



**UNITED STATES ENVIRONMENTAL PROTECTION AGENCY**  
**REGION IX**  
**75 Hawthorne Street**  
**San Francisco, CA 94105-3901**

**AUG 18 2008**

**OFFICE OF THE  
REGIONAL ADMINISTRATOR**

The Honorable Arnold Schwarzenegger  
Governor of California  
State Capitol  
Sacramento, CA 95814

Dear Governor Schwarzenegger:

Thank you for your recommendations on the status of fine particle pollution throughout California. Fine-particle pollution represents one of the most significant barriers to clean air facing our nation today. Health studies link these tiny particles – about 1/30<sup>th</sup> the diameter of a human hair – to serious human health problems including aggravated asthma, increased respiratory symptoms such as coughing and difficult or painful breathing, chronic bronchitis, decreased lung function, and even premature death in people with heart and lung disease. Fine particle pollution can remain suspended in the air for long periods of time and create public health problems far away from emission sources. Reducing levels of fine-particle (PM<sub>2.5</sub>) pollution is an important part of our nation's commitment to clean, healthy air.

We have reviewed the December 17, 2007 letter from James N. Goldstene, Executive Officer, Air Resources Board, submitting California's recommendations on air quality designations for the 2006 24-Hour PM<sub>2.5</sub> standards. We have also reviewed the technical information submitted to support California's recommendations. We appreciate the effort your state has made to develop this supporting information. Consistent with the Clean Air Act, this letter is to inform you that the Environmental Protection Agency (EPA) intends to make modifications to California's recommended designations and boundaries for the following areas: Butte County, Imperial County, Sacramento County, and Yuba/Sutter Counties. We intend to support California's recommended designations and boundaries for the following areas: San Francisco Bay Area, San Joaquin Valley Air Basin, and South Coast Air Basin.

We have enclosed a detailed description of areas where EPA intends to modify your state recommendations, and the basis for such modification. We have also enclosed a detailed analysis of areas where we support the state recommendations, and the basis for that support. Mr. Goldstene will receive a copy of this letter and the enclosure. Should you have additional information that you wish to be considered by EPA in this process, please provide it to Deborah Jordan, Air Division Director, by October 20, 2008.

EPA has taken steps to reduce fine particle pollution across the country, such as the Clean Diesel Program to dramatically reduce emissions from highway, nonroad and stationary diesel engines. In addition, state programs to attain the 1997 PM<sub>2.5</sub> standards will also help to reduce unhealthy levels of fine particle pollution.

We intend to make final designation decisions for the 2006 24-Hour PM<sub>2.5</sub> standards by December 18, 2008. Please also be aware that in the near future, EPA is planning to publish a notice in the Federal Register to solicit public comments on our intended designation decisions. If you have any questions, please do not hesitate to contact me or have your staff contact Deborah Jordan at 415-947-8715. We look forward to a continued dialogue with you as we work together to implement the PM<sub>2.5</sub> standards.

Sincerely,



Wayne Natri  
Regional Administrator

Enclosure

cc: James N. Goldstene, Executive Officer, Air Resources Board  
Lynn Terry, Air Resources Board  
Karen Magliano, Air Resources Board  
Brad Poiriez, APCO, Imperial County Air Pollution Control District  
Jack Broadbent, APCO, Bay Area Air Quality Management District  
Larry Greene, APCO, Sacramento Metropolitan Air Quality Management District  
Seyed Sadredin, APCO, San Joaquin Valley Air Pollution Control District  
Dave Valler, APCO, Feather River Air Quality Management District  
W. James Wagoner, APCO, Butte County Air Quality Management District  
Barry Wallerstein, APCO, South Coast Air Quality Management District  
Tom Christofk, APCO, Placer County Air Pollution Control District  
Marcella McTaggart, APCO, El Dorado County Air Quality Management District  
Mat Ehrhardt, APCO, Yolo-Solano Air Quality Management District

## Attachment 1

### CALIFORNIA Area Designations For the 24-Hour Fine Particle National Ambient Air Quality Standard

The table below identifies the counties in California that EPA intends to designate as not attaining the 2006 24-hour fine particle (PM<sub>2.5</sub>) standard.<sup>1</sup> A county will be designated as nonattainment if it has an air quality monitor that is violating the standard or if the county is determined to be contributing to the violation of the standard.

Area	California Recommended Nonattainment Counties	EPA's Intended Nonattainment Counties
Butte County	Butte County - Partial	Butte County
Imperial County	Imperial County - Partial	Imperial County
Sacramento County	Sacramento County	Sacramento County Yolo County Placer County – Partial El Dorado County – Partial Solano County - Partial
San Francisco Bay Area	Sonoma County – Partial Napa County Marin County San Francisco County Contra Costa County Alameda County Santa Clara County San Mateo County Solano County - Partial	Sonoma County – Partial Napa County Marin County San Francisco County Contra Costa County Alameda County Santa Clara County San Mateo County Solano County - Partial
San Joaquin Valley Air Basin	San Joaquin County Stanislaus County Merced County Madera County Fresno County Kings County Tulare County Kern County - Partial	San Joaquin County Stanislaus County Merced County Madera County Fresno County Kings County Tulare County Kern County - Partial
South Coast Air Basin	Los Angeles County – Partial San Bernardino County Partial Riverside County – Partial Orange County	Los Angeles County – Partial San Bernardino County Partial Riverside County – Partial Orange County
Yuba County Sutter County	Yuba County – Partial Sutter County - Partial	Yuba County Sutter County

EPA intends to designate the remaining counties in the state as attainment/unclassifiable.

<sup>1</sup> EPA designated nonattainment areas for the 1997 fine particle standards in 2005. In 2006, the 24-hour PM<sub>2.5</sub> standard was revised from 65 micrograms per cubic meter (average of 98<sup>th</sup> percentile values for 3 consecutive years) to 35 micrograms per cubic meter; the level of the annual standard for PM<sub>2.5</sub> remained unchanged at 15 micrograms per cubic meter (average of annual averages for 3 consecutive years).

## **EPA Technical Analysis for Butte County**

Pursuant to section 107(d) of the Clean Air Act, EPA must designate as nonattainment those areas that violate the NAAQS and those areas that contribute to violations. This technical analysis for Butte County identifies the monitor that violates the 24-hour PM<sub>2.5</sub> standard and evaluates the counties that potentially contribute to fine particle concentrations in the area. EPA has evaluated these counties based on the weight of evidence of the following nine factors recommended in EPA guidance and any other relevant information:

- pollutant emissions
- air quality data
- population density and degree of urbanization
- traffic and commuting patterns
- growth
- meteorology
- geography and topography
- jurisdictional boundaries
- level of control of emissions sources

Figure 1 is a map of the counties in the area and other relevant information such as the locations and design values of air quality monitors, the metropolitan area boundary, and counties recommended as nonattainment by the State.

# Butte County, CA

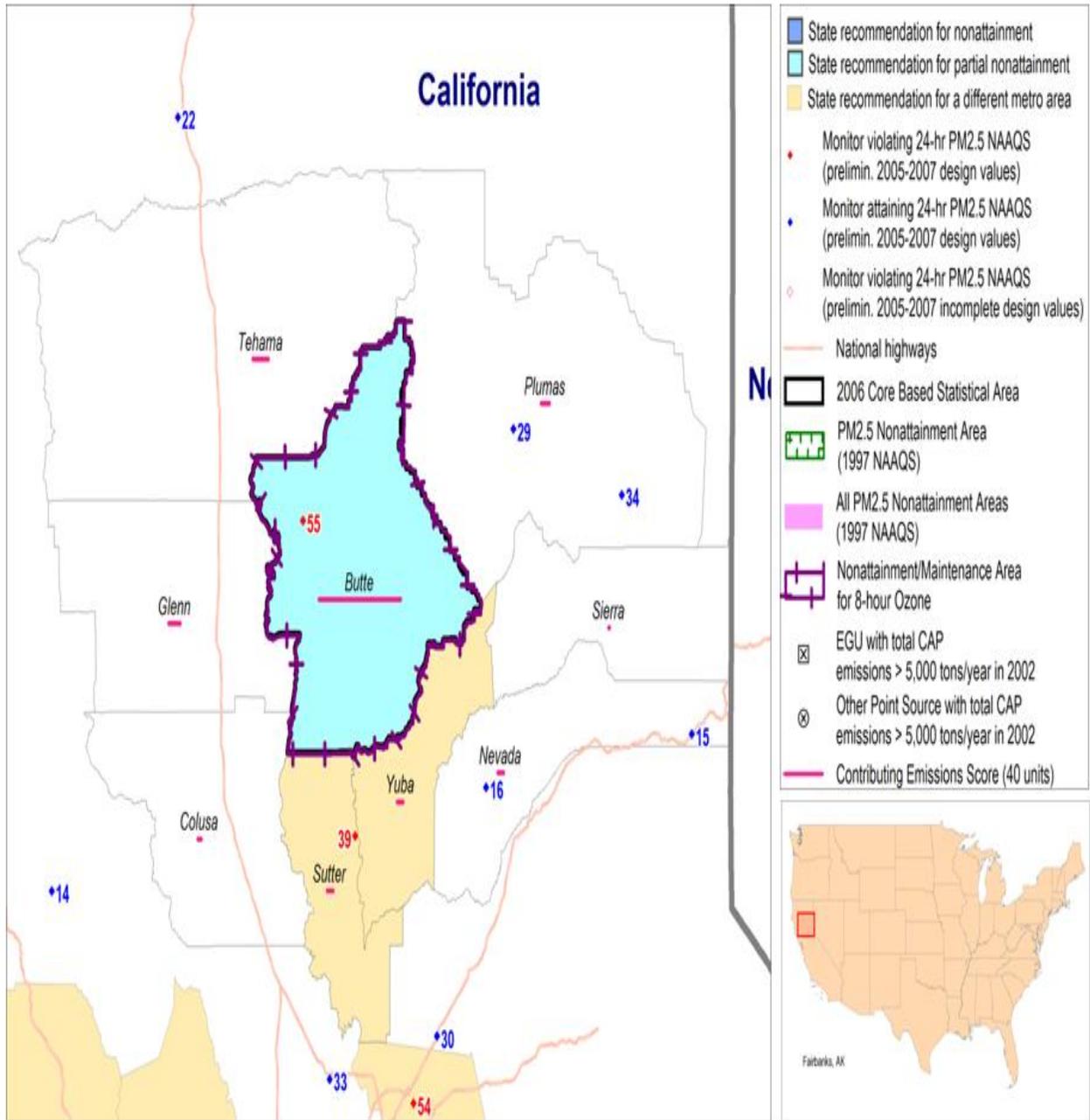


Figure 1

Counties labeled in bold reflect NAAs under 1997 NAAQS

The California Air Resources Board (CARB), sent a letter to EPA, dated December 17, 2007, recommending that the City of Chico in Butte County be designated as “nonattainment” for the 2006 24-hour PM<sub>2.5</sub> standard based on the most recent three years of air quality data that were available in December 2007. These data are from a Federal Reference Method (FRM) monitor located in Chico, California.

Air quality monitoring data on the composition of fine particle mass are available from the EPA Chemical Speciation Network and the IMPROVE monitoring network, as well as from the Chico monitoring site. Analysis of these data indicates that the days with the highest fine particle concentrations occur predominantly in the cold season, and the average chemical composition of the highest days is characterized by high levels of organic carbon (e.g., 75%).

Based on EPA's 9-factor analysis described below, EPA believes that Butte County should be designated nonattainment for the 24-hour PM<sub>2.5</sub> air-quality standard, based on currently available information.

Area	State-Recommended Nonattainment Counties	EPA-Recommended Nonattainment Counties
City of Chico	Butte County (P)	Butte County

P= partial

Several factors led EPA to recommend a larger PM<sub>2.5</sub> nonattainment area than recommended by California. The most important reason was to ensure that all of the urban population in Butte County was included in the nonattainment area because the urban areas are most affected by wood smoke, which is one of the primary sources of PM<sub>2.5</sub> for Butte County. The recommended boundary does not include the entire population that would be exposed to high levels of PM<sub>2.5</sub> represented by the Chico design value, nor does it address transport that can occur from traffic and other sources within the relatively flat, valley floor of the Sacramento Valley.

Another significant consideration in expanding the nonattainment area recommended by California was that the State relied on future mobile source controls at a statewide level to address NO<sub>x</sub> emissions and, therefore, discounted mobile sources as an important consideration in their analysis. EPA believes that there is a significant contribution from mobile sources, both commuting and commercial truck traffic, in Butte County.

The following is a summary of the 9-factor analysis for Butte County.

**Factor 1: Emissions data**

For this factor, EPA evaluated county level emission data for the following PM<sub>2.5</sub> components and precursor pollutants: “PM<sub>2.5</sub> emissions total,” “PM<sub>2.5</sub> emissions carbon,” “PM<sub>2.5</sub> emissions other,” “SO<sub>2</sub>,” “NO<sub>x</sub>,” “VOCs,” and “NH<sub>3</sub>.” “PM<sub>2.5</sub> emissions total” represents direct emissions of PM<sub>2.5</sub> and includes: “PM<sub>2.5</sub> emissions carbon,” “PM<sub>2.5</sub> emissions other”, primary sulfate (SO<sub>4</sub>), and primary nitrate. (Although primary sulfate and primary nitrate, which are emitted directly from stacks rather than forming in atmospheric reactions with SO<sub>2</sub> and NO<sub>x</sub>, are part of “PM<sub>2.5</sub> emissions total,” they are not shown on the template or data spreadsheet as separate

items). “PM<sub>2.5</sub> emissions carbon” represents the sum of organic carbon (OC) and elemental carbon (EC) emissions, and “PM<sub>2.5</sub> emissions other” represents other inorganic particles (crustal). Emissions of SO<sub>2</sub> and NO<sub>x</sub>, which are precursors of the secondary PM<sub>2.5</sub> components sulfate and nitrate, are also considered. VOCs (volatile organic compounds) and NH<sub>3</sub> (ammonia) are also potential PM<sub>2.5</sub> precursors and are included for consideration.

Emissions data were derived from the 2005 National Emissions Inventory (NEI), version 1. See [http://www.epa.gov/ttn/naaqs/pm/pm25\\_2006\\_techinfo.html](http://www.epa.gov/ttn/naaqs/pm/pm25_2006_techinfo.html).

EPA also considered the Contributing Emissions Score (CES) for each county. The CES is a metric that takes into consideration emissions data, meteorological data, and air quality monitoring information to provide a relative ranking of counties in and near an area. Note that this metric is not the exclusive way for consideration of data for these factors. A summary of the CES is included in attachment 2, and a more detailed description can be found at: [http://www.epa.gov/ttn/naaqs/pm/pm25\\_2006\\_techinfo.html#C](http://www.epa.gov/ttn/naaqs/pm/pm25_2006_techinfo.html#C).

Table 1 shows emissions of PM<sub>2.5</sub> and precursor pollutants components (given in tons per year) and the CES for violating and potentially contributing counties in the Butte County area. Counties are listed in descending order by CES.

<b>Table 1. Related Emissions (tons per year) and Contributing Emission Score</b>									
<b>County</b>	<b>State Recommended Nonattainment?</b>	<b>CES</b>	<b>PM<sub>2.5</sub> total</b>	<b>SOx</b>	<b>NOx</b>	<b>Carbon PM<sub>2.5</sub></b>	<b>PM<sub>2.5</sub> other</b>	<b>VOCs</b>	<b>NH<sub>3</sub></b>
Butte	Yes (P)	100	2,974	2,115	8,486	1,513	1,461	9,754	1,757
Tehama	No	19	1,443	2,087	3,936	823	620	4,150	782
Glenn	No	14	1,851	1,347	3,882	833	1,017	4,392	2,139

P = partial

Additional data considered in EPA’s analysis of this factor are summarized in the following table derived from the California Air Resources Board Almanac of Emissions and Air Quality Data (<http://www.arb.ca.gov/Aqd/almanac/almanac.htm>). The following table further defines, in tons per day, the type of area sources contributing to PM<sub>2.5</sub> emissions in Butte County. Area sources include residential fuel combustion, farming operations, construction/demolition, paved road dust, unpaved road dust, fugitive windblown dust, fires, managed burning and disposal and cooking. As is indicated, area sources represent the largest percentage of primary PM<sub>2.5</sub> emissions (approximately 70%) and the balance is divided between stationary and mobile sources.

<b>SOURCE</b>	<b>PM<sub>2.5</sub></b>
Residential Fuel Combustion	2.65
Farming Operations	0.82
Construction/Demolition	0.11
Paved Road Dust	0.53
Unpaved Road Dust	0.76
Fugitive Windblown Dust	0.04
Fires	0.01
Managed Burning & Disposal	1.4
Cooking	0.07
Total Area Wide	6.4
Area Wide percent of total	68%
Total All	9.9

**Source: ARB Almanac website (2006) <http://www.arb.ca.gov/ei/maps/statemap/cntymap.htm>**

Given the significance of NO<sub>x</sub> emissions in the formation of the PM<sub>2.5</sub>, EPA also considered emissions provided in the CARB Recommendation letter under this factor, along with the NO<sub>x</sub> data from NEI summarized in Table 1. Table 3 summarizes NO<sub>x</sub> emissions from stationary, area, and mobile source categories for 2006, 2010, and 2020.

<b>Source Category</b>	<b>2006</b>	<b>2010</b>	<b>2020</b>
Stationary Sources	1.4	1.4	1.4
Area Sources	1.7	1.7	1.7
Mobile Sources	23.3	19.9	11.3

Source: California Air Resources Board in their letter of December 17, 2007  
Note: Although provided by CARB, the 2010 and 2020 data was not relied on for this analysis.

