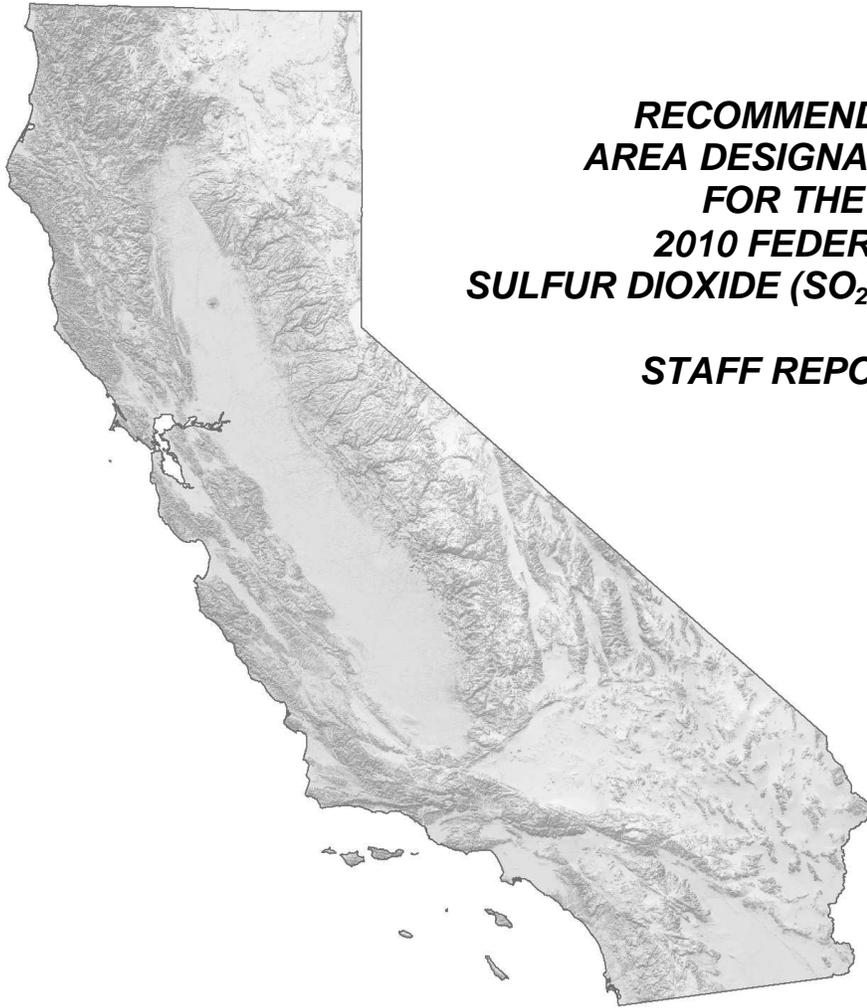


**State of California**  
**AIR RESOURCES BOARD**



**RECOMMENDED  
AREA DESIGNATIONS  
FOR THE  
2010 FEDERAL  
SULFUR DIOXIDE (SO<sub>2</sub>) STANDARD  
STAFF REPORT**

*June 2011*

California Environmental Protection Agency



**Air Resources Board**

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## **BACKGROUND**

This report provides the Air Resources Board's (ARB) recommendations on designations for the revised federal sulfur dioxide (SO<sub>2</sub>) standard, based on air quality monitoring data for California.

On June 2, 2010, the United States Environmental Protection Agency (U.S. EPA) established a new primary 1-hour SO<sub>2</sub> standard of 75 parts per billion (ppb). At the same time, U.S. EPA revoked the 24-hour and annual average standards. In addition to changing the averaging time and level of the standard, U.S. EPA revised the ambient air monitoring and data reporting requirements for SO<sub>2</sub>. The final rule for the SO<sub>2</sub> standard was published in the Federal Register on June 22, 2010 and can be accessed via the link below:

