846 | 1,370 | 3,319 |
| **Low Level Stack and Fugitive Total** | 26,400 | 6,497 | 5,864 | 1,963 | 6,083 |
| **High and Low Level** | | | | | |
| **Total** | 94,300 | 11,347 | 10,345 | 3,620 | 10,851 |

[34] The original MPR analysis projected an hourly emissions rate of 94,242 pounds of sulfur dioxide per hour as the basis for the "rollback" for the San Manuel Smelter. This projection was based on sulfur balance data submitted by the facility and supports empirical evidence that approximately thirty percent of the sulfur content in sulfide copper concentrate will be oxidized by an initial melting step such as occurs in reverberatory furnaces. Of the remaining 70%, it is estimated that the 1980 vintage primary hood system at the San Manuel smelter was, at best, sixty percent efficient in capturing converter gasses. Consequently, 42% of these emissions actually reported to the converter stack. The remaining 28% was emitted as low-level fugitive emissions.

[35] Values represent average emissions from 1997 through 1999. Because smelter operations were suspended in May 1999, emissions for this year were estimated based on January through April operating levels to reflect a full year of emissions.

[36] A recent permit revision limits dryer $SO_2$ emissions to 2,073 tpy based on a twelve month rolling average.

| Table 5.3 - Emissions Source Distance from Facility Boundary (feet) | | |
|---|---|---|
| **Emissions Source** | **Distance to Property Line-1974** | **Distance to Property Line-Present** |
| Reverb Stack | 1,399 | 1,399 |
| Converter Stack | 1,955 | 1,955 |
| Dryer Stack | NA | 144 |
| Tail I | NA | NA |
| Tail II | NA | 2,160 |
| Tail III | NA | 1,744 |
| Converter fugitives | 1,735 | 1,735 |

release geometry. This consistency of $SO_2$ release locations continued through the 1990's thereby providing assurance that the ambient $SO_2$ monitoring network continues to represent the maximum impact of $SO_2$ emissions from the San Manuel smelter. As demonstrated above, $SO_2$ concentrations in the San Manuel nonattainment area have been shown to attain the NAAQS

## 6.0 CONTROL MEASURES

Because the BHP smelter is responsible for the majority of $SO_2$ emissions in the area, the following attainment demonstration control measures relate specifically to BHP smelting operations. Applicable controls for other point sources in the San Manuel nonattainment area are discussed in Chapter 4.0.

### 6.1 Background [37]

Smelting operations at San Manuel began in 1956. By the late 1950s the facility operated three reverberatory furnaces to process copper sulfide ore from nearby mines. Today the San Manuel primary copper smelter utilizes a flash smelting process and has a processing capacity of more than 25 percent of total U.S. smelting capacity.

The processing of copper sulphide ore begins at the mine where ore is crushed and transported to the San Manuel concentrator. At the concentrator facilities, the ore is ground at milling operations and processed by froth flotation to separate copper mineral from ore. Further processing at a molybdenite plant recovers a molybdenum disulphide concentrate from the bulk concentrate, a major byproduct of the San Manuel operations. Concentrates from this plant are filtered and dried in a concentrate dryer. These are the copper concentrates used in the smelting operations. Dryer process gas is treated in a baghouse for dust removal and vented to the atmosphere via stack.

The copper concentrate, containing approximately equal parts of copper, iron, and sulfur, is transferred to the Outokumpu design flash furnace for smelting. Dry concentrate and fluxes are injected through a concentrate burner into the flash furnace and are rapidly oxidized in an oxygen rich atmosphere. Oxygen for the flash reaction is produced by fractional distillation at the oxygen plant. Hot gas from the flash furnace, containing nearly 26 percent $SO_2$, is drawn into a waste heat boiler where the heat is removed for the production of steam by the San Manuel power plant. The cooled process gas is ducted to two electrostatic precipitators for dust removal prior to additional treatment in the acid plant and then exhausted to the atmosphere via one of two acid train stacks. Secondary process gas from the furnace matte skimming and slag tapping launder covers are also treated by electrostatic precipitator and exhausted to the atmosphere via stack. The remaining products of flash smelting are matte and slag.

Molten copper matte, containing about 60 percent copper, is tapped through covered launders into ladles and transferred by overhead cranes to one of three operating hot converters. In the converters, further oxidation of sulphur and slagging of iron and other metals takes place until the copper reaches a purity of 99 percent. The molten copper from the converters, called blister copper, is further fire refined for the removal of oxygen and cast into anodes in the casting department for

[37] Calculations used in this section were based on the following:

a. US EPA, AP-42, Compilation of Air Pollution Emission Factors, Fifth Edition, August 31, 1998.
b. BHP Smelter Federal Operating Permit Application, submitted November 1, 1994.
c. BHP Smelter 1998 Emissions Inventory Survey.

transport to an electrollytic refinery. Converter primary process gases are treated by Lurgi scrubber then ducted for treatment in the acid plant. Converter secondary hood gases are directed to electrostatic precipitators and discharged to the atmosphere via stack.

Molten slag from the flash furnace and converters, containing small amounts of copper, is cooled, crushed, and then returned to the mill for grinding and a copper content recovery flotation operation before joining other concentrate for processing in the flash furnace. Detailed process flow diagrams are included in this submittal in Appendix C.

Prior to 1974, all smelting operations process gasses were emitted into the atmosphere after particulate removal by electrostatic precipitators. From sulfur balance data the average emissions were reported to be 94,242 lbs/hr. The installation of an acid plant in late 1974 added $SO_2$ control for primary converter gas. A series of improvements in 1988 included replacement of the reverberatory furnaces with an Outokumpu Flash Furnace. During the flash furnace conversion, BHP also installed a 690 ton per day oxygen plant to enrich the furnace combustion air and retrofitted the existing single contact acid plant to a double-contact acid plant with a production capacity of 4,286 tons of sulfuric acid per day for treatment of all flash furnace and converter primary process gases.

The double-absorption sulphuric acid plant is the predominant control device for primary process $SO_2$ emissions at this smelter. Process gases produced by the flash furnace and converters are cleaned of particulates in a gas scrubbing system to prepare the gas stream for treatment in the acid plant. The flash furnace provides a steady gas feed to the acid plant, enabling optimal plant performance. In the acid plant, the $SO_2$ is cleaned, dried, and converted by catalyst to sulphur trioxide ($SO_3$). The $SO_3$ is readily adsorbed in circulating dilute sulphuric acid to become salable grade acid. The acid plant provides control of process gas $SO_2$ at or below the outlet $SO_2$ concentration limit of 0.065 percent by volume set forth in the federal New Source Performance Standard 40 CFR 60, Part P. The $SO_2$ control performance for the BHP acid plant is an outlet emission concentration of 0.0200 percent by volume. The maximum annual process rate for this smelter is estimated at 180-240 tons per hour (tph) of new sulfide concentrates. The production throughput of this facility, however, is dependent upon the operational capacity of the sulfuric acid plant to treat $SO_2$ emissions from the flash furnace and converters.