Finally, speciation data from the Chico air monitoring station was considered in evaluating this factor as a way to link emission sources to high PM<sub>2.5</sub> levels. As shown in the pie chart below, the chemical makeup of PM<sub>2.5</sub> in Chico is dominated by organic carbon and ammonium nitrate when the highest concentrations occur, which is during the winter months (i.e., November through February).

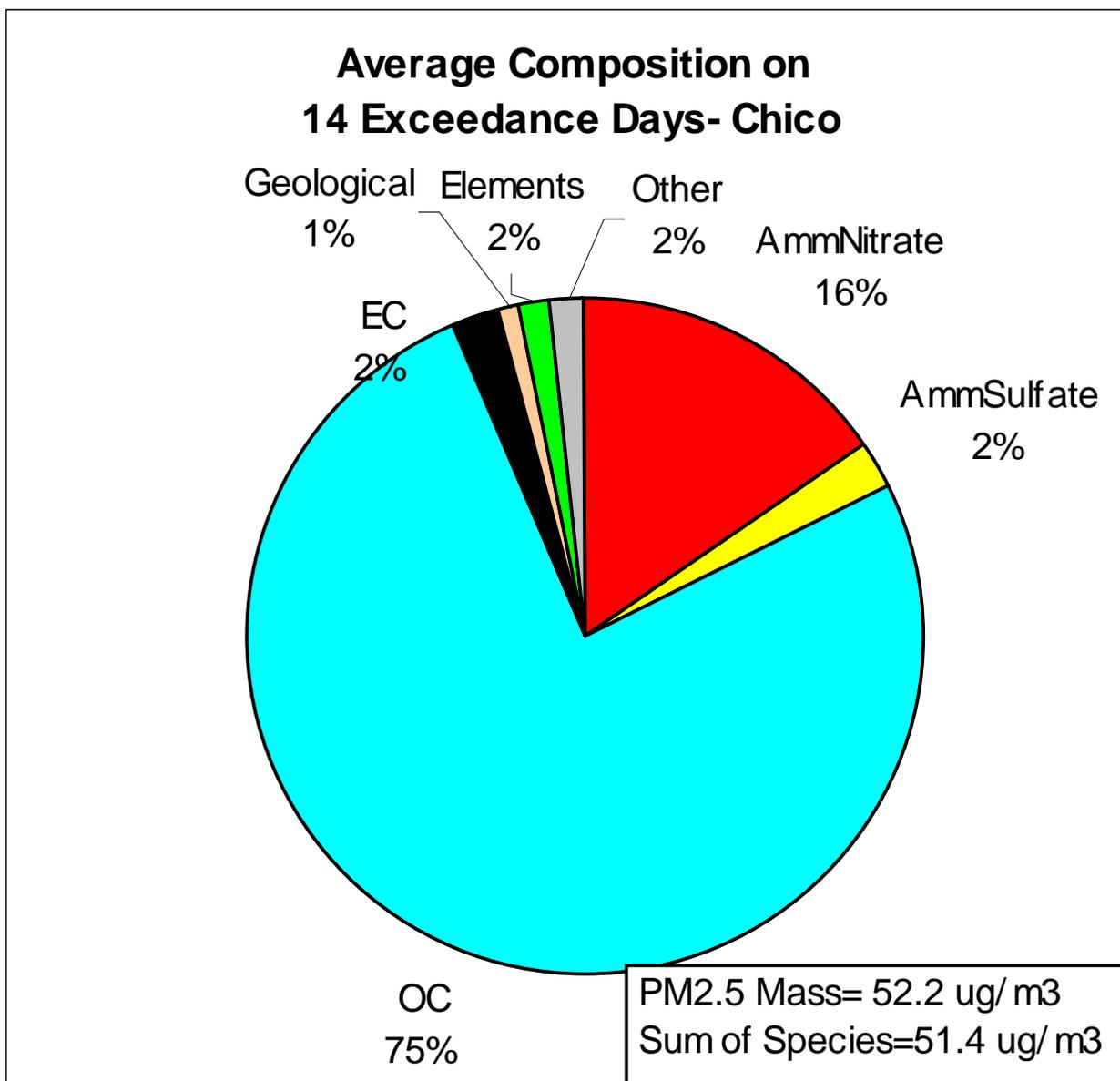


Figure 2: Average PM<sub>2.5</sub> Composition - Chico

The CES shown in Table 1 describe the relative contribution of emissions from surrounding counties to the high emission days based on a broad analysis of NOAA HYSPLIT trajectories linking county-wide emissions from Butte and the surrounding counties and speciated air monitoring data on high days. With respect to this factor, the CES clearly demonstrates a connection between pollution levels in Chico and sources throughout Butte County. The CES shows less of a link between PM<sub>2.5</sub> levels in Chico and neighboring Tehama and Glenn County.

With respect to primary PM<sub>2.5</sub> emissions, area sources represent the dominant source category in Butte County. Based on Table 2, within the area source category, residential wood burning is the dominant source of PM<sub>2.5</sub>. This corresponds with the speciation data summarized in Figure 2

which shows that as much as 75% of the  $PM_{2.5}$  makeup is carbon which can be attributed to residential wood burning during the winter months.

Finally,  $NO_x$  emissions were considered. According to the speciation data in Figure 2, as much as 16% of the  $PM_{2.5}$  composition can be nitrates, and thereby related to  $NO_x$  sources in the winter. Both Table 1 and 3 describe  $NO_x$  emissions data for Butte County and, as shown in Table 3, mobile sources are the dominant source of  $NO_x$  emissions. In light of the commuting patterns discussed under Factor 4 and illustrated in Figure 3, there appears to be a clear link between mobile source emissions in Butte County and the  $PM_{2.5}$  exceedances measured in Chico.

# Butte County Population Density, Truck and Commuting Traffic

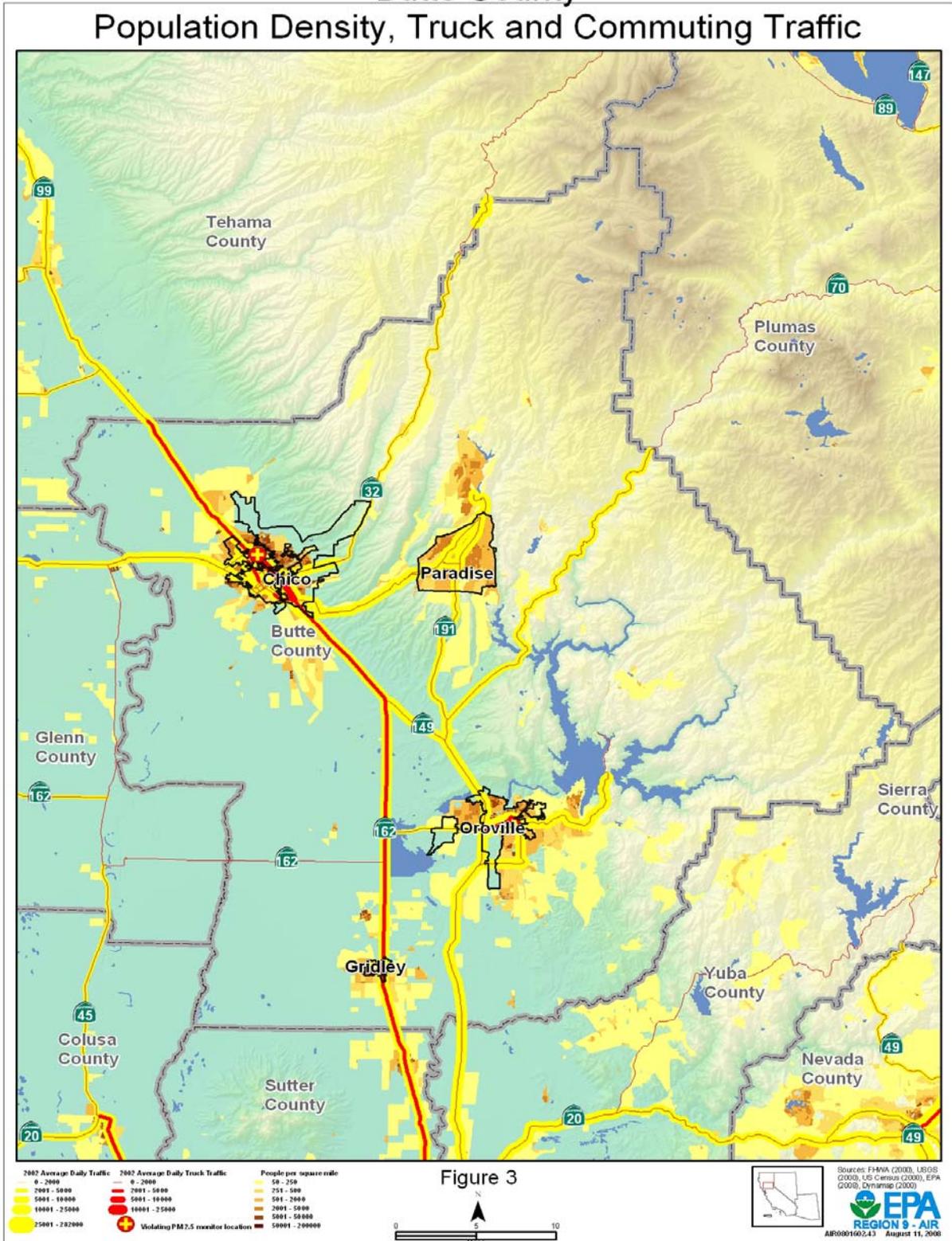


Figure 3

In summary, PM<sub>2.5</sub> exceedances most often occur in Chico during the winter months and speciation data suggest that residential wood burning and mobile source emissions are the most important sources. Area source data show that residential wood burning is the dominant source of PM<sub>2.5</sub> and thereby, could be linked to PM<sub>2.5</sub> exceedances measured in Chico. With respect to mobile sources, Butte County has significant mobile source emissions which, combined with the commuting patterns, suggest a link between exceedances in Chico and emissions within Butte County.

Based on emission levels and CES values, Butte County in California is a candidate for a 24-hour PM<sub>2.5</sub> nonattainment designation. However, it does not appear that the surrounding counties are significantly contributing to the pollution levels in Butte County.

**Factor 2: Air quality data**

This factor considers the 24-hour PM<sub>2.5</sub> design values in micrograms per cubic meter (µg/m<sup>3</sup>) for air quality monitors in Butte County based on data for the 2004-2006 and 2005-2007 period. A monitor’s design value indicates whether that monitor attains a specified air quality standard. The 24-hour PM<sub>2.5</sub> standards are met when the 3-year average of a monitor’s 98<sup>th</sup> percentile values are 35 µg/m<sup>3</sup> or less. A design value is only valid if minimum data completeness criteria are met.

The 24-hour PM<sub>2.5</sub> design values for Butte County and neighboring Plumas County are shown in Table 4. Monitors for PM<sub>2.5</sub> are not located in Tehama and Glenn Counties.

<b>Table 4. Air Quality Data</b>			
<b>County/ City</b>	<b>State Recommended Nonattainment ?</b>	<b>24-hour PM<sub>2.5</sub> Design Values 2004-06 (µg/m<sup>3</sup>)</b>	<b>24-hour PM<sub>2.5</sub> Design Values 2005-07 (µg/m<sup>3</sup>)</b>
Butte County, CA City of Chico	Yes	56	55
Plumas County CA	No	30	34

The violating monitor for 2004–2006 and 2005–2007 is located in the City of Chico in Butte County. Therefore, Butte County is a candidate for designation as a nonattainment area. Tehama and Glenn counties have no data showing violations. Plumas County has a design value for 2005–2007 that is just below the PM<sub>2.5</sub> standard (at 34 µg/m<sup>3</sup>). Given the air quality data, including consideration of CES values, and the State’s recommendations, Plumas, Tehama and Glenn Counties were not further considered as nonattainment areas.

In addition to considering design values, EPA also considered information supplied in the CARB recommendation letter regarding the area represented by PM<sub>2.5</sub> air monitoring data. Two studies cited by CARB support nonattainment area boundaries larger than the areas that they recommended. The studies were both based on data collected during the 2000 California Regional PM<sub>10</sub>/PM<sub>2.5</sub> Air Quality Study (CRPAQS). These studies focused on the San Joaquin

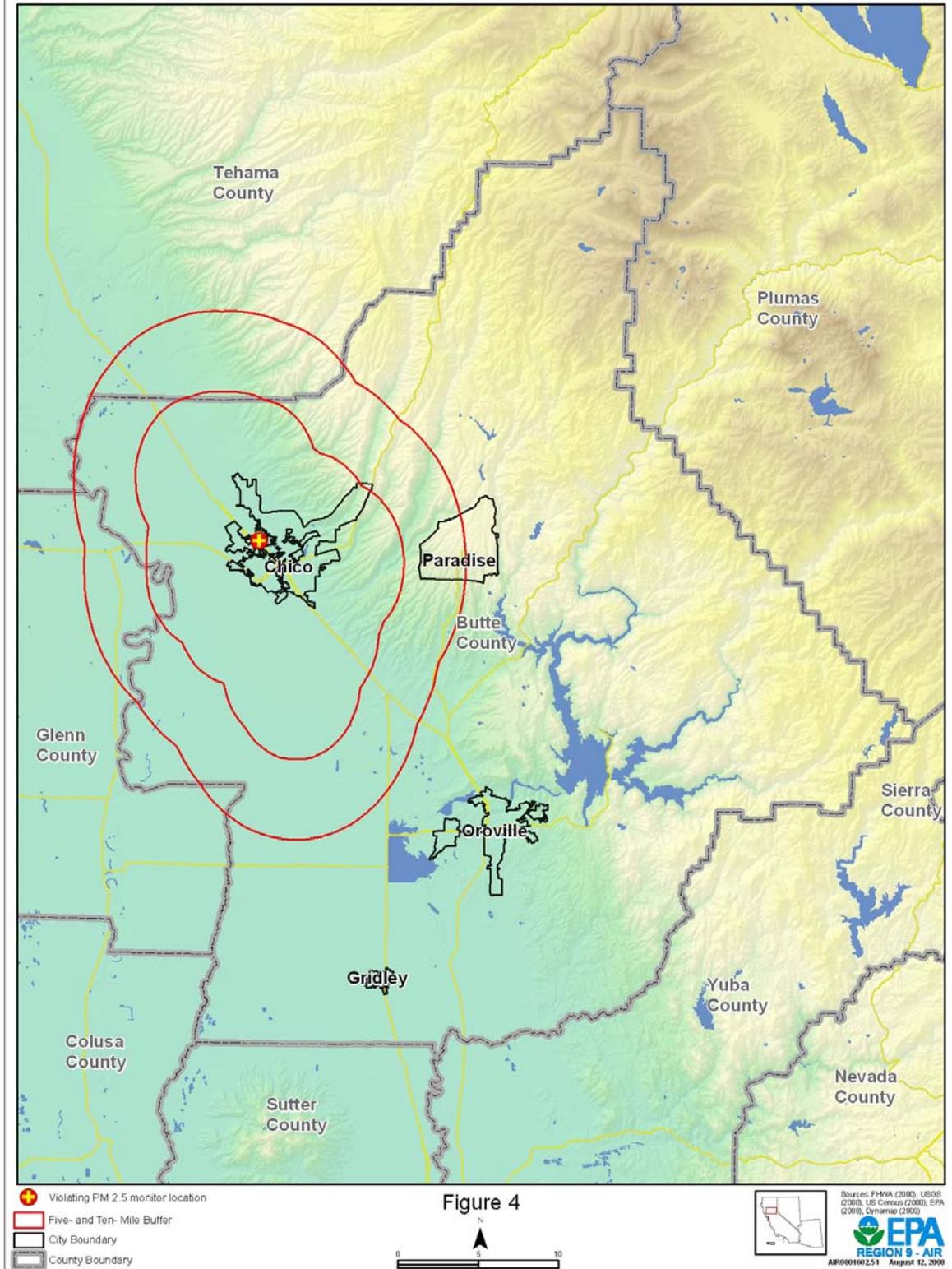
Valley which, together with the Sacramento Valley to the north, comprises California's Central Valley situated between the Sierra Nevada and the coastal mountain ranges. CARB cited the studies as showing that the organic carbon portion of  $PM_{2.5}$  is largely urban rather than rural, because of the limited range of influence of  $PM_{2.5}$  monitors (which are in urban areas). While it is likely true that organic carbon concentrations are higher in urban than in rural areas, this does not in itself support nonattainment areas limited to city boundaries.

Range of influence (or zone or radius of representation) can be defined in various ways. In the 2006 Chow study cited by CARB, zone of representation is defined as the area over which the average concentration differs less than 10% from the monitored value and this area was estimated based on concentration differences between monitors. A rapid concentration drop from one monitor to another nearby monitor would show a small zone of representation while a slow concentration drop between distant monitors would show a large zone. The study found the radius of representation to range from 3 km to 21 km (2 mi to 13 mi) and averaging 13 km (8 mi). This study included monitoring locations in the Sacramento Valley locations which were intended to describe the spatial distribution of concentrations and not to set boundaries for planning purposes. However, they do give a rough sense of the size of the area that is represented by a  $PM_{2.5}$  air monitor.

In a second study using CRPAQS data, MacDonald et al. defined "zone of influence" as the distance at which CALPUFF-modeled concentrations fell to 1/10 of the urban maximum. This analysis showed larger regions of influence in the Sacramento area, 15-100 km (9-60 mi), than in the San Joaquin Valley, 15-50 km (9-30 mi).

Considering the results from these studies, EPA used buffer zones of 5 and 10 miles around city boundaries to approximate the area which could be influenced by  $PM_{2.5}$  measurements in Chico. These boundaries are shown in Figure 4.