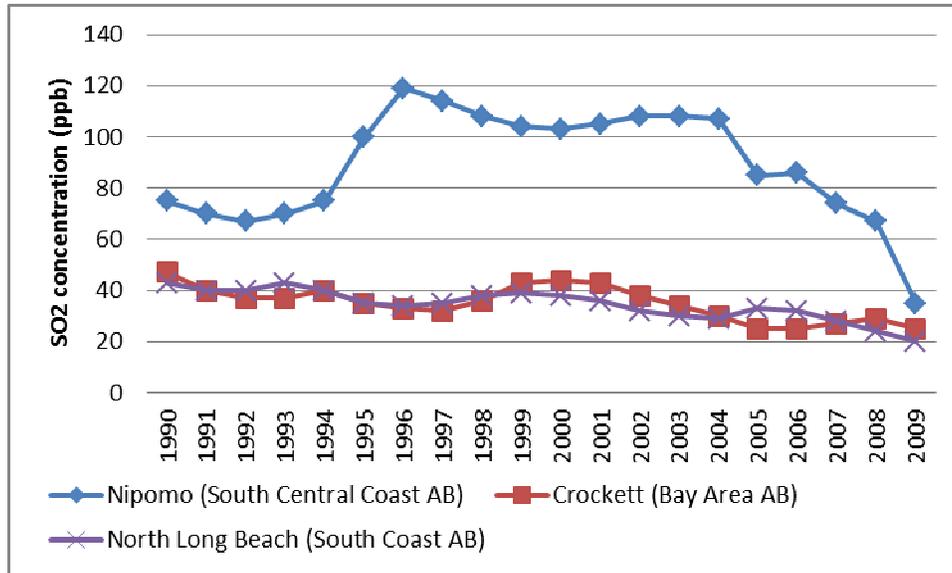
<http://www.epa.gov/ttn/naaqs/standards/so2/fr/20100622.pdf>

## **SULFUR DIOXIDE AIR QUALITY**

### Routine Monitoring

California has attained the 24-hour and annual average standards since the late 1980s. In the early 1970s, peak 1-hour SO<sub>2</sub> concentrations in California were as high as 230 ppb, but by the early 1990s, had decreased to less than 50 ppb. Based on California's routine monitoring network, in 2009, 1-hour SO<sub>2</sub> concentrations are one tenth of 1970 levels, ranging from 3 ppb to 35 ppb. Figure 1 below shows the trends in 1-hour SO<sub>2</sub> concentrations for the South Central Coast, San Francisco Bay Area and South Coast Air Basins. These urban areas have the highest level of SO<sub>2</sub> concentrations in California. Although the Nipomo site in the South Central Coast once had concentrations above the level of the 1-hour standard, concentrations have decreased as a result of new emission control requirements and revised permit requirements for a nearby refinery. The 20 year trend shows that sites with the highest SO<sub>2</sub> concentrations in 2009 are well below the standard.

**FIGURE 1**  
**1-hour SO<sub>2</sub> Design Values at Highest Monitoring Sites in California**



Special Purpose Monitoring

In addition to the routine monitoring network, several special purpose monitoring networks are operated in the South Coast and San Francisco Bay Area. In the South Coast, the Port of Long Beach/Los Angeles Air Quality Monitoring Program collects data on criteria air pollutants, including SO<sub>2</sub>, to estimate ambient levels of pollution that are due to Port operational activities. Together, the two Ports operate six monitoring sites. At the Port of Los Angeles these sites are the Wilmington Community Monitoring Station, the San Pedro Community Monitoring Station, the Outer Harbor site, and the Terminal Island Treatment Plant Station. The two sites at the Port of Long Beach are the Inner and Outer Port sites. Terminal Island Treatment Plant Station (at the Port of Los Angeles) and the Inner Port site (at the Port of Long Beach) are expected to have the highest exposure to emissions from port operations, as they are in direct proximity to terminal operations which use a large number of diesel engine sources. The 2010 1-hour SO<sub>2</sub> design value at the Terminal Island Treatment Station was 59 ppm. The 1-hour SO<sub>2</sub> 2010 design value at the Inner Port site was 62 ppb.

In the San Francisco Bay Area, 15 ground level monitors are deployed at the region's five petroleum refineries. These ground level monitors, required under the Bay Area Air Quality Management District's Regulation 9, are located near or outside the facility property boundaries and monitor downwind near-source concentrations as part of the facility operating permit requirements. Measurements were collected at all 15 sites during the 2008 through 2010 timeframe, and all but one have valid 2010 1-hour SO<sub>2</sub>

design values. The highest design values were 56 ppb, measured near the Chevron facility and 53 ppb measured near the Conoco facility.