The 1988 conversion included the addition of equipment to improve the collection and control of fugitive $SO_2$ emissions and minimize the release of fugitive emissions directly to the atmosphere. The installation of a Lurgi scrubber (a variable flow Venturi radial scrubber to cool and clean process gas prior to treatment in the acid plant) replaced a previously extensive duct system used for cooling converter primary process gas. The old, difficult to maintain, ductwork was subject to recurring leaks and was a major source of fugitive emissions.

The flash furnace, oxygen plant, acid plant, and other improvements made during the transition from the reverberatory furnaces to the flash furnace, subsequently reduced the $SO_2$ emissions rate by 50 percent. This improvement is demonstrated in Figure 6.1, which illustrates the pre-control and post-control ambient $SO_2$ levels. Figure 6.2 illustrates the reduction in emissions though BHP was increasing copper production.

Although the converter secondary process emissions are hooded to minimize the release of fugitive emissions directly to the atmosphere, fugitive emission control is also dependent upon maintenance and operating procedures. The level of control of the converter secondary hood gas is achieved through the scheduling of the copper converting process. Control of the converter process is a major contributor to this smelter's reduction in $SO_2$ emissions. After the secondary hoods were installed, BHP found that the majority of secondary hood gas is generated during the roll-in and roll-out of the converters. By minimizing the amount of blast air during these periods, while at the same time balancing the primary and secondary hood draft, more of the process gas is captured by the primary hoods and reports to the acid plant for treatment. This operating technique reduced the amount of fugitive emissions due to converter activity by 3,040 tpy. BHP continues to identify fugitive emissions problem areas and correct the deficiencies as necessary.

In 1999, BHP rebuilt the flash furnace, the concentrate dryer burner, and replaced an electrostatic precipitator with a baghouse for treatment of concentrate dryer off-gas. The new design, completed during the temporary closure period which began in May 1999, improved the capture of fugitive emissions and minimized the oxidation of sulfur in the dryer circuit. At this time, BHP accepted a 2,073 tpy permit limit for $SO_2$ emissions from the concentrate dryer providing a 50 percent decrease of allowable emissions from this unit. A net decrease in future $SO_2$ emissions is estimated at 97.17 tpy, which is approximately an 0.8 percent reduction in the total estimated smelter emissions. The emissions control improvements implemented at the BHP smelter are summarized in Table 6.1 .

**Table 6.1 - Implementation of $SO_2$ Control Technology**

| Year | Control Equipment |
|---|---|
| 1974 | Installation of a two train sulfuric acid plant No.1 and No. 2 (primary converter gas only). |
| 1988 | Replacement of reverberatory furnaces with an Outokumpu Flash Furnace.<br>Retrofit to a double absorption acid plant for treatment of all primary process gas (flash furnace and converters), and installation of a new flux processing unit.<br>Replacement of primary converter hoods and jackets and installation of a lurgi scrubber.<br>Installation of matte skimming and slag tapping launder covers, and installation of converter secondary hoods for capture and venting of fugitive gases to the stack. |
| 1992 | Installation of two trim coolers on one acid plant tail stack to control acid temperature and maximize $SO_2$ conversion to $SO_3$ at the acid plant. |
| 1993 | Development and implementation of the optimal operating scenario for majority capture of converter process gas in primary collection system for treatment in acid plant. |
| 1994 | Installation of a new larger capacity third train to supplement the existing two train sulfuric acid plant and upgrade of Acid Plant Train II. The additional capacity allowed more of the converter off-gas to be drawn into the acid plant, thereby lowering emissions from both the converter secondary hood gas as well as roof fugitives. |
| 1995 | Installation and upgrade of Acid plant train III, upgrade acid plant train II, and retrofit of No. 3 converter. |

| Table 6.1 - Implementation of $SO_2$ Control Technology | |
|---|---|
| 1996 | Installation of stainless steel ducting from the converters to the acid plant eliminating rubber expansion joints which eventually deteriorate from the sulfuric acid stream.<br><br>Redesign of the secondary hooding system to reduce the gap between the hoods and converters during the scheduled converter rebuild program (rebuild of converters occurs every 2 years to ensure optimum control of fugitive emissions). |
| 1997 | Installation of two additional roof vent fan sulfur dioxide analyzers to quantify converter area uncaptured fugitive $SO_2$ emissions and further identify processes associated with increased emissions. |
| 1998 | Expansion of the emissions capture capacity of the flash smelter furnace launder system by increasing volume of airflow by over 50 percent. |
| 1999 | Rebuild of the Outokumpu type flash smelter, redesign of concentrate dryer burner to minimize the oxidation of sulfur in the dryer circuit, and replacement of the electrostatic precipitator for treatment of dryer off gas with a high temperature baghouse to further minimize the oxidation of sulfur. |