# Butte County - City Boundaries and Buffer Zones



Eligible monitors for providing design value data generally include State and Local Air Monitoring Stations (SLAMS) at population-oriented locations with a FRM or FEM monitor. All data from Special Purpose Monitors (SPM) using an FRM, FEM, or Alternative Reference Method (ARM) which has operated for more than 24 months is eligible for comparison to the relevant NAAQS, subject to the requirements given in the October 17, 2006 Revision to Ambient Air Monitoring Regulations (71 FR 61236). All monitors used to provide data must meet the monitor siting and eligibility requirements given in 71 FR 61236 to 61328 in order to be acceptable for comparison to the 24-hr PM<sub>2.5</sub> NAAQS for designation purposes.

**Factor 3: Population density and degree of urbanization (including commercial development)**

Population data are relevant in defining the boundaries of the PM<sub>2.5</sub> nonattainment area given the correlation between population and the emission sources contributing to PM<sub>2.5</sub> exceedances (i.e., residential wood burning and mobile sources), as well as the population exposed to high PM<sub>2.5</sub> levels. Table 5 shows the 2005 population for each county in the area being evaluated, as well as the population density for each county in that area. Population data gives an indication of whether it is likely that population-based emissions might contribute to violations of the 24-hour PM<sub>2.5</sub> standards.

<b>Table 5. Population</b>			
<b>County</b>	<b>State Recommended Nonattainment?</b>	<b>2005 Population</b>	<b>2005 Population Density (pop/sq mi)</b>
Butte	Yes (P)	214,153	128
Plumas County	No	21,409	8
Tehama	No	60,932	21
Glenn	No	27,683	21

P= partial

According to Table 5, Butte County has the highest population and population density. Tehama County has the next highest population of the adjacent counties, but significantly below Butte (also in terms of population density). Population centers in Butte County include Chico (population of 59,444 per 2000 US Census), Paradise (population of 26408 per 2000 US Census) and Oroville (population of 13004 per 2000 US Census). Tehama and Glenn County have the same population density of 21 pop/sq mi, compared to Butte County at 128. Both Butte and Glenn counties experienced a 5% population growth from 2000-2005, while Plumas and Tehama counties saw slightly higher growth at 8%. However, the small populations and moderate growth in Plumas, Tehama, and Glenn counties further supports elimination of these counties from consideration as nonattainment areas. The presence of population centers outside of Chico supports EPA’s recommendation to expand the nonattainment area to capture these other population centers.

#### Factor 4: Traffic and commuting patterns

This factor considers the number of commuters in each county who drive to Butte County, the percent of total commuters in each county who commute to Butte County, as well as the total Vehicle Miles Traveled (VMT) for each county in thousands of miles (see Table 6). A county with numerous commuters is generally an integral part of an urban area and is likely contributing to fine particle concentrations in the area. Such an area could be an appropriate county for implementing mobile source emission control strategies, thus warranting inclusion in the nonattainment area.

County	State Recommended Nonattainment?	2005 VMT (1000s mi)	Number Commuting to any violating county	Percent Commuting to any violating county
Butte County	Yes (P)	2,078	75,510	92%
Plumas County	No	231	50	1%
Tehama County,	No	599	1,170	6%
Glenn County	No	330	1,770	17%

P = partial

According to the data in Table 6, Butte County has a significantly larger number of commuters commuting into the violating area, 75,510 or 92%. Butte County has a large number of commuters traveling to and from Chico, the location of the violating monitor. There is also significant traffic into and out of Chico from the Cities of Paradise (on Highway 91) and to Oroville (on Highway 149).

In addition to the contribution of Butte County to traffic levels in the City of Chico, average daily truck traffic on Highway 162 is in the range of 5001 to 10,000 trucks. This highway extends from Sutter County to Butte County beyond the city limits of Chico. The daily car and truck traffic from Chico to Paradise, and from Chico to Oroville is much lower, in the range of 0 to 2000 vehicles, but does shows a daily traffic pattern.

Based on Factor 4, Tehama, Plumas and Glenn Counties can be eliminated from consideration as nonattainment areas. However, Butte County has significant commuter and truck traffic which argues for including Butte County as a nonattainment area. Figure 3 shows the traffic patterns in and around Chico.

The 2005 VMT data used for Tables 6 and 7 of the 9-factor analysis has been derived using methodology similar to that described in “Documentation for the final 2002 Mobile National Emissions Inventory, Version 3, September 2007, prepared for the Emission Inventory Group, U.S. EPA. This document may be found at: [atftp://ftp.epa.gov/EmisInventory/2002finalnei/documentation/mobile/2002\\_mobile\\_nei\\_version](http://ftp.epa.gov/EmisInventory/2002finalnei/documentation/mobile/2002_mobile_nei_version)

\_3\_report\_092807.pdf. The 2005 VMT data were taken from documentation which is still draft, but which should be released in 2008.

**Factor 5: Growth rates and patterns**

This factor considers population growth for 2000-2005 and growth in vehicle miles traveled for 1996-2005 for Butte County and the surrounding counties, as well as patterns of population and VMT growth. A county with rapid population or VMT growth is generally an integral part of an urban area and likely to be contributing to fine particle concentrations in the area.

Table 7 below shows population, population growth, VMT and VMT growth for counties that are in the area adjacent to Butte County. Counties are listed in descending order based on VMT growth between 1996 and 2005.

<b>County</b>	<b>Population (2005)</b>	<b>Population Density</b>	<b>Population % change (2000 - 2005)</b>	<b>2005 VMT (millions mi)</b>	<b>% VMT change (from 1996-2005)</b>
Butte	214,153	128	5%	2,078	61%
Plumas	21,409	8	3%	253	57%
Tehama	60,932	21	8%	485	(41)%
Glenn	27,683	21	5%	253	(40)%

According to Table 7, Butte County has the highest population and population density. Tehama County has the next highest population of the adjacent counties, but significantly below Butte (also in terms of population density). Tehama and Glenn County have the same population density of 21 pop/sq mi, compared to Butte County at 128. Both Butte and Glenn counties experienced a 5% population growth from 2000-2005, while Plumas and Tehama counties also saw slightly higher growth at 8%.

Glenn and Tehama Counties, while having a relatively small increase in population from 2000 to 2005, also experienced a decline in VMT growth from 1996 to 2005. Plumas County, with the smallest total population of these counties, also had the lowest growth in population from 2000 to 2005, but relatively large growth in VMT for part of the same period.

Based on the analysis under Factor 5, Tehama and Glenn Counties, while experiencing modest growth in population, also had significant decreases in VMT which further supports elimination of these counties from consideration as nonattainment areas. Plumas County also had slight growth in population, but saw increased VMT. However, the total numbers for Plumas are still very low further supporting its elimination from consideration as a nonattainment area. Butte County has the largest population, by far, and also the most significant growth in VMT.

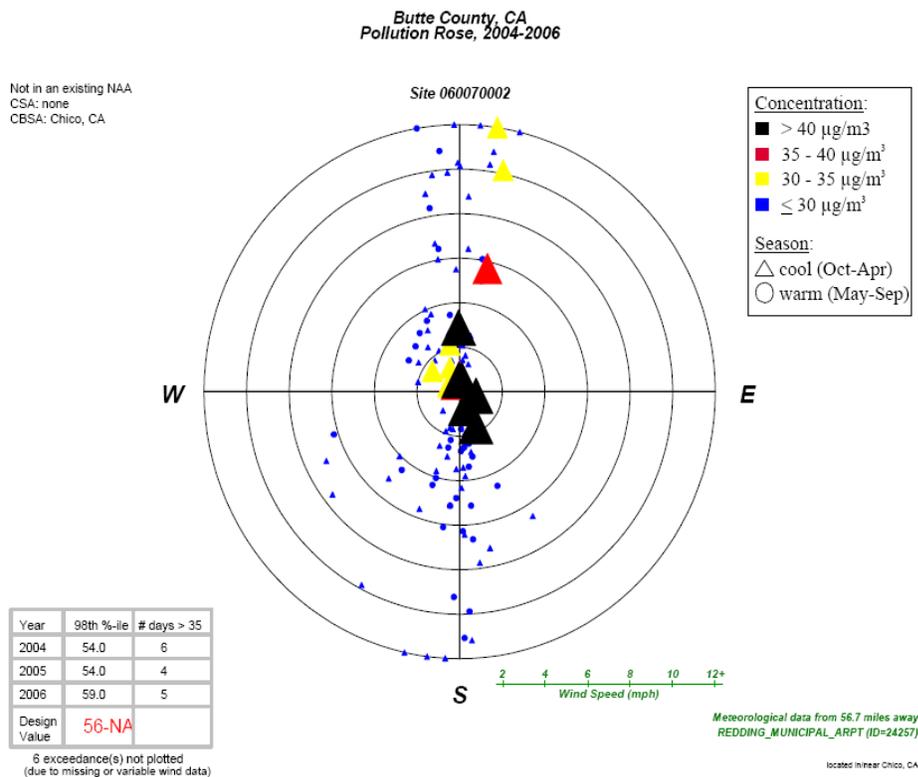
**Factor 6: Meteorology (weather/transport patterns)**

For this factor, EPA considered data from National Weather Service instruments in the area. Wind direction and wind speed data for 2004-2006 were analyzed, with an emphasis on “high PM<sub>2.5</sub> days” for each of two seasons (an October-April “cold” season and a May-September

“warm” season). These high days are defined as days where any FRM or Federal Equivalent Method (FEM) air quality monitors had 24-hour PM<sub>2.5</sub> concentrations above 95% on a frequency distribution curve of PM<sub>2.5</sub> 24-hour values, or were 24-hr values exceeded 35.1 µg/m<sup>3</sup>.

For each air quality monitoring site, EPA developed a “pollution rose” to understand the prevailing wind direction and wind speed on the days with highest fine particle concentrations. Figure 5 identifies 24-hour PM<sub>2.5</sub> values by color; days exceeding 35 µg/m<sup>3</sup> are denoted with a red or black icon. A dot indicates the day occurred in the warm season; a triangle indicates the day occurred in the cool season. The center of the figure indicates the location of the air quality monitoring site, and the location of the icon in relation to the center indicates the direction from which the wind was blowing on that day. An icon that is close to the center indicates a low average wind speed on that day. Higher wind speeds are indicated when the icon is further away from the center.

The pollution rose for Butte County, shown below, indicates that the elevated levels of the PM<sub>2.5</sub> 24-hour values for the Chico monitoring site occur primarily when the wind is from the south, and occasionally when the wind is from the north. The pollutant rose for Butte County also indicates that elevated PM<sub>2.5</sub> 24-hour values occur during the cool season, during time periods of low wind speeds.



These data are consistent with the analysis provided by California, and may also support the CARB position that the organic carbon portion of the particulate matter problem is localized. However, as discussed in Factor 2: Air Quality, above, the buffer zones of 5 and 10 miles around city boundaries approximate the area which could be influenced by PM<sub>2.5</sub> measurements in Chico. Therefore, the presumptive boundary of the City of Chico appears to be inappropriately small for taking into account the area influenced by the PM<sub>2.5</sub> measurements in Chico.

This factor, together with Factor 2, supports the EPA proposal that all of Butte County, California be considered for designation as a nonattainment area for the 24-hour PM<sub>2.5</sub> air-quality standard.

The meteorology factor is also considered in each county's Contributing Emissions Score because the method for deriving this metric included an analysis of trajectories of air masses for high PM<sub>2.5</sub> days.

#### **Factor 7: Geography/topography (mountain ranges or other air basin boundaries)**

The geography/topography analysis looks at physical features of the land that might have an effect on the airshed and, therefore, on the distribution of PM<sub>2.5</sub> within Butte County.

Butte County is part of the larger Northern Sacramento Valley Air Basin (NSVAB), which includes the counties of Butte, Colusa, Glenn, Shasta, and Tehama. The NSVAB is bounded on north and west by the Coastal Mountain Range and on the east by the southern portion of the Cascade Mountain Range and the northern portion of the Sierra Nevada Mountains. These mountain ranges reach heights in excess of 6,000 feet with peaks rising much higher. This provides a substantial physical barrier to locally created pollution.

Because the Butte area has topographical features higher than the typical daytime height of the inversion layer, EPA considered the inversion height, as well as the using the top of the mountain or ridgeline, to estimate the size of the area likely to have similar pollution conditions, and to determine an appropriate eastern boundary. To get a sense of the eastern edge of area in which pollution could be confined, EPA examined the Sierra foothills elevation contour that is 1500 feet. This contour is represented in Figure 6.

# Butte County - Inversion Layer Boundary

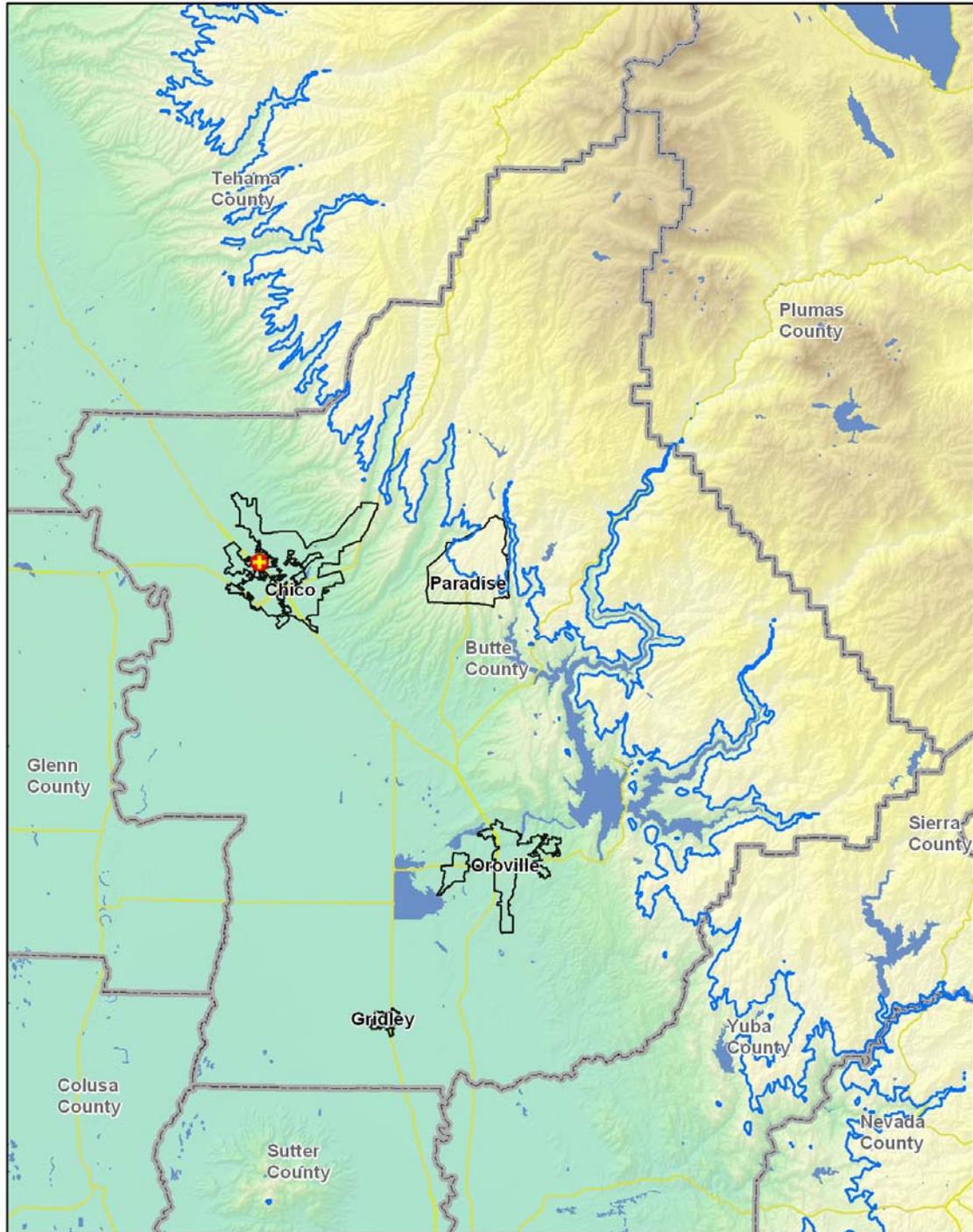


Figure 6

- ⊕ Violating PM 2.5 monitor location
- ▭ City Boundary
- ▭ County Boundary



Sources: FHMA (2000), USGS (2003), US Census (2000), EPA (2008), Dynamic (2007)

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For the areas under consideration, high PM<sub>2.5</sub> concentrations mostly occur during stagnant conditions during winter, with radiant inversions. The cooling of the ground, as heat is radiated away, creates an inversion, since air near the ground is cooler than that above. This inhibits mixing and confines pollutants to a relatively shallow layer near the ground. Ferreria and Shipp examined the meteorology of San Joaquin Valley PM<sub>2.5</sub> and PM<sub>10</sub> episodes, including inversion heights, typically based on aircraft temperature soundings. (During CRPAQS, radio acoustic sounding system (RASS) data were also available.) A typical value for maximum mixing height during high PM<sub>2.5</sub> conditions is 500 meters and a minimum mixing height can be 100 meters or less.

EPA recognizes that an inversion height is not a rigid boundary extending through a fixed elevation. In reality the inversion would be partly terrain-following, and the degree of stagnation would be subject to additional influences at the foothill edges, such as strong diurnal slope flows. In any case, the mixing heights vary substantially by site and date, so any single height can provide only a scale for comparison, not a definitive value. Nevertheless, this contour gives a rough sense of the area over which inversions may be enhancing pollution concentrations.

In summary, topography is considered to be an important factor given that inversion layers during the winter, when PM<sub>2.5</sub> exceedances typically occur, can contribute to higher pollution levels in the Sacramento Valley. In addition to affecting the City of Chico, these conditions are expected to create similar pollution conditions throughout Butte County and, thereby, provides further reason to expand the nonattainment boundary beyond the City of Chico. Tehama and Glenn County are also within the Sacramento Valley but, given the analysis in the preceding factors, we continue to support excluding them from the nonattainment area. Plumas County is not in the Sacramento Valley and, therefore, is not influenced by the same inversion conditions.