## **EMISSIONS**

ARB maintains a comprehensive Oxides of Sulfur (SO<sub>x</sub>) inventory. Staff estimates that SO<sub>2</sub> comprises 97% of the SO<sub>x</sub> inventory. Additionally, in most combustion categories almost all SO<sub>x</sub> will be SO<sub>2</sub>. Therefore, in this report, SO<sub>x</sub> emissions are used to represent SO<sub>2</sub> emissions.

Emissions of SO<sub>x</sub> declined tremendously in California between 1990 and today. Statewide, emissions have decreased by 45% since 1990. SO<sub>x</sub> emissions from stationary sources have decreased due to improved industrial source controls and switching from fuel oil to natural gas for electric generation and industrial boilers. The SO<sub>x</sub> emissions from land-based on- and off-road gasoline and diesel-fueled engines and vehicles have also decreased due to lower sulfur content in the fuel, and regulations to reduce the sulfur content in fuel used by commercial harbor craft.

As SO<sub>x</sub> is emitted primarily from combustion of fuels, emission control efforts have focused largely on reducing the content of sulfur in fuels. California has required the use of ultra-low-sulfur diesel fuel for on-road vehicles since 2006. In 2007, the U.S. EPA followed suit, requiring the ultra-low sulfur content (15ppm) in on-road diesel fuel sold in the United States. Off-road diesel fuel was required to transition to ultra-low sulfur by 2010. Railroad locomotive and marine diesel fuel was reduced to 500 ppm sulfur in 2007, and will change to ultra-low sulfur in 2012. By the end of 2014, all highway, off-road, locomotive and marine diesel fuel produced will be ultra-low-sulfur diesel.

Implementation of the revised SO<sub>2</sub> standard is focused on large stationary sources. U.S. EPA guidance suggests initial focus on those emitting 100 tons per year or greater of SO<sub>2</sub>. States are required to identify and eventually conduct air quality modeling of any sources that may be anticipated to contribute to a violation of the revised SO<sub>2</sub> standard. SO<sub>x</sub> emissions from stationary sources in California are a fraction of the levels in other parts of the country. The largest sources in the U.S. have emissions exceeding 100,000 tons per year. These are large fossil fuel electrical generation facilities located in the eastern and southern states. In contrast, the largest source of SO<sub>x</sub> emissions in California, a refinery in the Bay Area, has emissions of approximately 5,000 tons per year, and ranks 350 on the list of top SO<sub>2</sub> emitters in the nation. In total, there are 34 facilities in California with emissions greater than 100 tons per year. ARB staff is working with air districts to conduct additional dispersion modeling as required by U.S. EPA.

## RECOMMENDED AREA DESIGNATIONS

ARB staff evaluated the available ambient SO<sub>2</sub> data and SO<sub>x</sub> emissions data to determine appropriate area designations throughout the State. The recommendations in this report are based on SO<sub>2</sub> air quality data collected between 2007 and 2009. The analysis was conducted for each monitoring site in the State for which data are available. Generally, the 99<sup>th</sup> percentile is the fourth highest 1-hour SO<sub>2</sub> concentration measured during a year. However, if data are incomplete, a higher value may be used, in accordance with established U.S. EPA criteria.

ARB staff has conducted a five factor analysis to determine the appropriate designations and boundaries. The five factors recommended by U.S. EPA for the purposes of determining the appropriate attainment area boundaries include: jurisdictional boundaries, geography/topography, meteorology, emissions, and air quality data. No areas with monitors in California violate the federal 1-hour SO<sub>2</sub> standard.

Areas of the State where no monitors exist are generally more rural in nature. There are no facilities located in these air basins with significant SO<sub>x</sub> emissions (greater than 100 tons per year), and only two facilities with SO<sub>x</sub> emissions greater than 50 tons per year. In comparison to the rest of the state, total SO<sub>x</sub> emissions are low. Since the existing monitoring network indicates that all areas with monitors are well below the level of the standard, ARB staff conclude that areas without monitors should also be below the standard.