## Figure 6.1 - Comparison of SO2 Emissions and Percent Control

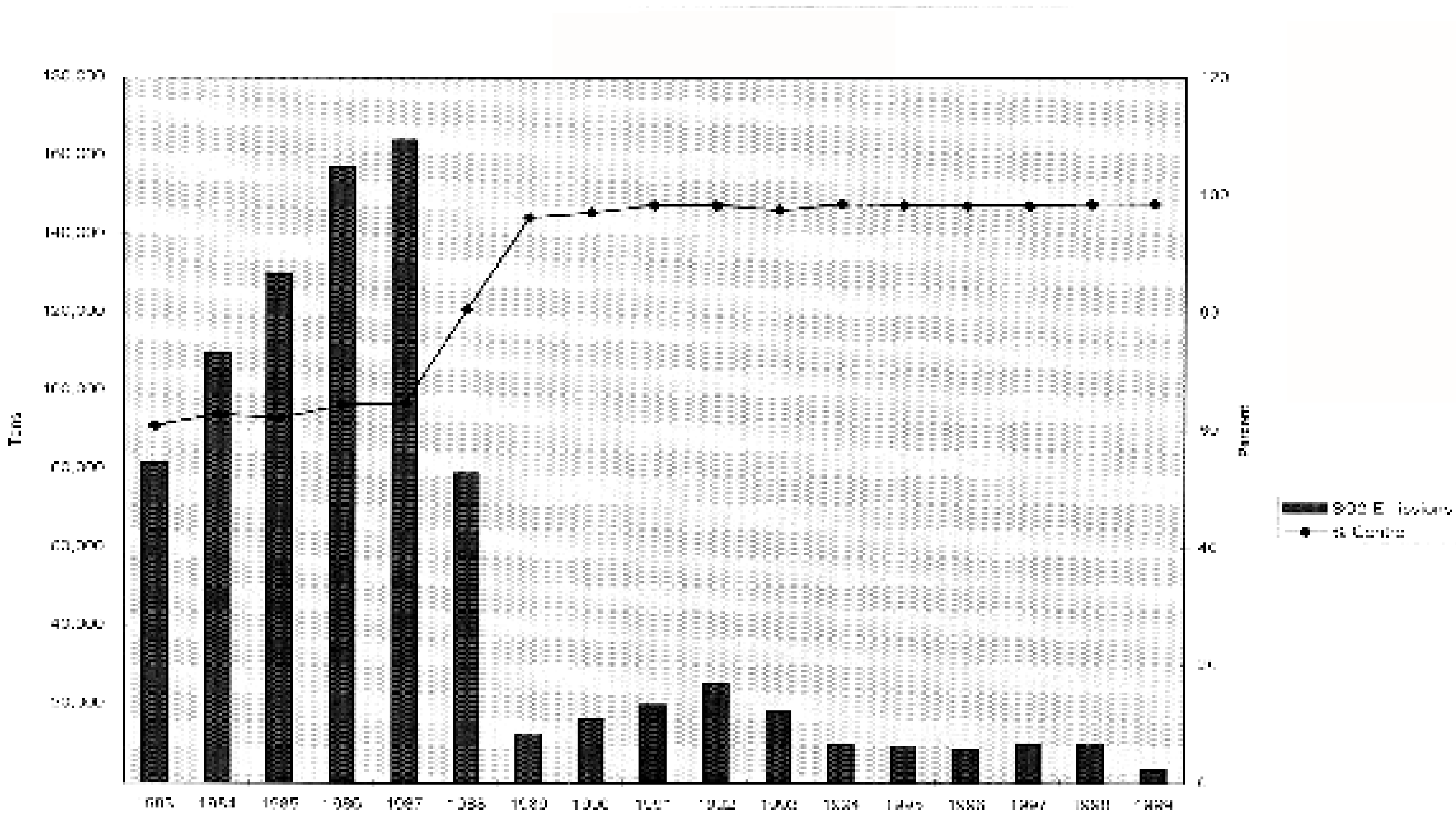
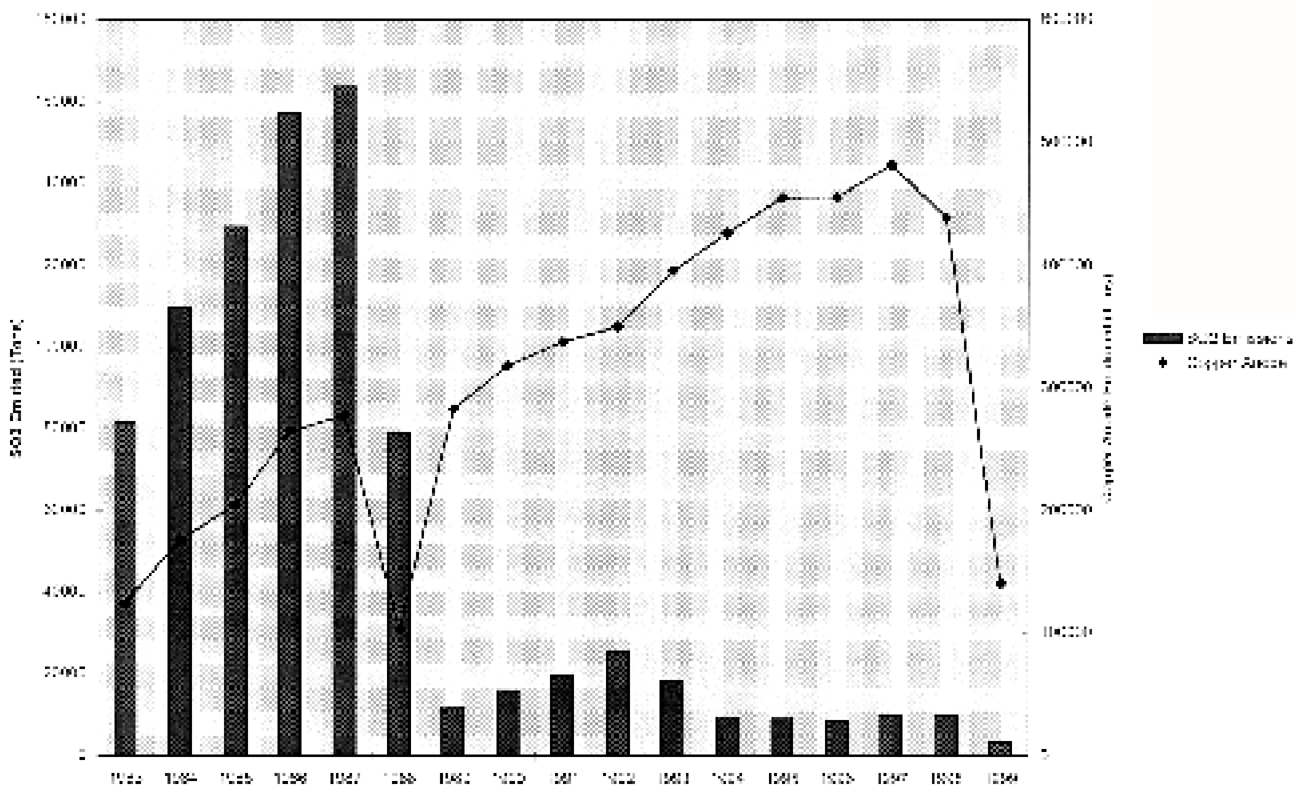


**Figure 6.2 Comparison of $SO_2$ Emissions and Copper Production**



## 6.2 Emissions Limitations for BHP

6.2.1 AAC Rule R18-2-715(F)(1), R18-2-715(G) and R18-2-715.01 - Standards of Performance for Existing Primary Copper Smelters: Site specific requirements; Compliance and Monitoring

**Measure Description:**

In 1979, ADEQ promulgated site specific emissions limits at Arizona Administrative Rules and Regulations (AARR) R9-3-515, currently codified at AAC R18-2-715 (See **Appendix A**). The rule required all existing primary copper smelters to implement control technology sufficient to comply with the 1979 MPR stack limits as well as any fugitive emissions control technology necessary to assure attainment and maintenance of the NAAQS. The following emissions limits were specified for the BHP copper smelter at San Manuel:

1. Annual average stack emissions, as calculated pursuant to AAC R18-2-715.01(C) through (J) shall not exceed 18,275 lbs/hr. The number of three-hour emissions, as calculated pursuant to AAC R18-2-715.01(C) through (J) shall not exceed the limits as listed in AAC R18-2-715(F)(1).