#### **Factor 8: Jurisdictional boundaries (e.g., existing PM and ozone areas)**

In evaluating the jurisdictional boundary factor, consideration should be given to existing boundaries and organizations that may facilitate air quality planning and the implementation of control measures to attain the standard. Areas designated as nonattainment (e.g. for PM<sub>2.5</sub> or 8-hour ozone standard) represent important boundaries for state air quality planning.

The analysis of jurisdictional boundaries considered the planning and organizational structure of the City of Chico in Butte County to determine if the implementation of controls in a potential nonattainment area can be carried out in a cohesive manner.

Tehama County is within the jurisdiction of the Tehama County Air Pollution Control District, and Plumas County is within the jurisdiction of the Northern Sierra Air Quality Management District. A goal in designating PM<sub>2.5</sub> nonattainment areas is to achieve a degree of consistency with ozone nonattainment areas. Butte County is currently a nonattainment area for the 8-hour ozone standard. Tehama, Glenn and Plumas are not currently designated nonattainment for 8-hour ozone.

All of Butte County, including the City of Chico, is within the jurisdiction of the Butte County Air Management District. Therefore, a Butte County PM<sub>2.5</sub> nonattainment area that relies on the county boundaries would provide a single management boundary for both 8-hour ozone and PM<sub>2.5</sub> planning, and would include the three cities of major population within Butte County. In addition, the Butte County boundary also encompasses the 5-mile buffer zone that EPA identified for the City of Chico. All of these factors argue for the inclusion of Butte County as a nonattainment area.

**Factor 9: Level of control of emission sources**

This factor considers emission controls currently implemented for major sources in Butte County.

The emission estimates on Table 1 (under Factor 1) include any control strategies implemented by Butte County area before 2005 that may influence emissions of any component of PM<sub>2.5</sub> emissions (i.e., total carbon, SO<sub>2</sub>, NO<sub>x</sub>, and crustal PM<sub>2.5</sub>).

## Attachment 2

### Description of the Contributing Emissions Score

The CES is a metric that takes into consideration emissions data, meteorological data, and air quality monitoring information to provide a relative ranking of counties in and near an area. Using this methodology, scores were developed for each county in and around the relevant metro area. The county with the highest contribution potential was assigned a score of 100, and other county scores were adjusted in relation to the highest county. The CES represents the relative maximum influence that emissions in that county have on a violating county. The CES, which reflects consideration of multiple factors, should be considered in evaluating the weight of evidence supporting designation decisions for each area.

The CES for each county was derived by incorporating the following significant information and variables that impact PM<sub>2.5</sub> transport:

- Major PM<sub>2.5</sub> components: total carbon (organic carbon (OC) and elemental carbon (EC)), SO<sub>2</sub>, NO<sub>x</sub>, and inorganic particles (crustal).
- PM<sub>2.5</sub> emissions for the highest (generally top 5%) PM<sub>2.5</sub> emission days (herein called “high days”) for each of two seasons, cold (Oct-Apr) and warm (May-Sept)
- Meteorology on high days using the NOAA HYSPLIT model for determining trajectories of air masses for specified days
- The “urban increment” of a violating monitor, which is the urban PM<sub>2.5</sub> concentration that is in addition to a regional background PM<sub>2.5</sub> concentration, determined for each PM<sub>2.5</sub> component
- Distance from each potentially contributing county to a violating county or counties

A more detailed description of the CES can be found at [http://www.epa.gov/ttn/naaqs/pm/pm25\\_2006\\_techinfo.html#C](http://www.epa.gov/ttn/naaqs/pm/pm25_2006_techinfo.html#C).

## Attachment 1

### CALIFORNIA Area Designations For the 24-Hour Fine Particle National Ambient Air Quality Standard

The table below identifies the counties in California that EPA intends to designate as not attaining the 2006 24-hour fine particle (PM<sub>2.5</sub>) standard.<sup>1</sup> A county will be designated as nonattainment if it has an air quality monitor that is violating the standard or if the county is determined to be contributing to the violation of the standard.

Area	California Recommended Nonattainment Counties	EPA's Intended Nonattainment Counties
Butte County	Butte County - Partial	Butte County
Imperial County	Imperial County - Partial	Imperial County
Sacramento County	Sacramento County	Sacramento County Yolo County Placer County – Partial El Dorado County – Partial Solano County - Partial
San Francisco Bay Area	Sonoma County – Partial Napa County Marin County San Francisco County Contra Costa County Alameda County Santa Clara County San Mateo County Solano County - Partial	Sonoma County – Partial Napa County Marin County San Francisco County Contra Costa County Alameda County Santa Clara County San Mateo County Solano County - Partial
San Joaquin Valley Air Basin	San Joaquin County Stanislaus County Merced County Madera County Fresno County Kings County Tulare County Kern County - Partial	San Joaquin County Stanislaus County Merced County Madera County Fresno County Kings County Tulare County Kern County - Partial
South Coast Air Basin	Los Angeles County – Partial San Bernardino County Partial Riverside County – Partial Orange County	Los Angeles County – Partial San Bernardino County Partial Riverside County – Partial Orange County
Yuba County Sutter County	Yuba County – Partial Sutter County - Partial	Yuba County Sutter County

EPA intends to designate the remaining counties in the state as attainment/unclassifiable.

<sup>1</sup> EPA designated nonattainment areas for the 1997 fine particle standards in 2005. In 2006, the 24-hour PM<sub>2.5</sub> standard was revised from 65 micrograms per cubic meter (average of 98<sup>th</sup> percentile values for 3 consecutive years) to 35 micrograms per cubic meter; the level of the annual standard for PM<sub>2.5</sub> remained unchanged at 15 micrograms per cubic meter (average of annual averages for 3 consecutive years).

## **EPA Technical Analysis for Imperial County**

Pursuant to section 107(d) of the Clean Air Act, EPA must designate as nonattainment those areas that violate the NAAQS and those areas that contribute to violations. This technical analysis for Imperial County identifies the monitor that violates the 24-hour PM<sub>2.5</sub> standard and evaluates the county contribution to fine particle concentrations in the area. EPA has evaluated Imperial County based on the weight of evidence of the following nine factors recommended in EPA guidance and any other relevant information:

- pollutant emissions
- air quality data
- population density and degree of urbanization
- traffic and commuting patterns
- growth
- meteorology
- geography and topography
- jurisdictional boundaries
- level of control of emissions sources

Figure 1 is a map of the area and other relevant information such as the locations and design values of air quality monitors, the metropolitan area boundary, and counties recommended as nonattainment by the State.

Imperial County is an existing 8-hour ozone nonattainment area. The State of California did not recommend that the boundaries of the PM<sub>2.5</sub> area coincide with the existing nonattainment boundaries. Rather, the State of California recommended that only the City of Calexico be designated as nonattainment for PM<sub>2.5</sub>. (See Figure1)

# Imperial County, CA

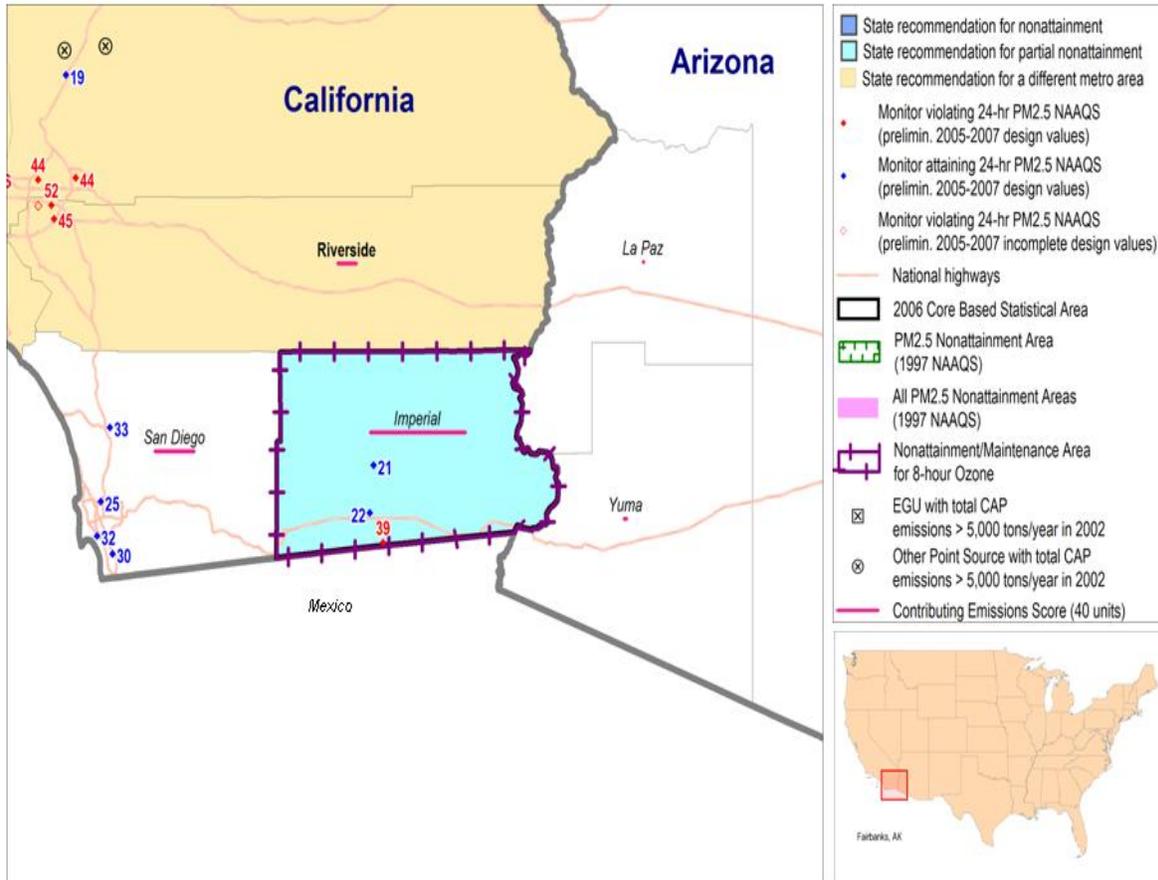


Figure 1

Counties labeled in bold reflect NAAs under 1997 NAAQS

The California Air Resources Board (CARB) sent a letter to EPA, dated December 17, 2007, recommending that only the City of Calexico in Imperial County be designated as “nonattainment” for the 2006 24-hour PM<sub>2.5</sub> standard based on the most recent three years of air quality data that were available in December 2007, for 2004 – 2006. These data are from Federal Reference Method (FRM) and Federal Equivalent Method (FEM) monitors located in Imperial County.

Air quality monitoring data on the composition of fine particle mass are available from the EPA Chemical Speciation Network and the IMPROVE monitoring network, as well as from data derived by CARB from the Calexico site. Analysis of these data indicates that the days with the highest fine particle concentrations occur predominantly in the winter, and the average chemical composition of the highest days is typically characterized by high levels of organic carbon (52%), nitrate (22%), sulfate (6%), and other components (14%).

Area	State Recommended Nonattainment Counties	EPA’s Intended Nonattainment Counties
City of Calexico	Imperial County (P)	Imperial County

Based on EPA's 9-factor analysis described below, EPA believes that Imperial County in California should be designated nonattainment for the 24-hour PM<sub>2.5</sub> air-quality standard, based upon currently available information.

The State recommended designating a portion of Imperial County as nonattainment. EPA has taken this request under consideration, but finds that the information provided to date does not adequately support a partial county designation. Accordingly, all of Imperial County is included in EPA’s intended designation. EPA will consider any additional information provided by the State in making final decisions on the designations.

Several Factors led EPA to recommend a significantly larger PM<sub>2.5</sub> nonattainment area than recommended by California. Most importantly, the recommended boundary does not include the population that would be exposed to high levels of PM<sub>2.5</sub> represented by the Calexico design value, nor does it address transport that can occur from traffic and other sources within the relatively flat, valley floor of the Imperial Valley. In addition, the State relied on future mobile source controls at a statewide level to address NO<sub>x</sub> emissions and, therefore, discounted mobile sources as an important consideration in their analysis. EPA believes that mobile sources are an important contributor to PM<sub>2.5</sub> emissions in Imperial County.

The following is a summary of the 9-factor analysis for Imperial County.

**Factor 1: Emissions data**

For this factor, EPA evaluated county level emission data for the following PM<sub>2.5</sub> components and precursor pollutants: “PM<sub>2.5</sub> emissions total,” “PM<sub>2.5</sub> emissions carbon,” “PM<sub>2.5</sub> emissions other,” “SO<sub>2</sub>,” “NO<sub>x</sub>,” “VOCs,” and “NH<sub>3</sub>.” “PM<sub>2.5</sub> emissions total” represents direct emissions of PM<sub>2.5</sub> and includes: “PM<sub>2.5</sub> emissions carbon,” “PM<sub>2.5</sub> emissions other”, “primary sulfate

(SO<sub>4</sub>)”, and “primary nitrate”. (Although primary sulfate and primary nitrate, which are emitted directly from stacks rather than forming in atmospheric reactions with SO<sub>2</sub> and NO<sub>x</sub>, are part of “PM<sub>2.5</sub> emissions total,” they are not shown in Table 1 as separate items). “PM<sub>2.5</sub> emissions carbon” represents the sum of organic carbon (OC) and elemental carbon (EC) emissions, and “PM<sub>2.5</sub> emissions other” represents other inorganic particles (crustal). Emissions of SO<sub>2</sub> and NO<sub>x</sub>, which are precursors of the secondary PM<sub>2.5</sub> components sulfate and nitrate, are also considered. VOCs (volatile organic compounds) and NH<sub>3</sub> (ammonia) are also potential PM<sub>2.5</sub> precursors and are included for consideration.

Emissions data were derived from the 2005 National Emissions Inventory (NEI), version 1. See [http://www.epa.gov/ttn/naaqs/pm/pm25\\_2006\\_techinfo.html](http://www.epa.gov/ttn/naaqs/pm/pm25_2006_techinfo.html).

EPA also considered the Contributing Emissions Score (CES) for each county. The CES is a metric that takes into consideration emissions data, meteorological data, and air quality monitoring information to provide a relative ranking of counties in and near an area. Note that this metric is not the exclusive way for consideration of data for these factors. A summary of the CES is included in attachment 2, and a more detailed description can be found at: [http://www.epa.gov/ttn/naaqs/pm/pm25\\_2006\\_techinfo.html#C](http://www.epa.gov/ttn/naaqs/pm/pm25_2006_techinfo.html#C).

Table 1 shows emissions of PM<sub>2.5</sub> and precursor pollutants components (given in tons per year) and the CES for Imperial County.

Table 1. PM <sub>2.5</sub> Related Emissions (tons per year) Data and Contributing Emissions Score									
County	State Recommended Non-attainment?	CES	PM <sub>2.5</sub> emissions total	PM <sub>2.5</sub> emissions carbon	PM <sub>2.5</sub> emissions other	SO <sub>2</sub>	NO <sub>x</sub>	VOCs	NH <sub>3</sub>
Imperial	Yes (P)	100	3,422	831	2,592	2,171	12,445	11,885	18,992
P = partial. Data for emissions apply to the whole County.									

Imperial County has 3,422 tpy of total PM<sub>2.5</sub>, most of which is PM<sub>2.5</sub> other than organic carbon. Imperial County has high levels of PM<sub>2.5</sub> precursors relative to total PM<sub>2.5</sub>. The nitrogen oxides (NO<sub>x</sub>), volatile organic compounds (VOC) and ammonia (NH<sub>3</sub>) emission levels in Imperial County are substantial while the organic carbon emissions are much lower. CARB states that the two key components of PM<sub>2.5</sub> are ammonium nitrate, which is a regional pollutant primarily derived from reactions with NO<sub>x</sub> emissions from mobile source activity, and organic carbon, which is a more localized pollutant related to burning.

With respect to CES values, Imperial County has a score of 100. Imperial County is bordered by San Diego and Riverside Counties in California, Yuma and La Paz Counties in Arizona, and Mexicali in Baja California, Mexico. San Diego, Yuma and La Paz are attaining the PM<sub>2.5</sub> standard. Riverside is located in the South Coast area which is nonattainment for the 1997 PM<sub>2.5</sub> standard and has been recommended as nonattainment for the 2006 PM<sub>2.5</sub> standard. Based on emissions levels and CES values, Imperial County is a candidate for a 24-hour PM<sub>2.5</sub> nonattainment designation and, therefore, requires further analysis.

CARB argues that “the Calexico city level nonattainment boundary is appropriate due to the unique international pollutant transport problem between Calexico and Mexicali, Mexico”.