Therefore, ARB staff is recommending that all areas in California be designated attainment for the 1-hour SO<sub>2</sub> standard. The recommended area designations are summarized in Table 1 below. Staff is recommending the air basin as the appropriate boundary for all of the attainment areas. Air basin boundaries were developed based on regions with similar meteorology and topography. The five factor analysis for each air basin is provided in Appendix 1. Design values for individual monitoring sites are provided in Appendix 2.

**Table 1  
Area Designation Recommendations**

<b>Air Basin Name</b>	<b>Recommended Designation</b>	<b>2009 DV SO<sub>2</sub> (ppb)</b>
Mojave Desert	Attainment	10
North Central Coast	Attainment	11*
North Coast	Attainment	5
Sacramento Valley	Attainment	4*
Salton Sea	Attainment	10
San Diego	Attainment	17
San Francisco Bay Area	Attainment	25
San Joaquin Valley	Attainment	9*
South Central Coast	Attainment	35
South Coast	Attainment	20
Great Basin Valleys	Attainment	n/a
Lake County	Attainment	n/a
Mountain Counties	Attainment	n/a
Northeast Plateau	Attainment	n/a
Lake Tahoe	Attainment	n/a

\*Design value is not considered complete under U.S. EPA criteria. While no other site exists in the basin with a valid design value, the indicated design value is representative of concentrations in the region.

## **SULFUR DIOXIDE MONITORING NETWORK REQUIREMENTS**

The final rule for the primary SO<sub>2</sub> standard also specifies the minimum number of SO<sub>2</sub> monitoring sites that State and local air agencies must operate. The monitoring regulations require SO<sub>2</sub> monitors be placed in Core Based Statistical Areas (CBSAs) based on a population weighted emissions index (PWEI) for the area. The PWEI is calculated by multiplying the latest available SO<sub>2</sub> emission data within each CBSA by the population of the CBSA, and then dividing the result by one million. The final rule requires:

- Three SO<sub>2</sub> monitors in CBSAs with PWEI values of one million or more;
- Two SO<sub>2</sub> monitors in CBSAs with PWEI values less than one million but greater than 100,000; and
- One SO<sub>2</sub> monitor in CBSAs with PWEI values greater than 5,000 but less than 100,000.

California has thirty-five CBSAs with population ranging from 17,000 to more than 12 million people. Table 2 lists the three CBSAs in California that require SO<sub>2</sub> monitoring. In addition, Table 2 shows that these CBSAs either meet or exceed federal monitoring requirements for SO<sub>2</sub>. California's monitoring network currently consists of 39 monitors, in excess of the 4 required monitors.

**Table 2  
Minimum Monitoring Requirements for Sulfur Dioxide**

<b>CBSA</b>	<b>Counties in CBSA</b>	<b>SO<sub>2</sub> emissions per CBSA (tpy)</b>	<b>Population (2009)</b>	<b>PWEI (Million persons-tpy)</b>	<b>Required SO<sub>2</sub> Monitors</b>	<b>Existing SO<sub>2</sub> monitors</b>
Los Angeles-Long Beach-Santa Ana	Los Angeles, Orange	13,498	12,874,797	173,785	2	5
Riverside-San Bernardino-Ontario	Riverside, San Bernardino	2,478	4,143,113	10,266	1	4
San Francisco-Oakland-Fremont	Alameda, Contra Costa, San Francisco, San Mateo, Marin	12,669	4,317,853	54,702	1	9

**SUMMARY**

ARB has used California's air quality monitoring and emissions data to develop recommended area designations for U.S. EPA's revised 1-hour SO<sub>2</sub> standard. The statewide monitoring network shows no violations and the highest concentrations are far below the new federal standard. A review of the statewide monitoring data and SO<sub>x</sub> emissions shows that California attains the SO<sub>2</sub> standard. Therefore, ARB recommends all air basins in California be designated as attainment. Additional dispersion modeling, for sources with SO<sub>x</sub> emissions greater than 100 tons per year, will be provided to the U.S. EPA. ARB is working with air districts to complete the required modeling and plans to submit the modeling results to the U.S. EPA later this year.