ADEQ's 2001 rule revision incorporated the following voluntary stack limits and added converter roof fugitive limits for the BHP smelter (See **Appendix A** for rule revision):

1. Annual average stack emissions, as calculated pursuant to AAC R18-2-715.01(C), shall not exceed 1,742 lbs/hr. The number of three-hour emissions, as calculated pursuant to AAC R18-2-715.01(C), shall not exceed the revised limits listed in AAC R18-2-715(F)(1).
2. Annual average converter roof fugitive emissions, as calculated pursuant to AAC R18-2-715.01(R), shall not exceed 715 lbs/hr. The number of three-hour emissions, as calculated pursuant to AAC R18-2-715.01(R), shall not exceed the limits as listed in AAC R18-2-715(G)(1).

**Estimated $SO_2$ Emission Reduction:**

Emissions were reduced 480,273 tpy following compliance with the 1979 rule. Subsequent implementation of additional emissions collection and control measures enabled the 2001 revision that provides a further reduction in allowable emissions of 74,166 tpy.

**Responsible Agency and Authority for Implementation:**

ADEQ is the responsible agency with authority designated by ARS §49-104(A)(11) and ARS §49-422.

**Implementation Schedule:**

The 1979 rule provided a compliance date of January 14, 1986, unless otherwise provided in a consent decree or a delayed compliance order. The compliance date for implementation of the 2001 rule revisions is January 15, 2002.

**Level of Personnel and Funding Allocated for Implementation:**

No additional personnel are required; implementation funding for ADEQ personnel is underwritten through emission and inspection fees. The approximate cost to the smelter is $100,000 per annum for operation and maintenance of the ambient air analyzers. Expenditures for emissions collection and control improvements at the smelter are noted below.

**Enforcement Program:**

ADEQ is responsible for tracking the progress made through the implementation of this measure and for enforcing all applicable regulations through the schedule of inspections and the development of compliance and enforcement actions. (See **Section 7.3** for a description of inspection and compliance and enforcement procedures.)

**Measure Monitoring Program:**

BHP submitted a proposed compliance schedule in response to a 1987 Consent Decree (CIV 87-106-Tuc-WDB, dated September 28, 1987), for achievement of the 1979 MPR stack emission limits as expeditiously as practicable. The smelter subsequently submitted a permit application in 1987 for installation of $157 million worth of emissions collection and control equipment. All on-site construction and installation of emission control equipment and process modification was completed in 1988, meeting the incremental compliance schedule requirements of the Consent Decree. The collection and control technology implemented by BHP has allowed the facility to reduce emissions sufficient to demonstrate attainment and to request additional emissions reductions in 2001 (See **Section 6.2** for a description of the implemented equipment).

For purposes of determining compliance with the emissions limits as codified in 1979, BHP was required to install, calibrate, maintain, and operate a measurement system for continuously monitoring $SO_2$ concentrations and stack gas volumetric flow rates in each stack that could emit 5 percent or more of the allowable annual average $SO_2$ emissions from the smelter. Demonstrations of stack gas volumetric flow rate and $SO_2$ concentration measurement systems required by subsections AAC R18-2-715.01 (K)(5)(a) and (b) were initiated in 1976. The location of all stack sampling points were approved by ADEQ in conjunction with the consent decree prior to installation and operation of the continuous emission monitoring systems (CEMS). BHP installed and operates CEMS at the outlets of the acid plant train I and II (currently II and III), the concentrate dryer, the flash furnace fugitive gas circuit, and the converter secondary hood gas circuit. In addition to primary process gas, captured fugitive emissions are continuously monitored for $SO_2$ concentrations and stack gas volumetric flow rates, and are included when determining compliance with the cumulative occurrence and emissions limits contained in R18-2-715(F)(1). Monitoring and emissions data submitted by BHP indicated that the smelter was in compliance with the 1979 emission limits by 1989.

To quantify converter area uncaptured fugitive emissions, BHP also installed and operates CEMS at the outlets of the converter building forced draft roof ventilators. Requirements to maintain and operate CEMS for continuously monitoring $SO_2$ concentrations at the converter roof vents was included in the 2001 revision for determining compliance with the cumulative occurrence and emissions limits contained in R18-2-715(G)(1).

Provisions for minimum performance and operating specifications for CEMS at this facility are contained in AAC R18-2-715.01(K)(5) and R18-2-715.01(S). Additional requirements for emission monitoring of the sulfuric acid plant are contained in AAC R18-2-313, Existing Source Emissions Monitoring. The BHP smelter stack and fugitive monitoring system is subject to the manufacturer's recommended zero adjustment and calibration procedures at least once per 24-hour operating period and meets all applicable performance specification and quality assurance procedures contained in 40 CFR 60, Appendix B and F. Daily calibration and quarterly audits conducted by BHP are reported to ADEQ. To ensure continued compliance, BHP maintains on hand and has ready for immediate installation sufficient spare parts or duplicate systems for the continuous monitoring equipment to allow for the replacement within six hours of any monitoring equipment part which fails or malfunctions during operation.

As required by AAC R18-2-715.01 (L), BHP measures at least 95 percent of the hours during which emissions occurred in any month and has not failed to measure any 12 consecutive hours of emissions. BHP maintains records of all average hourly emissions measurements for at least five years following the date of measurement as required by 40 CFR 60 Subpart P - Standards of Performance for Primary Copper Smelters. All of the following measurement results are expressed as pounds per hour of $SO_2$, summarized monthly, and submitted to ADEQ within 20 days after the end of each month:

1. The annual average of the month;
2. The total number of hourly periods during the month in which measurements are not taken and the reason for loss of measurement for each period;
3. The number of three-hour emissions averages which exceeded each of the applicable emissions levels listed in R18-2-715.01(F)(1) (and R18-2-715.01(G)(1) subsequent to 2001 revision) for the compliance periods ending on each day of the month being reported;
4. The date on which a cumulative occurrence limit listed in R18-715.01(F)(1) (and R18-2-715.01(G)(1) subsequent to 2001 revision) was exceeded if such exceedance occurred during the month being reported.