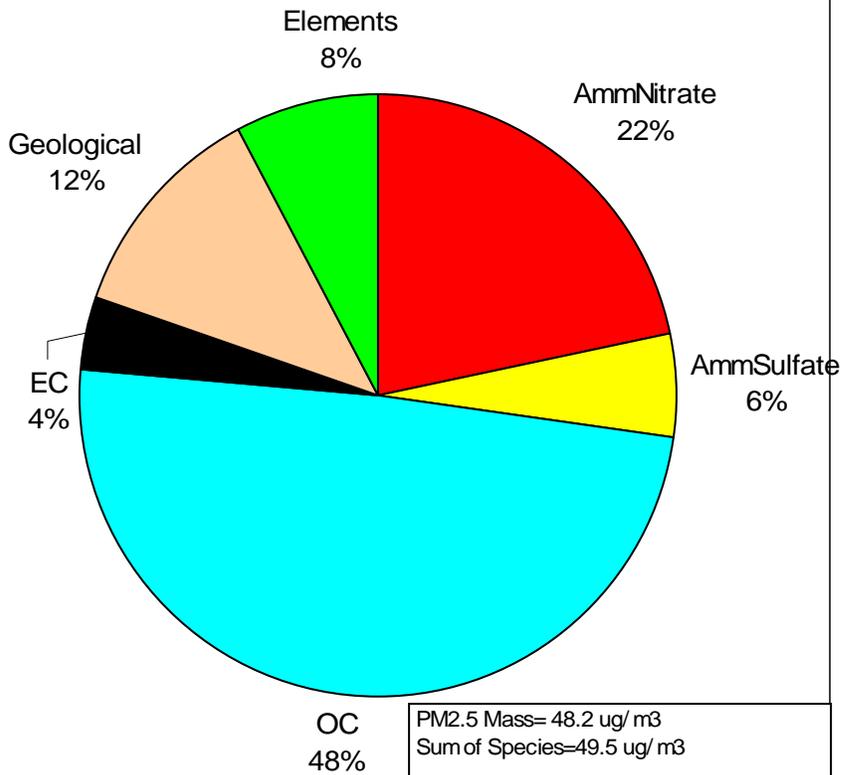
CARB also states that Calexico is distinct from the rest of Imperial County based on the distribution and nature of emission sources. California’s letter recommending that the City of Calexico be designation as nonattainment, states that “Calexico exceedances of the federal PM<sub>2.5</sub> standards are the result of urban activity associated with the densely population international Calexico/Mexicali border region.” While EPA believes that Mexicali likely impacts Calexico and Imperial County, the data provided by CARB is not sufficient to fully discount emissions from Imperial County which could contribute to exceedances at monitoring sites in the County.

Table 2. Area Source Emissions (Tons per day)	
IMPERIAL COUNTY	
Source: CARB Almanac website (2007)	
SOURCE	PM <sub>2.5</sub> %
Residential Fuel Combustion	0.09
Farming Operations	3.86
Construction/Demolition	0.2
Paved Road Dust	0.65
Unpaved Road Dust	3.41
Fugitive Windblown Dust	26.63
Fires	0
Managed Burning & Disposal	2.63
Cooking	0.04
Total Area Wide	92%
Area Wide percent of total	68%
Total All	40.59%

Table 2 indicates that for the entire Imperial County, fugitive windblown dust is a major portion of the PM<sub>2.5</sub> section of the County’s inventory, followed by farming operations, unpaved road dust and managed burning and disposal. CARB argues that this chart does not reflect the situation in Calexico and that the PM<sub>2.5</sub> emissions for Calexico are different than those of the rest of the County.

The pie chart below shows the average PM<sub>2.5</sub> composition for the City of Calexico on exceedance days at the Calexico Ethel Street site. It indicates that organic carbon represents 48% of the total followed by ammonium nitrate at 22%. CARB states that the sources affecting Calexico are waste and wood burning plus vehicle exhaust from the large amount of vehicle traffic at the border. While it appears that the proportion of organic carbon is higher in Calexico than the rest of the county, the sources are vehicles, residential wood combustion, agricultural and prescribed burning, and stationary combustion sources. All these sources are present on both sides of the border. CARB did not provide any studies that demonstrate the proportion of emissions that come from Mexico for these sources.

### Average Composition on 9 Exceedance Days Calexico



In the absence of clear data from CARB to differentiate the air quality issues in Calexico from the rest of the county and show that emissions from Mexico only impact Calexico, EPA would propose to designate all of Imperial County as nonattainment for PM<sub>2.5</sub> unless the remaining factors in our analysis indicate otherwise.

**Factor 2: Air quality data**

This factor considers the 24-hour PM<sub>2.5</sub> design values in micrograms per cubic meter (µg/m<sup>3</sup>) for air quality monitors in counties in Imperial County based on data for the 2005-2007 period. A monitor’s design value indicates whether that monitor attains a specified air quality standard. The 24-hour PM<sub>2.5</sub> standards are met when the 3-year average of a monitor’s 98<sup>th</sup> percentile values are 35 µg/m<sup>3</sup> or less. A design value is only valid if minimum data completeness criteria are met.

The 24-hour PM<sub>2.5</sub> design values for Imperial County are shown in Table 3.

Table 3. Air Quality Data			
County	State Recommended Nonattainment?	24-hr PM <sub>2.5</sub> Design Value 2004-06 (µg/m <sup>3</sup> )	24-hr PM <sub>2.5</sub> Design Values 2005-07 (µg/m <sup>3</sup> )
Imperial County	Yes (P)	40	39
P = partial			

The violating monitor in Imperial County is located in the City of Calexico at Ethel Street. There are two other monitoring sites in Imperial County, in the cities of El Centro and Brawley, which are located north of Calexico. Monitors in these cities have not recorded violations of the PM<sub>2.5</sub> standard. CARB argues that a nonattainment area including just the City of Calexico would be appropriate given that the other two monitors did not record violations of the standard. However, it is EPA’s position that the whole County with the violating monitor should be included in the nonattainment area and the contributions to the total PM<sub>2.5</sub> levels at the violating monitor should be considered, unless information is provided justifying a more limited area designation. Imperial County shows violations of the 24-hour PM<sub>2.5</sub> standard. Therefore, this county is a candidate for a 24-hour PM<sub>2.5</sub> nonattainment designation.

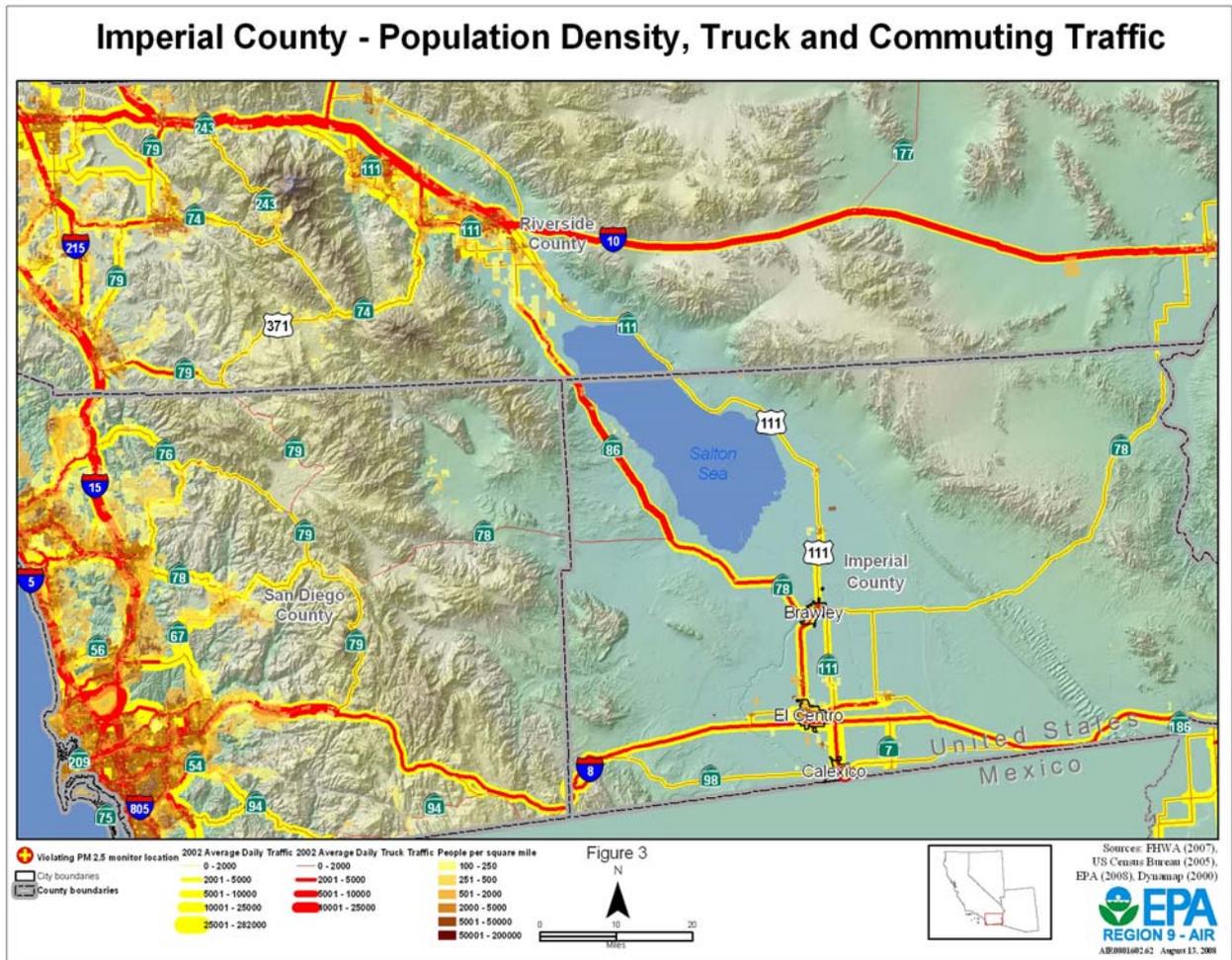
Eligible monitors for providing design value data generally include State and Local Air Monitoring Stations (SLAMS) at population-oriented locations with a FRM or FEM monitor. All data from Special Purpose Monitors (SPM) using an FRM, FEM, or Alternative Reference Method (ARM) which has operated for more than 24 months is eligible for comparison to the relevant NAAQS, subject to the requirements given in the October 17, 2006 Revision to Ambient Air Monitoring Regulations (71 FR 61236). All monitors used to provide data must meet the monitor siting and eligibility requirements given in 71 FR 61236 to 61328 in order to be acceptable for comparison to the 24-hr PM<sub>2.5</sub> NAAQS for designation purposes.

**Factor 3: Population density and degree of urbanization (including commercial development)**

Table 4 shows the 2005 population for all of Imperial County, as well as the population density. Population data gives an indication of whether it is likely that population-based emissions might contribute to violations of the 24-hour PM<sub>2.5</sub> standards.

County/City	State Recommended Nonattainment	2005 Population	2005 Population Density (pop/sq mi)	% Population Change
Imperial	Yes (P)	155,862	39	9%

Figure 3, “Imperial County. Population Density, Truck and Commuting Traffic” indicates that population density in Imperial County is very sparse, only 39 people per square mile. Based solely on this factor, Imperial County would not be considered for designation as nonattainment. Calexico, El Centro, and Brawley include most of the population in Imperial County. This factor argues for a partial county designation that includes these three cities but not the rest of the county.



**Figure 3**

#### **Factor 4: Traffic and commuting patterns**

This factor considers the number of commuters in each county who drive to Imperial County, the percent of total commuters in each county who commute to Imperial County, as well as the total Vehicle Miles Traveled (VMT) for Imperial County in thousands of miles (see Table 5). A county with numerous commuters is generally an integral part of an urban area and is likely contributing to fine particle concentrations in the area.

Figure 3 above shows both the average daily traffic and average daily truck traffic within Imperial County.

County	State Recommended Non-attainment?	2005 VMT (Million Miles annually)	Number of cars commuting to any violating counties	Percent Commuting to any violating counties
Imperial County	Yes (P)	2,189	40,870	95 %
P = partial				

Interstate 8 carries traffic from Arizona all the way to San Diego through Imperial County. Interstate 8 carries approximately 10,357,143 cars per year, or 28,376 cars per day, and 534,274 trucks per year, or 1,464 trucks per day. Trucks coming from Mexico are permitted to travel 20 miles into Imperial County which accounts for the heavy truck traffic indicated on the map from Calexico to El Centro.

By designating the entire County as nonattainment for PM<sub>2.5</sub>, EPA would include all major traffic routes and the motor vehicle emissions from the associated car and truck traffic which has been identified as a major contributor to PM<sub>2.5</sub> levels.

The 2005 VMT data used for table 5 and 6 of the 9-factor analysis has been derived using methodology similar to that described in “Documentation for the final 2002 Mobile National Emissions Inventory, Version 3, September 2007, prepared for the Emission Inventory Group, U.S. EPA. This document may be found at: [atftp://ftp.epa.gov/EmisInventory/2002finalnei/documentation/mobile/2002\\_mobile\\_nei\\_version\\_3\\_report\\_092807.pdf](http://ftp.epa.gov/EmisInventory/2002finalnei/documentation/mobile/2002_mobile_nei_version_3_report_092807.pdf). The 2005 VMT data were taken from documentation which is still draft, but which should be released in 2008.

### Factor 5: Growth rates and patterns

This factor considers population growth for 2000-2005 and growth in vehicle miles traveled (VMT) for 1996-2005 for Imperial County. A county with rapid population or VMT growth is generally an integral part of an urban area and likely to be contributing to fine particle concentrations in the area. In addition, such a county could be appropriate for implementing mobile source and other emission control strategies, thus warranting inclusion in the nonattainment area.

Table 6 below shows population, population growth, VMT and VMT growth for Imperial County.

County	Population (2005)	Population Density (2005)	Population % change (2000 - 2005)	2005 VMT (millions mi)	VMT % Change 1996 -2005
Imperial County	155,862	39	9%	2,189	(1)

Imperial County is primarily a rural, agricultural area with few people except in the major cities of Calexico, El Centro and Brawley. The County grew 9% in the years 2000-2005. Between 2005 and 2010, the population of Imperial County is projected to increase another 9%, compared to a significantly higher growth rate of 50% for the City of Calexico from 2000-2010. CARB states that the growth in Imperial is small compared to the growth on the Mexican side of the border. Mexicali had approximately 922,000 residents in 2006 and is expected to have over 1,045,000 residents in 2010, which is a growth rate of approximately 13%.

Imperial County had moderate (9%) population growth between 2000 and 2005, and one area of high population growth (Calexico) adjacent to the border with Mexico. The City of Calexico also includes the violating monitor. While EPA agrees that emissions from the Mexican side of the border are likely affecting Calexico, CARB did not quantify the emissions from Mexico. Consequently the analysis presented by CARB does not justify limiting the nonattainment area to the Calexico city boundaries. By designating the entire County as nonattainment for PM<sub>2.5</sub>, EPA would include the rapidly growing City of Calexico along with other urban centers such as El Centro and Brawley.

#### **Factor 6: Meteorology (weather/transport patterns)**

Climatic conditions in the Salton Sea Air Basin are governed by the large-scale sinking and warming air in the subtropical high-pressure center of the Pacific Ocean. The high pressure ridge blocks most mid-latitude storms except in the winter when the high-pressure ridge is weakest and farther south. Similarly, the coastal mountains prevent the intrusion of any cool damp marine air from the coast. Because of the weakened storms and the mountainous barrier, the Salton Sea Air Basin has hot summers, mild winters, and little rainfall. The flat terrain of the Valley and the strong temperature differentials created by intense solar heating produces moderate winds and deep thermal convection.

EPA analysis of wind trajectories on days with high levels of PM<sub>2.5</sub> in Calexico confirms that on many days there is a potential contribution from emissions from the Mexican side of the border. However, the NOAA HYSPLIT back trajectories for January 8, 2006 and January 17, 2006, shown in figures 4 and 5, indicate that there is a potential contribution from emissions from throughout Imperial County to the PM<sub>2.5</sub> elevated levels at the Calexico Ethel Street monitor on those days.

By designating the entire County as nonattainment for PM<sub>2.5</sub>, EPA would include the emissions from areas identified as potential contributors to PM<sub>2.5</sub> levels.

The meteorology factor is also considered in each county's Contributing Emissions Score because the method for deriving this metric included an analysis of trajectories of air masses for high PM<sub>2.5</sub> days.