These submitted reports have shown continued compliance with all applicable regulations and averaging standards. ADEQ has not issued any notices of compliance actions for a monitoring violation to this facility.

As a means of determining total overall emissions, BHP performs a monthly material balance for sulfur and includes the results in the monthly compliance reports to ADEQ. Based on these reports, the smelter continues to document a sulfur recovery rate over 98 percent. The average monthly sulfur recovery rate for May 1997, through April 1999, was calculated to be 98.48 percent and ranged from 98.01 percent to 98.82 percent through the period.

In addition to monthly compliance reports, ADEQ also receives from BHP quarterly audit, upset, and excess emissions reports, as well as annual emissions inventory reports based in part on the $SO_2$ CEMS data.

The rule also specifies requirements regarding bypass operations. At each point in the smelter facility where a means exists to bypass the sulfur removal equipment, the bypass is instrumented and monitored to detect and record all periods that the bypass is in operation. The bypass has been used for maintenance failures, especially at the acid plant, with the average bypass time lasting approximately 10 minutes. All production activities at the smelter cease during a bypass. BHP reports the required information to ADEQ, not later than the 15th day of each month, and includes an explanation for the necessity of the use of the bypass.

### 6.2.2 AAC Rule R18-2-715.02 Standards of Performance for Existing Primary Copper Smelters; Fugitive Emissions

**Measure Description:**

This measure provides for an evaluation of the ambient impact of fugitive emissions from the San Manuel smelter. The regulation requires a measurement or accurate estimate of fugitive $SO_2$ emissions to determine whether these emissions have the potential to contribute to violations of the ambient $SO_2$ standards in the vicinity of the smelter. The rule also requires the adoption of rules specifying emission limits or other appropriate measures necessary to maintain the standards.

**Estimated $SO_2$ Emission Reduction:**

A reduction of 40,023 tpy is estimated due to implementation of fugitive emissions collection and control measures.

**Responsible Agency and Authority for Implementation:**

ADEQ is the responsible agency with authority designated by ARS §49-104(A)(11) and ARS §49-422.

**Implementation Schedule:**

The rule provides a compliance date of January 14, 1986.

**Level of Personnel and Funding Allocated for Implementation:**

No additional personnel is required; implementation funding for the fugitive emission evaluation study was provided by BHP. The approximate cost of the $SO_2$ fugitive emission evaluation study was one million dollars.

**Enforcement Program:**

ADEQ is responsible for tracking the progress made through the implementation of this measure and for enforcing this measure through the schedule of inspections and the development of compliance and enforcement actions (See **Section 7.3** for a description of inspection and compliance enforcement procedures).

**Measure Monitoring Program:**

Fugitive $SO_2$ emissions at the BHP smelter are primarily generated from the flash furnace, converter, and anode process areas. Emissions escape the ventilation systems and exit the buildings through roof vents. These structures mounted on the roofs of the building provide an escape route for uncaptured emissions. A portion of the $SO_2$ emissions may escape through other exit points, such as open walls and doors in the building. These alternate exit points were identified by BHP through flow visualization tests and survey sampling. The following studies and other data gathered demonstrated that the majority of the $SO_2$ fugitive emissions escape from the furnace and the converter processes and identify the converter area as the primary source of uncaptured emissions at the smelter.

On April 3, 1986, BHP submitted to the Arizona Department of Health Services (ADHS) a fugitive $SO_2$ emissions description, evaluation, and demonstration study, to partially fulfill the outstanding SIP commitments for analysis of fugitive emissions. The study analyzed data from January 1983 through January 1984 and identified converter operations as the major source of fugitive emissions.

A fugitive $SO_2$ emissions study of the launders was submitted on December, 1989. This study quantified uncaptured fugitive emissions from flash furnace slag and matte tapping operations and analyzed the ambient impacts of uncaptured flash furnace and converter fugitive emissions as well as impacts from the acid plant tail stacks. An assessment of the launders estimated a 90-95 percent emissions capture from these systems.

A Differential $SO_2$ Ambient Impact Assessment Report was completed and submitted to the Arizona Department of Environmental Quality (ADEQ) on January, 1993. The study compared specific ambient monitored concentrations with modeled values based on actual hourly stack and converter area uncaptured fugitive emissions rates. A second analysis incorporated a cartesian receptor grid to estimate ambient impacts from each of the smelter sources and compared the maximum impacts of stack and converter vent fugitives. Although fugitive emissions demonstrated a higher proportion of ambient impact relative to stack emissions in certain locations close to the smelter, the studies concluded that fugitive emissions will neither cause nor significantly contribute to a violation of the NAAQS. Summaries of the fugitive emissions studies are contained in Appendix C.

Measures to improve collection and control of fugitive emissions together with control of primary process gasses have reduced total emissions to a level protective of the NAAQS in the San Manuel area (See **Section 6.2** for a description of implemented equipment). Captured fugitive emissions currently comprise approximately 36 percent of total facility emissions and are included when determining compliance with the stack limits described in Section 6.3.1. The section also details control of an additional 27 percent of total emissions achieved through the adoption of limits for uncaptured converter area fugitive emissions.

### 6.2.3 BHP Permit Conditions

Reasonably Available Control Technology (RACT) for sources located in $SO_2$ nonattainment areas is defined as "that control technology necessary to achieve the NAAQS and is determined by the technological and economic feasibility of the control."[38] Submittal of biennial compliance certifications under AAC R18-2-309(2)(a) are required to demonstrate the compliance status of the source with all applicable permit conditions. Controls implemented by BHP to reduce smelter emissions and comply with emissions limit regulations are included in the following permits outlined in Table 6.2, found on the following page. Additionally, BHP submitted a standard Title V permit application form to ADEQ on November 2, 1994. The application for the BHP smelter including the Outokumpu flash furnace, Pierce-Smith converters, anode furnaces, concentrate dryers, double absorption acid plants, oxygen plant, gas cleaning plant including electrostatic precipitators, filter plant, revert crushing plant and associated equipment has been processed and the final permit was issued on November 19, 2001.

**Table 6.2 - Permit Conditions**

| Date | Permit Number | Controls[39] |
|---|---|---|
| October 7, 1987 | 0355-88 | Retrofit to install Outokumpu Flash Furnace, converter secondary hoods, double absorption acid plant to treat all process gases and new flux processing unit. |

[38] US EPA Office of Air and Radiation, Office of Air Quality Planning and Standards, "$SO_2$ Guideline Document," February 1994.

[39] All listed controls have been captured in the facility's Title V permit.

| | | |
|---|---|---|
| August 28, 1992 | 1241 | Installation of a new larger capacity third train to supplement the existing two train sulfuric acid plant and replacement of an existing copper converter. Shortly after the new third Train was completed, BHP upgraded Acid Plant Train II. The upgrades allowed BHP to increase the capacity of the new train, Acid Plant Train III, and take Acid Plant Train I out of service. This permit contained emissions limits for fugitive $SO_2$ emissions as measured from the converter roof. The limit for this source was 1,115 lbs/hr (4,884 tpy). |
| March 24, 1998 | 1000681 | Rebuild of Outokumpu flash smelting furnace and concentrate dryer burner to minimize sulfur oxidation. Additional emission limitations, fuel usage limitations, and air pollution emission control devices were included in this significant retrofit. Permit Section II(A) further limited $SO_2$ emissions from the concentrate dryer, to less than 2,073 tpy based on a 12-month, rolling monthly average. |
| July 23, 2001 | 1001582 | Revised the limits for stack and converter roof fugitive $SO_2$ emissions to 7,629 and 3,132 tpy respectively.<br><br>Requires maintenance and operation of all collection, process, and control equipment in a manner consistent with good air pollution control practice.<br><br>Continued operation of CEMS is required to monitor and record $SO_2$ discharge emissions rates from the smelting facility.<br><br>Continued operation, maintenance, and calibration of all current BHP ambient monitors are also required. |

## 7.0 MAINTENANCE PLAN

Section 107 (d) (3) of the amended CAA requires that nonattainment areas must have a fully-approved maintenance plan meeting the requirements of Section 175 (A) before they can be redesignated to attainment. Section 175 (A) requires submittal of a SIP revision that provides for the maintenance of the NAAQS for at least 10 years after the redesignation to attainment. The required components of the maintenance plan include:

1. A demonstration that future emissions of $SO_2$ will not cause a violation of the $SO_2$ NAAQS,
2. A commitment to continue to operate an appropriate air quality monitoring network to verify the attainment status of the area,
3. Assurance that the state has the legal authority necessary to implement and enforce all necessary measures used to attain and maintain the NAAQS,
4. An indication of how the state will track the progress of the maintenance plan, and
5. A contingency plan that contains measures to promptly correct any violation of the NAAQS that occurs after redesignation.

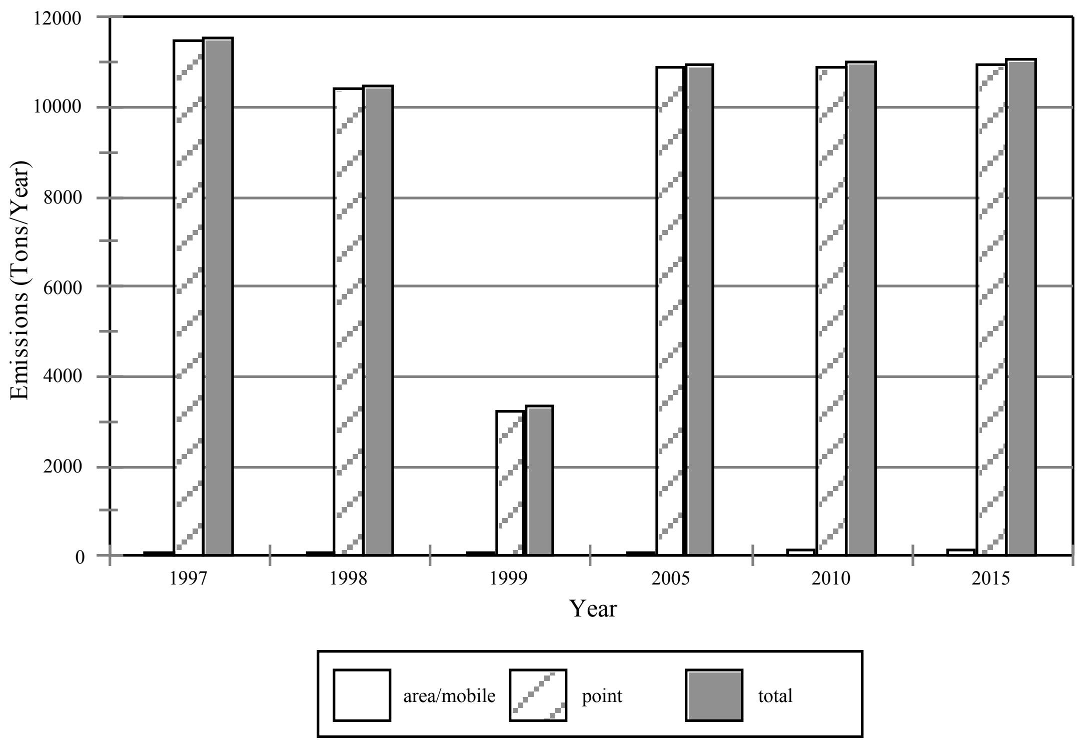
This submittal demonstrates that all of the above required elements have been met. ADEQ also commits to a SIP revision subsequent to this submittal providing for maintenance of the NAAQS for an additional ten years. This subsequent revision is due eight years into the first ten year maintenance period.

### 7.1 Maintenance Demonstration

Copper smelting operations at the BHP facility are the single greatest source of $SO_2$ emissions in the San Manuel nonattainment area comprising more than 99 percent of total emissions in the area. The conservative emissions limits that have been established for the smelter are based on actual emissions for the most recent eight quarters of smelter operations showing attainment of the $SO_2$ NAAQS (See **Chapter 4**). Once the area is redesignated, any new sources or modifications to existing point sources of $SO_2$ are subject to the new source permitting procedures contained in AAC Title 18, Chapter 2, Article 4, specifically, ADEQ's Prevention of Significant Deterioration (PSD) Permitting Program contained in AAC R18-2-406. The 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, utilizing BACT, before the facility is constructed, modified, or reconstructed.