NOAA HYSPLIT MODEL  
 Backward trajectories ending at 08 UTC 09 Jan 06  
 EDAS Meteorological Data

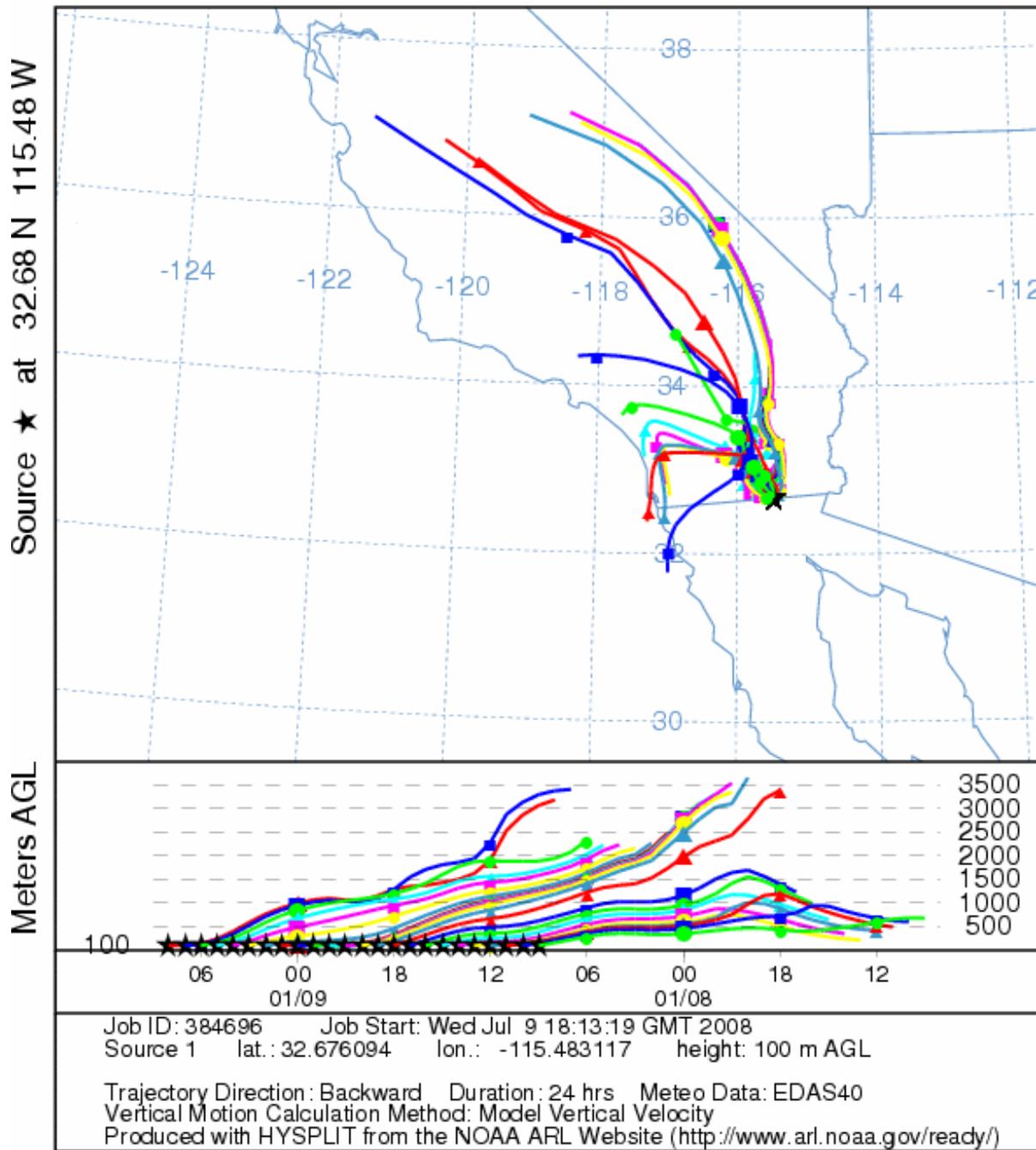


Figure 4

NOAA HYSPLIT MODEL  
 Backward trajectories ending at 08 UTC 18 Jan 06  
 EDAS Meteorological Data

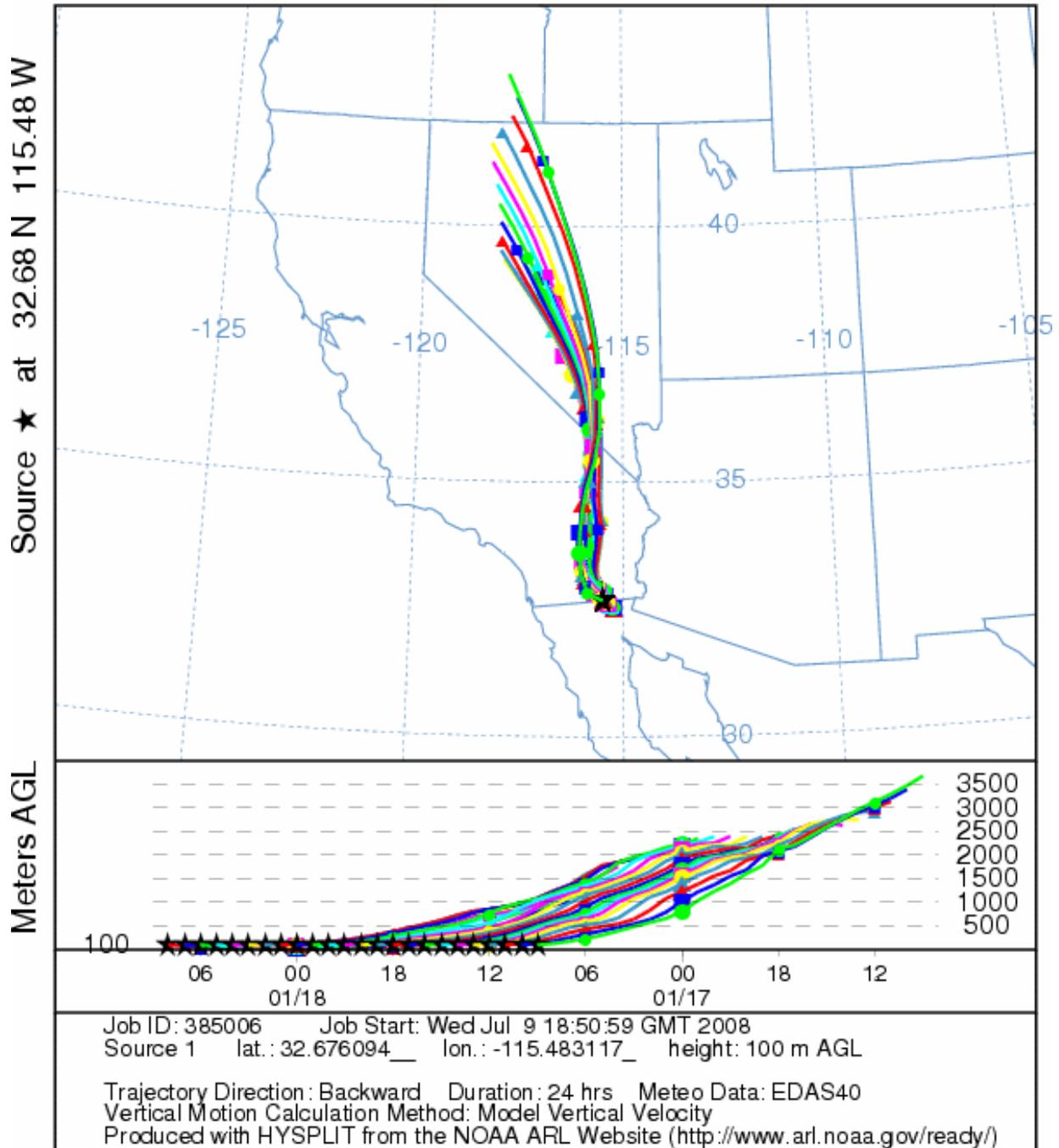


Figure 5

**Factor 7: Geography/topography (mountain ranges or other air basin boundaries)**

The geography/topography analysis looks at physical features of the land that might have an effect on the air shed and, therefore, on the distribution of PM<sub>2.5</sub> over Imperial County.

Imperial Valley is located within the Salton Sea Air Basin along with the desert portion of Riverside County. Imperial County consists of 4,175 square miles, bordering Mexico to the south, Riverside County to the north, San Diego County to the west, and the State of Arizona on the east. The Imperial Valley is a part of the larger Salton Trough. Also included in the Salton Trough is the western half of the Mexicali Valley and the Colorado River delta in Mexico. This trough is a very flat basin (see Figure 6) surrounded by mountains: the Peninsular Ranges to the west, the Chocolate, Orocopia and Cargo Muchacho Mountains to the east. Most of the trough is below sea level and is predominantly desert with agricultural land. Imperial Valley does not have any geographical or topographical barriers significantly limiting air-pollution transport within its airshed. There are no topographical barriers to separate the City of Calexico from the rest of Imperial County, so this factor does not support a partial county designation, but rather argues for including the entire county in the nonattainment area.



Figure 6

**Factor 8: Jurisdictional boundaries (e.g., existing PM and ozone areas)**

In evaluating the jurisdictional boundary factor, consideration should be given to existing boundaries and organizations that may facilitate air quality planning and the implementation of control measures to attain the standard. Areas designated as nonattainment (e.g for PM<sub>2.5</sub> or 8-hour ozone standard) represent important boundaries for state air quality planning.

The analysis of jurisdictional boundaries considered the planning and organizational structure of Imperial County to determine if the implementation of controls in a potential nonattainment area can be carried out in a cohesive manner.

The major jurisdictional boundary in Imperial County is the Imperial County Air Pollution Control District (APCD). Imperial County APCD will be responsible for developing the PM 2.5 State Implementation Plan and required control strategies.

Imperial County is a nonattainment area for both 8-hour ozone and PM-10. The Imperial County APCD is responsible for developing plans for these pollutants. One of the goals in designating PM 2.5 nonattainment areas is to achieve a degree of consistency with existing ozone and PM-10 nonattainment areas for air quality planning purposes. This argues for making the new PM 2.5 nonattainment area consistent with the existing nonattainment areas, which include the entirety of Imperial County.

**Factor 9: Level of control of emission sources**

This factor considers emission controls currently implemented for major sources in Imperial County.

The emission estimates on Table 1 (under Factor 1) include any control strategies implemented by California in Imperial County before 2005 that may influence emissions of any component of PM<sub>2.5</sub> emissions (i.e., total carbon, SO<sub>2</sub>, NO<sub>x</sub>, and crustal PM<sub>2.5</sub>).

## Attachment 2

### Description of the Contributing Emissions Score

The CES is a metric that takes into consideration emissions data, meteorological data, and air quality monitoring information to provide a relative ranking of counties in and near an area. Using this methodology, scores were developed for each county in and around the relevant metro area. The county with the highest contribution potential was assigned a score of 100, and other county scores were adjusted in relation to the highest county. The CES represents the relative maximum influence that emissions in that county have on a violating county. The CES, which reflects consideration of multiple factors, should be considered in evaluating the weight of evidence supporting designation decisions for each area.

The CES for each county was derived by incorporating the following significant information and variables that impact PM<sub>2.5</sub> transport:

- Major PM<sub>2.5</sub> components: total carbon (organic carbon (OC) and elemental carbon (EC)), SO<sub>2</sub>, NO<sub>x</sub>, and inorganic particles (crustal).
- PM<sub>2.5</sub> emissions for the highest (generally top 5%) PM<sub>2.5</sub> emission days (herein called “high days”) for each of two seasons, cold (Oct-Apr) and warm (May-Sept)
- Meteorology on high days using the NOAA HYSPLIT model for determining trajectories of air masses for specified days
- The “urban increment” of a violating monitor, which is the urban PM<sub>2.5</sub> concentration that is in addition to a regional background PM<sub>2.5</sub> concentration, determined for each PM<sub>2.5</sub> component
- Distance from each potentially contributing county to a violating county or counties

A more detailed description of the CES can be found at [http://www.epa.gov/ttn/naaqs/pm/pm25\\_2006\\_techinfo.html#C](http://www.epa.gov/ttn/naaqs/pm/pm25_2006_techinfo.html#C).

## Attachment 1

### CALIFORNIA Area Designations For the 24-Hour Fine Particle National Ambient Air Quality Standard

The table below identifies the counties in California that EPA intends to designate as not attaining the 2006 24-hour fine particle (PM<sub>2.5</sub>) standard.<sup>1</sup> A county will be designated as nonattainment if it has an air quality monitor that is violating the standard or if the county is determined to be contributing to the violation of the standard.

Area	California Recommended Nonattainment Counties	EPA's Intended Nonattainment Counties
Butte County	Butte County - Partial	Butte County
Imperial County	Imperial County - Partial	Imperial County
Sacramento County	Sacramento County	Sacramento County Yolo County Placer County – Partial El Dorado County – Partial Solano County - Partial
San Francisco Bay Area	Sonoma County – Partial Napa County Marin County San Francisco County Contra Costa County Alameda County Santa Clara County San Mateo County Solano County - Partial	Sonoma County – Partial Napa County Marin County San Francisco County Contra Costa County Alameda County Santa Clara County San Mateo County Solano County - Partial
San Joaquin Valley Air Basin	San Joaquin County Stanislaus County Merced County Madera County Fresno County Kings County Tulare County Kern County - Partial	San Joaquin County Stanislaus County Merced County Madera County Fresno County Kings County Tulare County Kern County - Partial
South Coast Air Basin	Los Angeles County – Partial San Bernardino County Partial Riverside County – Partial Orange County	Los Angeles County – Partial San Bernardino County Partial Riverside County – Partial Orange County
Yuba County Sutter County	Yuba County – Partial Sutter County - Partial	Yuba County Sutter County

EPA intends to designate the remaining counties in the state as attainment/unclassifiable.

<sup>1</sup> EPA designated nonattainment areas for the 1997 fine particle standards in 2005. In 2006, the 24-hour PM<sub>2.5</sub> standard was revised from 65 micrograms per cubic meter (average of 98<sup>th</sup> percentile values for 3 consecutive years) to 35 micrograms per cubic meter; the level of the annual standard for PM<sub>2.5</sub> remained unchanged at 15 micrograms per cubic meter (average of annual averages for 3 consecutive years).

## **EPA Technical Analysis for Sacramento**

Pursuant to section 107(d) of the Clean Air Act, EPA must designate as nonattainment those areas that violate the NAAQS and those areas that contribute to violations. This technical analysis for the Sacramento area identifies the counties with monitors that violate the 24-hour PM<sub>2.5</sub> standard and evaluates the counties that potentially contribute to fine particle concentrations in the area. EPA has evaluated these counties based on the weight of evidence of the following nine factors recommended in EPA guidance and any other relevant information:

- pollutant emissions
- air quality data
- population density and degree of urbanization
- traffic and commuting patterns
- growth
- meteorology
- geography and topography
- jurisdictional boundaries
- level of control of emissions sources

Figure 1 is a map of the counties in the area and other relevant information such as the locations and design values of air quality monitors, the metropolitan area boundary, and counties recommended as nonattainment by the State.

Sacramento and five surrounding counties comprise an existing 8-hour ozone nonattainment area. The State of California did not recommend that the boundaries of the PM<sub>2.5</sub> nonattainment area coincide with the existing nonattainment boundaries. Rather, the State of California recommended that only Sacramento County be designated as nonattainment for PM 2.5 (see Figure 1.)

# Sacramento County, CA

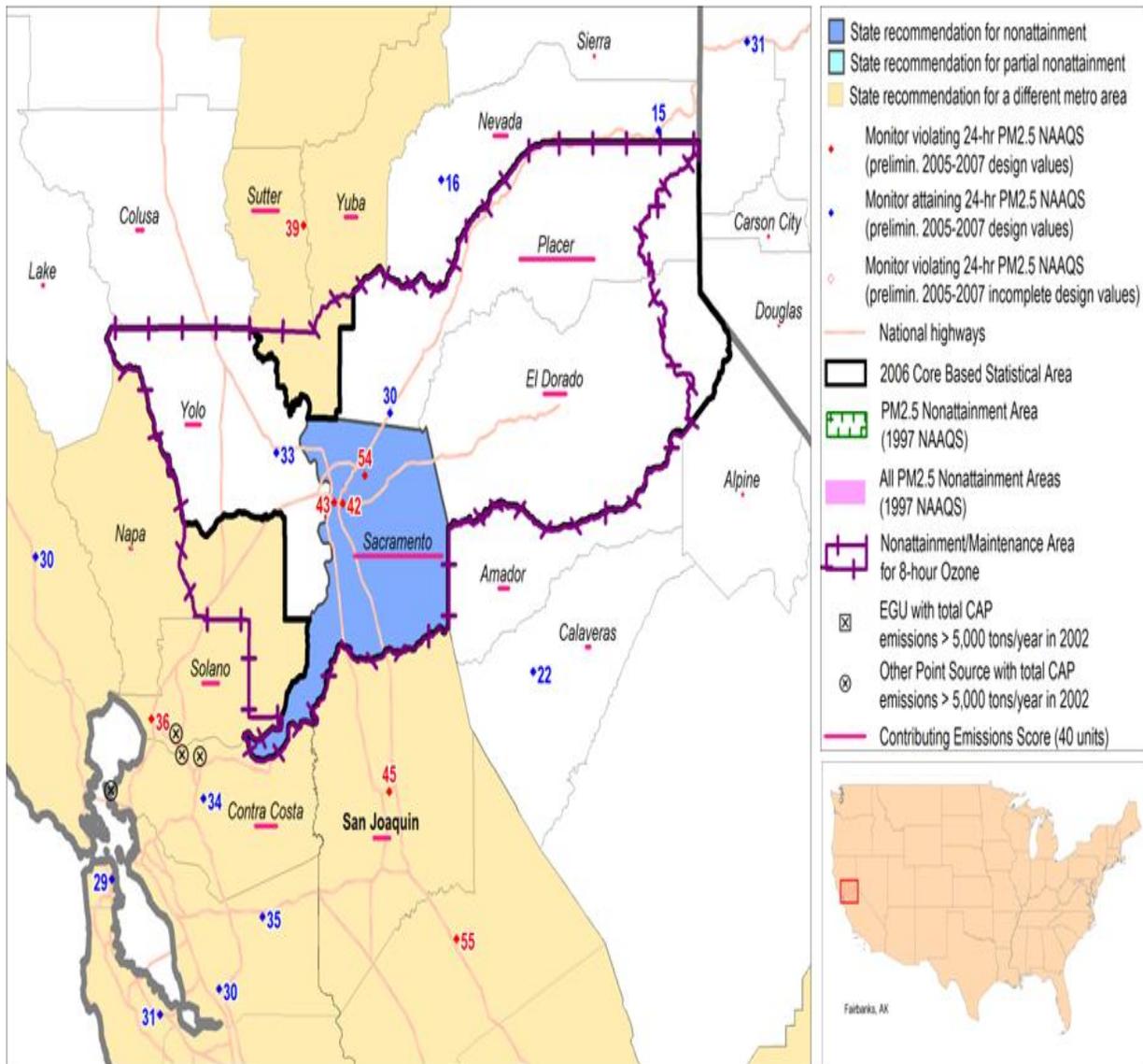


Figure 1

Counties labeled in bold reflect NAAs under 1997 NAAQS

The California Air Resources Board (CARB) sent a letter to EPA, dated December 17, 2007, recommending that Sacramento County be designated as “nonattainment” for the 2006 24-hour PM<sub>2.5</sub> standard based on the most recent three years of air quality data that were available in December 2007, for 2004 – 2006. These data are from Federal Reference Method (FRM) and Federal Equivalent (FEM) monitors within the State.

Air quality monitoring data on the composition of fine particle mass are available from the EPA Chemical Speciation Network and the IMPROVE monitoring network, as well as from monitoring sites in Sacramento County. Analysis of the Sacramento data indicates that the days with the highest fine particle concentrations occur predominantly in the winter, and the average chemical composition of the highest days is typically characterized by high levels of organic carbon (48% to 57%) nitrate (23% to 42%), and sulfate (3%).