Projections of 1998 base year attainment inventories for the BHP smelter and all other point sources in the nonattainment area are included in Table 4.3 of this submittal. These projections indicate that emissions in the area are estimated to demonstrate only slight growth through 2015. The estimate of mobile and area source emissions through the maintenance period is based on moderate population growth. Projections of 1998 base year attainment inventories for mobile and area source emissions in the nonattainment area are included in Table 4.4 of this submittal. Area, mobile, and point source projections are illustrated in Figure 7.1.[40] Chapter 4 contains detailed projection information for all sources. Although projections indicate an estimated five percent increase of point, mobile, and area source emissions through 2015, total nonattainment area emissions are four percent lower than 1997. Because the attainment emissions inventories demonstrate a stringent level of protection of ambient air quality and only slight growth from 1998 base year inventories is estimated for total source emissions, once redesignated, the area is projected to continue to exhibit a substantial margin of safety protective of the $SO_2$ NAAQS.

**Fig. 7.1-San Manuel Nonattainment Area**
**SO2 Emissions Projections**




## 7.2 Ambient Monitoring

Continued operation of an appropriate air quality monitoring network is required to verify the attainment status of the area. To comply with the requirements of this maintenance plan, ADEQ and BHP, commit to continue monitoring ambient $SO_2$ concentrations for at least 10 years following the approval of this SIP and maintenance plan. The requirement for BHP to continue to calibrate, maintain, and operate $SO_2$ ambient monitoring equipment that meets EPA protocol at the Townsite,

40 Projections assume resumption of BHP smelting operations.

Dorm, and Hospital sites were made enforceable in BHP permit number 1000047. Permit number 1001582 allows the shutdown of the BHP operated ambient $SO_2$ monitoring equipment if the facility has not operated for more than 24 consecutive months. Ambient $SO_2$ measurement is required to resume at all facility operated sites three months prior to restarting of smelting operations. To ensure adequate representation of ambient air quality, ADEQ will continue to calibrate, maintain, and operate the $SO_2$ monitoring equipment at the LDS site through the maintenance period.

Any changes in monitor location that may be indicated due to future changes in conditions will be discussed with EPA Region IX prior to final decisions. All ambient monitoring data will continue to be quality assured to meet the requirements of 40 CFR 58, Ambient Air Quality Surveillance. Data will also continue to be entered into EPA's *Aerometric Information Reporting System* (AIRS) database in accordance with federal guidelines.

In addition, BHP will continue to monitor ambient temperatures, and wind speed and direction for at least 10 years following the approval of this SIP and maintenance plan. The requirement for BHP to continue to calibrate, maintain, and operate ambient meteorological equipment at the Townsite, Dorm, and Hospital sites will be made enforceable as a permit condition for permit number 1000047. The provisions of this permit also allow the shutdown of the meteorological equipment if the smelting facility has not operated for more than 24 consecutive months. Meteorological measurement is required to resume at these sites three months prior to restarting of smelting operations.

### 7.3 Verification of Continued Attainment

ADEQ anticipates no relaxation of any of the already implemented control measures used to attain and maintain the ambient air quality standards. ADEQ commits to submit to EPA Region IX any changes to its 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 rules or permit provisions contained in this submittal.

Permitted sources are subject to the monitoring and reporting, and certification procedures contained in AAC R18-2-306 and AAC R18-2-309 respectively. BHP submits all certifications and reports as required by the above provisions (See **Section 4.3.1**). ADEQ has authority pursuant to ARS §49-101 *et seq.* to monitor and ensure source compliance with all applicable rules and permit conditions.

When ADEQ identifies a violation of any applicable permit requirement either through an inspection or records submitted to ADEQ, a decision will be made whether to issue a notice of opportunity to correct, a notice of violation (NOV), an administrative order, or to seek injunctive relief, and/or seek civil penalties. This decision will be made based upon the following considerations:

1. Risk to human health, safety, welfare or the environment;

2. The violator's indifference to the law;
3. The violator's previous compliance history.

Every notice of violation from ADEQ includes the following elements:

1. The factual nature of the violation.
2. The legal authority regarding compliance.
3. A description of what constitutes compliance and how it is to be documented.
4. A time frame in which ADEQ expects compliance to be achieved. Time frames shall require compliance at the earliest possible date.
5. An offer to meet.
6. A statement of consequences.

If violations are not corrected within 120 days from receipt of the notice of violation, the facility is required to enter into a consent order or an executed agreement for a consent decree and a compliance schedule. Measures for addressing violations of the NAAQS are provided in the contingency plan (See **Section 7.4**).

## 7.4 Contingency Plan

This contingency plan provides a procedure to ensure future compliance and promptly correct any violation of the $SO_2$ NAAQS that may occur after redesignation of the area to attainment. Contingency measures do not have to be fully implemented at the time of redesignation. The assurance that the contingency procedures outlined in this plan will be followed and commitments will be implemented and enforced is contained in state law at ARS §49-402 and §49-404. Because the BHP Copper San Manuel smelting facility is the major source of $SO_2$ emissions in the nonattainment area, the contingency measures presented in this section focus primarily on ambient impacts of emissions attributable to this facility. Contingency measures for all other point sources are provided by the Prevention of Significant Deterioration (PSD) requirements contained in AAC R18-2-403 and AAC R18-2-406.[41]

A first occurrence in a calender year of a verified 3-hour average $SO_2$ level in excess of 0.425 ppm but less than 0.5 ppm (85 percent of the secondary NAAQS but less than 100 percent) shall require notification as described in the procedures below. A second occurrence in a calender year of a verified 3-hour average $SO_2$ level in excess of 0.425 ppm but less than 0.5 ppm (85 percent of the secondary NAAQS but less than 100 percent) or any occurrence of a verified 3-hour average $SO_2$ level in excess of 0.5 ppm (100 percent of the secondary NAAQS), recorded at any ambient monitoring station, has been selected as the protective trigger level (PTL). When the PTL is exceeded, there will be ample time to complete all necessary facility inspections and technical

[41] State regulations comply with the federal requirements found in: 40 CFR 51.307 (NSR); 40 CFR 51.166 (PSD).

evaluations, develop recommendations, and implement necessary mitigation measures to prevent any violation of the $SO_2$ NAAQS. Multiple exceedances (either spatially or temporally) shall be considered a single event during an episode.[42] Special Measures described below for a second occurrence in a calender year of a verified 3-hour average ambient $SO_2$ level over 0.5 ppm (a violation of the secondary NAAQS), provide added protection to prevent a violation of the air quality standards.