Based on EPA’s 9-factor analysis described below, EPA recommends that all of Sacramento and Yolo Counties and parts of Placer, El Dorado and Solano Counties should be designated nonattainment for the 24-hour PM<sub>2.5</sub> air-quality standard as part of the Sacramento nonattainment area, based upon currently available information. These counties are listed in the table below.

Area	State-Recommended Nonattainment Counties	EPA-Proposed Nonattainment Counties
Sacramento County	Sacramento County	Sacramento, Yolo, El Dorado (P), Placer(P), and Solano (P) Counties
P = Partial		

The following is a summary of the 9-factor analysis for the Sacramento Nonattainment Area.

Several factors led EPA to recommend a significantly larger PM<sub>2.5</sub> nonattainment area than recommended by California. The most important consideration was that the recommended boundary does not include the population that would be exposed to high levels of PM<sub>2.5</sub> represented by the Sacramento design value, nor does it address transport that can occur from traffic and other sources within the relatively flat, valley floor of the Sacramento Valley. In addition, the State relied on future mobile source controls at a statewide level to address NOx emissions and, therefore, discounted mobile sources as an important consideration in their analysis. EPA believes that there is a significant contribution from mobile sources, both commuting and commercial truck traffic, in the Sacramento area.

The 24-hour PM<sub>2.5</sub> nonattainment area EPA recommends for Sacramento is largely consistent with the existing 8-hour ozone nonattainment area which encompasses all of Sacramento and Yolo Counties, and parts of El Dorado, Placer, and Solano Counties, as well as part of Sutter County (see Figure 1). Sutter and Yuba Counties were not recommended as part of the Sacramento nonattainment area since they are part of a separate and distinct PM<sub>2.5</sub> nonattainment area associated with the State’s recommendation to designate Yuba City and Marysville as a nonattainment area. All of Solano County is proposed as a nonattainment area but the county is split between two different nonattainment areas, the San Francisco Bay Area and Sacramento. The western half of Solano County was included in the State’s recommendation for the San

Francisco Bay Area's 9-county nonattainment area and, therefore, only the eastern half of Solano County is included in the Sacramento nonattainment area.

EPA recommends that parts of El Dorado and Placer Counties be included in the Sacramento PM<sub>2.5</sub> nonattainment area. The suggested partial boundaries are consistent with the existing 8-hour ozone boundary and reflect the existing mountain ridgeline to the east, as explained in Factors 2 and 7.

### **Factor 1: Emissions data**

For this factor, EPA evaluated county level emission data for the following PM<sub>2.5</sub> components and precursor pollutants: "PM<sub>2.5</sub> emissions total," "PM<sub>2.5</sub> emissions carbon," "PM<sub>2.5</sub> emissions other," "SO<sub>2</sub>," "NO<sub>x</sub>," "VOCs," and "NH<sub>3</sub>." "PM<sub>2.5</sub> emissions total" represents direct emissions of PM<sub>2.5</sub> and includes: "PM<sub>2.5</sub> emissions carbon," "PM<sub>2.5</sub> emissions other", "primary sulfate (SO<sub>4</sub>)", and "primary nitrate". (Although primary sulfate and primary nitrate, which are emitted directly from stacks rather than forming in atmospheric reactions with SO<sub>2</sub> and NO<sub>x</sub>, are part of "PM<sub>2.5</sub> emissions total," they are not shown on Table 1 as separate items). "PM<sub>2.5</sub> emissions carbon" represents the sum of organic carbon (OC) and elemental carbon (EC) emissions, and "PM<sub>2.5</sub> emissions other" represents other inorganic particles (crustal). Emissions of SO<sub>2</sub> and NO<sub>x</sub>, which are precursors of the secondary PM<sub>2.5</sub> components sulfate and nitrate, are also considered. VOCs (volatile organic compounds) and NH<sub>3</sub> (ammonia) are also potential PM<sub>2.5</sub> precursors and are included for consideration.

Emissions data were derived from the 2005 National Emissions Inventory (NEI), version 1. See [http://www.epa.gov/ttn/naaqs/pm/pm25\\_2006\\_techinfo.html](http://www.epa.gov/ttn/naaqs/pm/pm25_2006_techinfo.html).

EPA also considered the Contributing Emissions Score (CES) for each county. The CES is a metric that takes into consideration emissions data, meteorological data, and air quality monitoring information to provide a relative ranking of counties in and near an area. Note that this metric is not the exclusive way for consideration of data for these factors. A summary of the CES is included in attachment 2, and a more detailed description can be found at [http://www.epa.gov/ttn/naaqs/pm/pm25\\_2006\\_techinfo.html#C](http://www.epa.gov/ttn/naaqs/pm/pm25_2006_techinfo.html#C).

Table 1 shows emissions of PM<sub>2.5</sub> and precursor pollutants components (given in tons per year) and the CES for violating and potentially contributing counties in the Sacramento area.

County	State Recommended Nonattainment?	CES	PM <sub>2.5</sub> emission Total	PM <sub>2.5</sub> Emission Carbon	PM <sub>2.5</sub> emission Other	SO <sub>2</sub>	NOx	VOCs	NH <sub>3</sub>
Sacramento	Yes	100	4,240	2,255	1,985	3,307	33,183	26,828	5,786
Placer	No	85	2,310	1,329	982	915	11,595	10,528	862
El Dorado	No	25	2,784	1,668	1,116	513	4,831	8,369	430
Yolo	No	16	2,014	818	1,196	585	11,101	6,537	2,099
Solano	No	73 <sup>a</sup>	1,750	834	915	8,335	15,009	12,093	1,579

Source: 2005 National Emissions Inventory  
Note: CES is based on Solano County contributing to PM<sub>2.5</sub> levels in the Bay Area and not Sacramento.

Additional data considered in EPA’s analysis of this factor are summarized in the following table derived from the California Air Resources Board Almanac of Emissions and Air Quality Data (<http://www.arb.ca.gov/Aqd/almanac/almanac.htm>). Table 2 further defines, in tons per day, the type of area sources contributing to PM<sub>2.5</sub> emissions in Sacramento and the surrounding counties. Area sources include residential fuel combustion, farming operations, construction/demolition, paved road dust, unpaved road dust, fugitive windblown dust, fires, managed burning and disposal and cooking. In each of the counties, area sources represent the largest percentage of primary PM<sub>2.5</sub> emissions (e.g., > 70%) and the balance is divided between stationary and mobile sources.

Area Sources	Sacramento	Placer	El Dorado	Yolo	Solano
Residential Fuel Combustion	4.86	3.64	5.34	0.55	1.26
Farming Operations	0.32	0.08	0	0.92	0.64
Construction/Demolition	0.75	0.45	0.11	0.96	0.29
Paved Road Dust	2.31	0.86	0.68	0.41	0.85
Unpaved Road Dust	0.74	0.61	0.87	0.22	0.22
Fugitive Windblown Dust	0.07	0.02	0.02	0.58	0.48
Fires	0.05	0	0	0.01	0.01
Managed Burning & Disposal	0.33	1.37	0.23	0.34	0.33
Cooking	0.58	0.06	0.05	0.04	0.11
Total Area Wide	10.02	7.11	7.29	4.01	4.22
Grand Total of All PM <sub>2.5</sub>	13.94	9.33	8.10	6.41	7.18
<b>% Area Wide to Total PM<sub>2.5</sub></b>	<b>72%</b>	<b>76%</b>	<b>90%</b>	<b>63%</b>	<b>59%</b>

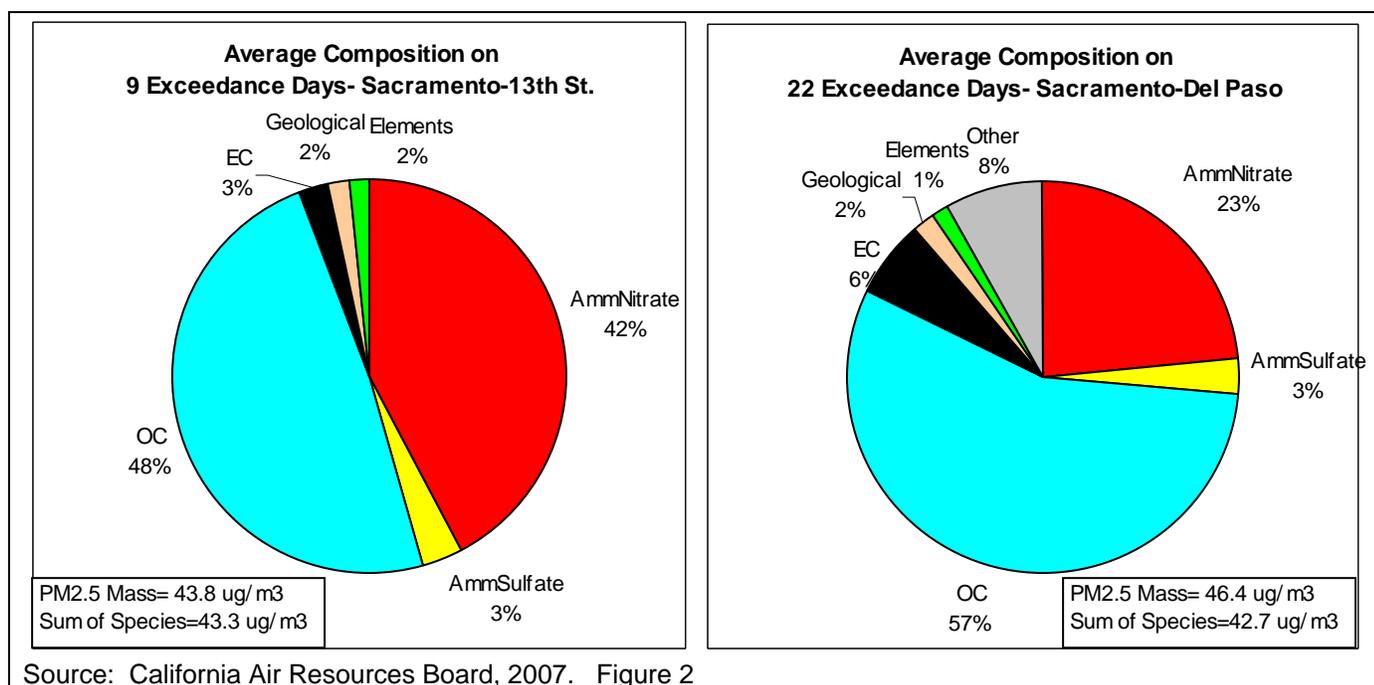
Source: ARB Almanac website (2006) <http://www.arb.ca.gov/ei/maps/statemap/cntymap.htm>

Given the significance of NOx emissions in the formation of the PM<sub>2.5</sub>, EPA also considered emissions provided in the CARB Recommendation letter under this factor, along with the NOx data from NEI summarized in Table 1. Table 3 summarizes NOx emissions from stationary, area, and mobile source categories for 2006, 2010, and 2020.

<b>Table 3. NOx Winter Emissions for Sacramento and Surrounding Counties (tons per day)</b>			
<b>Sacramento County</b>	<b>2006</b>	<b>2010</b>	<b>2020</b>
Stationary Sources	3.9	3.9	4.3
Area Sources	4.0	4.0	4.1
Mobile Sources	75.1	62.5	34.5
<b>Placer County</b>			
Stationary Sources	4.5	4.7	5.1
Area Sources	1.6	1.6	1.6
Mobile Sources	28.2	23.4	13.7
<b>El Dorado County</b>			
Stationary Sources	0.4	0.4	0.4
Area Sources	1.3	1.3	1.4
Mobile Sources	8.8	7.4	4.3
<b>Yolo County</b>			
Stationary Sources	3.0	2.9	2.8
Area Sources	0.7	0.7	0.7
Mobile Sources	21.3	17.3	9.9
<b>Solano County</b>			
Stationary Sources	6.3	6.5	7.1
Area Sources	1.6	1.7	1.7
Mobile Sources	42.4	36.0	21.8

Source: California Air Resources Board in their letter of December 17, 2007  
Note: Although provided by CARB, the 2010 and 2020 data was not relied on for this analysis.

Finally, speciation data from the Sacramento air monitoring stations (i.e., Del Paso and 13<sup>th</sup> Street) were considered in evaluating this factor as a way to link emission sources to high PM<sub>2.5</sub> levels. As shown in the pie charts below, the chemical makeup of PM<sub>2.5</sub> in Sacramento is dominated by organic carbon and ammonium nitrate when the highest concentrations occur, which is during the winter months (i.e., November through February).



The CES shown in Table 1 describe the relative contribution of emissions from surrounding counties to the high emission days based on a broad analysis of NOAA HYSPLIT trajectories linking county-wide emissions from Sacramento and the surrounding counties and speciated air monitoring data on high days. With respect to this factor, the CES clearly demonstrates a connection between pollution levels in Sacramento County and sources in Placer County. The CES shows less of a link between Sacramento County and sources located in El Dorado, Solano and Yolo Counties. However, the scores are high enough to further consider including these counties based on emissions data and other factors.

With respect to primary PM<sub>2.5</sub> emissions, area sources represent the dominant source category in Sacramento and the surrounding counties. Based on Table 2, within the area source category, residential wood burning is the dominant source of PM<sub>2.5</sub> emissions in Sacramento, Placer, El Dorado and Solano Counties. This corresponds with the speciation data summarized in Figure 2 which shows that more than 50% of the PM<sub>2.5</sub> makeup is carbon which can be attributed to residential wood burning during the winter months. In Yolo County, emissions data indicates that “Construction/Demolition” and “Farming Operations” are the most significant area sources, which are not obviously linked to speciation data shown in Figure 2.

Finally, NO<sub>x</sub> emissions were considered. According to the speciation data in Figure 2, as much as 42% of the PM<sub>2.5</sub> composition can be nitrates and thereby related to NO<sub>x</sub> sources. Both Table 1 and 3 describe NO<sub>x</sub> emissions data for Sacramento and the surrounding counties. As shown in Table 1, Sacramento is the dominant source of NO<sub>x</sub> emissions followed by Solano, Placer, Yolo and El Dorado County. As shown in Table 3, mobile sources are the dominant source of NO<sub>x</sub> emissions in all of the counties. In light of the commuting patterns discussed under Factor 4 and illustrated in Figure 3, there appears to be a clear link between mobile source emissions in Sacramento and the surrounding counties and PM<sub>2.5</sub> exceedances measured in Sacramento.

In summary, PM<sub>2.5</sub> exceedances most often occur in Sacramento during the winter months and speciation data suggest that residential wood burning and mobile source emissions are the most important sources. Area source data for Sacramento and the surrounding counties, with exception for Yolo County, show that residential wood burning is the dominant source of PM<sub>2.5</sub> and thereby, could be linked to PM<sub>2.5</sub> exceedances measured in Sacramento. With respect to mobile sources, Sacramento and the surrounding counties have significant mobile source emissions which, combined with the commuting patterns, suggest a link between exceedances in Sacramento and mobile source emissions from the surrounding counties.

## **Factor 2: Air quality data**

This factor considers the 24-hour PM<sub>2.5</sub> design values in micrograms per cubic meter ( $\mu\text{g}/\text{m}^3$ ) derived from air-quality monitors in Sacramento and the surrounding counties for the 2005-2007 period. A monitor’s design value indicates whether that monitor attains a specified air-quality standard. The 24-hour PM<sub>2.5</sub> standards are met when the 3-year average of a monitor’s 98<sup>th</sup> percentile values are  $35\mu\text{g}/\text{m}^3$  or less. A design value is only valid if minimum data completeness criteria are met. The 24-hour PM<sub>2.5</sub> design values for Sacramento County and the other counties are shown in Table 4.

<b>County</b>	<b>State Recommended Nonattainment?</b>	<b>24-hour PM<sub>2.5</sub> Design Values 2004-06 (<math>\mu\text{g}/\text{m}^3</math>)</b>	<b>24-hour PM 2.5 Design Values 2005-07 (<math>\mu\text{g}/\text{m}^3</math>)</b>
Sacramento County	Yes	49	54
Placer County	No	38	30
El Dorado County	No	No data	No data
Yolo County	No	30	33
Solano County (1)	No	36	36

1. The western portion of Solano County is included in the State’s recommendation for the San Francisco Bay Area’s nonattainment area, and is within the Bay Area Air Quality Management District. EPA is recommending that the eastern portion of Solano County be included in the Sacramento nonattainment area.

There are three monitoring sites throughout Sacramento County for PM<sub>2.5</sub>; however, only two sites, Del Paso Manor and Stockton Boulevard, have complete data to support designations. The design value monitor in Sacramento County is based on measurements at the Del Paso Manor site.

Placer County showed a violation based on 2004 – 2006 data, but meets the standard based on 2005–2007 data. Yolo County was in attainment for both the 2004–2006 and 2005–2007 periods, although it is noted that levels appear to be increasing based on the 2005-2007 design value. Air quality data was not available for El Dorado and Solano Counties; therefore, these counties can only be assessed according to the data from surrounding counties. Based on design values, Sacramento appears to be a candidate for nonattainment area designation.

However, in addition to considering design values, EPA also considered information supplied in the CARB recommendation letter regarding the area represented by PM<sub>2.5</sub> air monitoring data. Two studies cited by CARB support nonattainment area boundaries that are larger than recommended. The studies were both based on data collected during the 2000 California Regional PM<sub>10</sub>/PM<sub>2.5</sub> Air Quality Study (CRPAQS). These studies focused on the San Joaquin Valley which, together with the Sacramento Valley to the north, comprises California’s Central Valley situated between the Sierra Nevada and the coastal mountain ranges. CARB cited these studies as showing that the organic carbon portion of PM<sub>2.5</sub> is largely urban rather than rural, because of the limited range of influence of PM<sub>2.5</sub> monitors (which are in urban areas). While it is likely true that organic carbon concentrations are higher in urban than in rural areas, this does not in itself support limiting nonattainment areas to city boundaries.