7.4.1 Notification Procedure

BHP will record the hourly concentrations for all facility operated ambient monitoring sites. ADEQ will record the hourly concentrations for the state operated ambient monitoring site. For the BHP operated $SO_2$ monitors, the facility responsible official must notify ADEQ as soon as practicable, but no later than the close of the next business day after initially verified monitoring data indicate that an ambient $SO_2$ level in excess of 0.425 ppm has been recorded. For the ADEQ operated $SO_2$ monitor, ADEQ must notify the BHP responsible official as soon as practicable, but no later than the close of the next business day after initially verified monitoring data indicate that an ambient $SO_2$ level above 0.425 ppm. The facility will also have access to ADEQ's data.

7.4.2 First Action Level

These actions must be completed as soon as practicable, but no later than 24 hours following an event and should include at a minimum:

1. A full calibration check of the ambient $SO_2$ analyzers and recording systems, and review of all applicable records of environmental conditions and electrical supply at the monitor at the time of the exceedance. Final validation will be based on current EPA and ADEQ quality assurance guidelines,
2. Inspection of all ductwork and hooding associated with the flash furnace process and fugitive gases and the converter process and secondary hood gases,
3. Assessment of the acid plant to ensure that this facility is operating within parameters recommended by the manufacturer for optimal performance within the New Source Performance Standards limits, and
4. Inspection of all other processing equipment.

If it is determined that the exceedance of the PTL or NAAQS was due to invalid ambient monitoring data no further action is necessary.

[42] For this SIP, an episode commences at the time that the first exceedance begins and an episode shall conclude at the end of the 3-hour period following the last exceedance that can be attributed to the same cause.

In the event of a valid exceedance, BHP will, as soon as feasible, perform any needed repairs or corrective maintenance actions as evidenced by the assessment, including if necessary, cessation of facility operations. The following preventive measures shall also be implemented:

> Walk through inspections and maintenance of emissions collection, control, and process equipment, shall be increased from bi-weekly to weekly for the 12 month period following an exceedance of the PTL.[43] These inspections shall be targeted to the cause of the exceedance. Should another exceedance of the PTL or NAAQS occur at any time within the ensuing 12 month period, the frequency of walk through inspections shall be increased to daily for the 12 month period following that exceedance. Daily inspections targeted to the cause shall continue for the 12 month period following any subsequent exceedances.

By the close of the second business day following an exceedance of the PTL, BHP will submit a report to ADEQ citing the nature of the event, any corrective actions or repairs undertaken to resolve the event, and recommendations for future corrective actions including specific milestones to avoid recurrence of such event. Any future repairs or corrective action taken must be reported to ADEQ within three working days after the repair or action is done. If the cause of the event has been resolved to ADEQ's satisfaction, no further action by BHP is necessary.

### 7.4.3 Second Action Level

Should a triggering of the PTL occur and not be found correctable by actions previously described, an analysis shall be performed to identify additional mitigation measures needed to ensure maintenance of the ambient air quality standards. Additional contingency measures considered for implementation may include:

1. Additional operating procedures consistent with good air pollution control practices,
2. Additional emissions collection and control technology,
3. Application of operating rate/process parameter limitations,
4. Further decreasing stack and/or fugitive emissions limits, and
5. Any other measures necessary to protect and maintain the NAAQS.

BHP's assessment and recommendation of the above measures shall be reported to ADEQ within 30 business days following a triggering of the PTL. No later than 90 business days following receipt of BHP's assessment and recommendations, and using all available data, ADEQ will make a determination regarding the cause and appropriate resolution of the event and shall require the

[43] Current maintenance procedures are described in BHP's Title V permit.

adoption and implementation of additional control measures, if needed, to ensure that the $SO_2$ NAAQS will not be violated. ADEQ commits to initiating any required revisions to rule or permit as soon as possible. The addition of permanent control measures will be made by SIP revision following the required public participation. Failure of BHP or the State of Arizona and its agencies to implement control measures necessary to maintain the $SO_2$ NAAQS may be considered a failure to fulfill the obligations of this plan.

7.4.4 Special Measure

The following operational change shall be implemented within 24 hours of a monitored violation of the secondary NAAQS:

Processing of new concentrate shall not exceed the rate as calculated by the following formula:

**S/AC * APR = Operating Rate**

Where:
**S** = 3-hour standard (1300 ug/m$^3$);
**AC** = actual maximum 3-hour average concentration recorded during the exceedance period (ug/m3); and
**APR** = average processing rate of new concentrate during the three hour exceedance period (tons/hour).

BHP shall also comply with the First Action Level requirements and, if necessary, the Second Action Level requirements. Within the same calender year, should a second and higher concentration exceedance of the secondary NAAQS be recorded following implementation of the Special Measure, the operating rate shall be recalculated accordingly. The Special Measure shall remain in effect until the facility has identified any source of emissions contributing to ambient $SO_2$ concentrations above the secondary NAAQS and has remedied the cause. If the violation can be attributable to an upset or malfunction the source may continue regular production while it submits a report within 24 hours detailing any repair or resolution. As detailed above, and in Chapter 5, the continuation of the $SO2_2$ NAAQS will be maintained during the next ten years.

## 8.0 REFERENCES


Supplemental D to Compilation of Air Pollutant Emission Factors, Volume I: Stationary Point and Area Sources (AP- 42 5th Edition), US Environmental Protection Agency, EPA-454F9903, Department of Commerce, National Technical Information Service, Springfield, Virginia, August 31, 1998.

Breathing Easier: A Report on Air Quality in California, Arizona, Nevada, & Hawaii, US Environmental Protection Agency, EPA-909-R-95-001, Region 9, Air and Toxics Division, San Francisco, California, May 1995.

Sulfur Dioxide Guideline Document, US Environmental Protection Agency, EPA-452/R-94-008, Research Triangle Park, North Carolina, February 1994.

Demonstration for a Fugitive Sulfur Dioxide Study at the BHP, Trinity Consultants Inc., Dallas, Texas, April 3, 1986.

Differential $SO_2$ Ambient Impact Assessment (San Manuel Smelter), Trinity Consultants Inc., Project 9260-094, Dallas, Texas, January 28, 1993.

Arizona Copper Smelter Handbook, Arizona Mining Association, Phoenix, Arizona, April 20, 1982.

Arizona Testing Manual for Air Pollutant Emissions (Revision E), Arizona Department of Air Quality, May 15, 1989.

National Annual Industrial Sulfur Dioxide Emission Trends 1995- 2015, US Environmental Protection Agency, EPA 454-R-95-001, Air and Radiation, Research Triangle Park, N.C., June 1995.

Western Regional Air Partnership (WRAP), *Annex to the Report of the Grand Canyon Visibility Transport Commission*, October 16, 2000.