Range of influence (or zone or radius of representation) can be defined in various ways. In the 2006 Chow study cited by CARB, zone of representation is defined as the area over which the average concentration differs less than 10% from the monitored value and this area was estimated based on concentration differences between monitors. A rapid concentration drop from one monitor to another nearby monitor would show a small zone of representation while a slow concentration drop between distant monitors would show a large zone. The study found the radius of representation to range from 3 to 21 kilometers (km) or 2 to 13 miles and averaging 13 km (8 mi). This study included monitoring locations in the Sacramento Valley locations which were intended to describe the spatial distribution of concentrations and not to set boundaries for

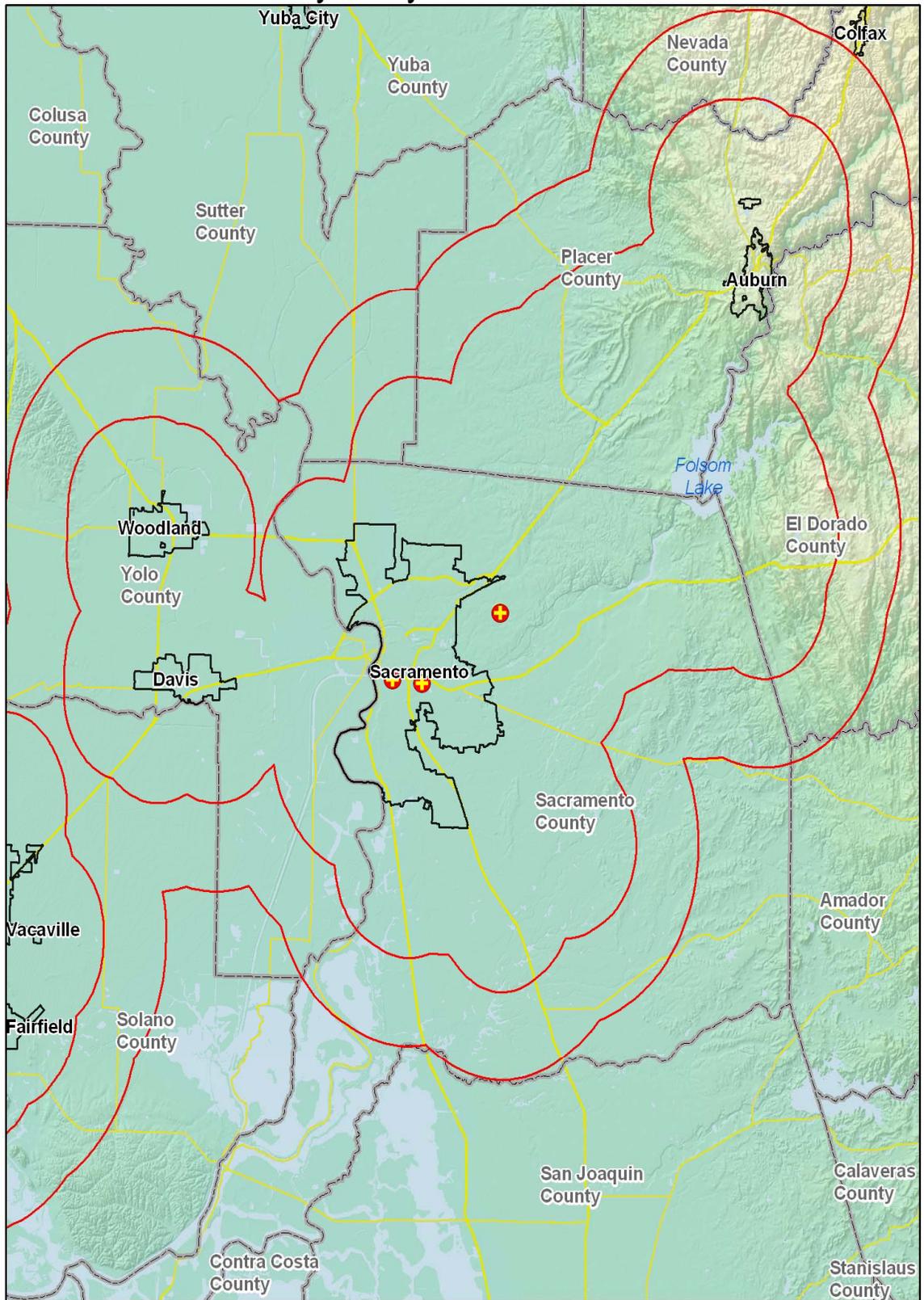
planning purposes. However, they do suggest a sense of the size of the area that is represented by a PM<sub>2.5</sub> air monitor.

In a second study using CRPAQS data, MacDonald et al. defined “zone of influence” as the distance at which CALPUFF-modeled concentrations fell to 1/10 of the urban maximum. This analysis showed larger regions of influence in the Sacramento area, 15-100 km (9-60 mi), than in the San Joaquin Valley, 15-50 km (9-30 mi).

Considering the results from these studies, EPA used buffer zones of 5 and 10 miles around city boundaries to approximate the area which could be influenced by PM<sub>2.5</sub> measurements in Sacramento, Placer and Yolo County. These boundaries are shown in Figure 3. These buffer zones support a nonattainment area designation that is larger than Sacramento County.

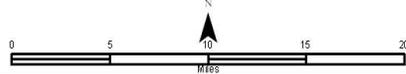
Eligible monitors for providing design value data generally include State and Local Air Monitoring Stations (SLAMS) at population-oriented locations with a FRM or FEM monitor. All data from Special Purpose Monitors (SPM) using an FRM, FEM, or Alternative Reference Method (ARM) which has operated for more than 24 months is eligible for comparison to the relevant NAAQS, subject to the requirements given in the October 17, 2006 Revision to Ambient Air Monitoring Regulations (71 FR 61236). All monitors used to provide data must meet the monitor siting and eligibility requirements given in 71 FR 61236 to 61328 in order to be acceptable for comparison to the 24-hr PM<sub>2.5</sub> NAAQS for designation purposes.

# Sacramento Valley - City Boundaries and Buffer Zones



- + Violating PM 2.5 monitor
- City Boundary
- County Boundary
- Five- and Ten- Mile Buffer

Figure 3



Sources: FHMA (2000), USGS (2000), US Census (2000), EPA (2008), Dynatrac (2000)

**EPA**  
REGION 9 - AIR  
AIR080160242 August 11, 2008

**Factor 3: Population density and degree of urbanization (including commercial development)**

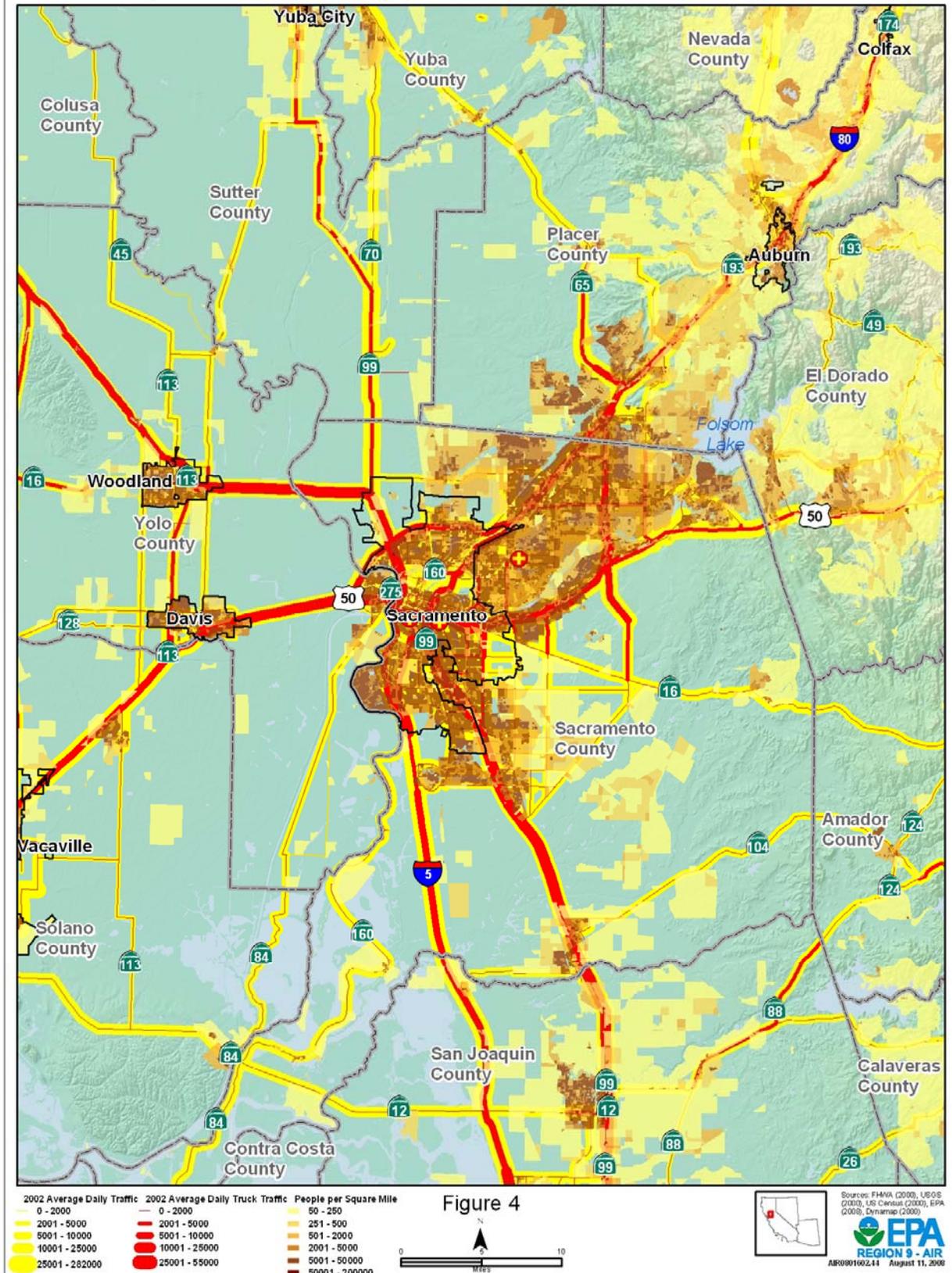
Table 5 shows the 2005 population for each county in the area being evaluated, as well as the population density for each county in that area. Population data gives an indication of whether it is likely that population-based emissions might contribute to violations of the 24-hour PM<sub>2.5</sub> standards. Population density and distribution is also illustrated in Figure 4.

<b>Table 5. Population</b>			
<b>County</b>	<b>State Recommended nonattainment?</b>	<b>2005 Population</b>	<b>2005 Population Density (pop/sq mi)</b>
Sacramento County	Yes	1,363,423	1,370
Placer County	No	316,868	211
El Dorado County	No	176,319	99
Yolo County	No	185,091	181
Solano County (1)	No	410,786	463
Source: 2005 National Emissions Inventory			
1. The western portion of Solano County is included in the State's recommendation for the San Francisco Bay Area's nonattainment area, and is within the Bay Area Air Quality Management District. EPA is recommending that eastern portion of Solano County be included in the Sacramento nonattainment area.			

Sacramento County has the highest population density, followed by Placer, Yolo and El Dorado Counties. Population data are relevant in defining the boundaries of the PM<sub>2.5</sub> nonattainment area given the correlation between population and the emission sources contributing to PM<sub>2.5</sub> exceedances (i.e., residential wood burning and mobile sources), as well as the population exposed to high PM<sub>2.5</sub> levels. Based on this factor, EPA recommends expanding the boundaries of the nonattainment area recommended by California to capture the population associated with the Sacramento metropolitan area, which extends beyond the boundaries of Sacramento County.

# Sacramento Valley

## Population Density, Truck and Commuting Traffic



As illustrated in Figure 4, “Sacramento Valley – Population Density, Truck and Commuting Traffic”, the populations associated with the City of Sacramento clearly extend into Placer, El Dorado, Solano, and Yolo Counties and; therefore, this factor supports expanding the nonattainment boundary to capture these surrounding populations

**Factor 4: Traffic and commuting patterns**

This factor considers the number of commuters in each county who drive to another county within the Sacramento County area, the percent of total commuters in each county who commute to other counties within the Sacramento area, as well as the total Vehicle Miles Traveled (VMT) for each county in thousands of miles (see Table 6). A county with numerous commuters is generally an integral part of an urban area and could be an appropriate county for implementing mobile-source emission control strategies, thus warranting inclusion in the nonattainment area. Figure 3 further illustrates the traffic and commuting patterns associated with the Sacramento metropolitan area and the surrounding counties.

County	State Recommended Nonattainment?	2005 VMT (1000s mi)	Number Commuting to any violating counties	Percent Commuting to any violating counties
Sacramento	Yes	11,821	464,260	87%
Placer	No	3,406	36,310	37%
El Dorado	No	1,695	19,760	27%
Yolo	No	2,350	20,800	28%
Solano (1)	No	4,173	105,850	61%

1. The western portion of Solano County is included in the State’s recommendation for the San Francisco Bay Area’s nonattainment area, and is within the Bay Area Air Quality Management District. EPA is recommending that eastern portion of Solano County be included in the Sacramento nonattainment area.

The number of commuters into Sacramento County from Yolo, Placer, Solano, and El Dorado counties is significant. In addition to the commuter traffic, Sacramento County has a large number of highways traversing the area which carry high levels of daily truck traffic. For example, Highway 99 extends through Sacramento and Placer County. Based on 2002 transportation data, the average daily truck traffic for Highway 99 ranges from approximately 10,000 to 25,000 trucks per day. Highway 80 and Interstate 5 from the cities of Davis and Woodland in Yolo County each carry 10,001 to 25,000 trucks per day. The significance of commuting and truck traffic is illustrated in Figure 4.

Based on the number of commuters and the significant truck traffic, Sacramento, Placer, El Dorado, Solano, and Yolo Counties are considered to be contributing to PM<sub>2.5</sub> exceedances measured in Sacramento County.

The 2005 VMT data used for table 5 and 6 of the 9-factor analysis has been derived using methodology similar to that described in “Documentation for the final 2002 Mobile National

Emissions Inventory, Version 3, September 2007, prepared for the Emission Inventory Group, U.S. EPA. This document may be found at: [atftp://ftp.epa.gov/EmisInventory/2002finalnei/documentation/mobile/2002\\_mobile\\_nei\\_version\\_3\\_report\\_092807.pdf](atftp://ftp.epa.gov/EmisInventory/2002finalnei/documentation/mobile/2002_mobile_nei_version_3_report_092807.pdf). The 2005 VMT data were taken from documentation which is still draft, but which should be released in 2008.

**Factor 5: Growth rates and patterns**

This factor considers population growth for 2000-2005 and growth in vehicle miles traveled (VMT) for 1996-2005 for counties in the Sacramento area, as well as patterns of population and VMT growth. A county with rapid population or VMT growth is generally an integral part of an urban area and likely to be contributing to fine particle concentrations in the area. In addition such a county could be appropriate for implementing mobile-source and other emission-control strategies, thus warranting inclusion in the nonattainment area.

Table 7 below shows population, population growth, VMT and VMT growth for Sacramento County and counties that are adjacent to Sacramento County. Counties are listed in descending order based on VMT growth between 1996 and 2005.

<b>Table 7. Population and VMT Values and Percent Change</b>					
<b>County</b>	<b>Population (2005)</b>	<b>Population Density (2005)</b>	<b>Population % change (2000 - 2005)</b>	<b>2005 VMT</b>	<b>VMT % change from 1996 to 2005)</b>
Sacramento	1,363,423	1,370	11%	11,821	22%
Placer	316,868	211	26%	3,406	20%
El Dorado	176,319	99	12%	757	23%
Yolo	185,091	181	9%	2,350	37%
Solano (1)		463	?	4,173	?
1. The western portion of Solano County is included in the State's recommendation for the San Francisco Bay Area's nonattainment area, and is within the Bay Area Air Quality Management District. EPA is recommending that eastern portion of Solano County be included in the Sacramento nonattainment area					

According to Table 7, Sacramento has the highest population and population density. It is followed by Solano, then Placer, Yolo, and El Dorado. All these counties have populations that are growing with increases between 9% and 26%. According to Factor 3, most of these counties have high population densities as well. The exception is El Dorado County which has the smallest population and population density; however, El Dorado's population increased at a rate of 12% in the period between 2000-2005. Looking at VMT, all five counties had substantial increases in VMT between 1996 and 2005. Even El Dorado had an increase of 23%. The largest increase was in Yolo County with 37%.

Based on the analysis under Factor 5, the pattern indicates substantial growth in Sacramento County and the surrounding counties as the Sacramento metropolitan area expands. It appears that all five counties are part of the Sacramento metropolitan area and should be included as part of the Sacramento nonattainment area.

## **Factor 6: Meteorology (weather/transport patterns)**

For this factor, EPA considered data from National Weather Service instruments in the area. Wind direction and wind speed data for 2004-2006 were analyzed, with an emphasis on “high PM<sub>2.5</sub> days” for each of two seasons (an October-April “cold” season and a May-September “warm” season). These high days are defined as days where any FRM or FEM air quality monitors had 24-hour PM<sub>2.5</sub> concentrations above 95% on a frequency distribution curve of PM<sub>2.5</sub> 24-hour values, or where 24-hr values exceeded 35 µg/m<sup>3</sup>.

For each air quality monitoring site, EPA developed a “pollution rose” to understand the prevailing wind direction and wind speed on the days with highest fine particle concentrations. Figure 5 identifies 24-hour PM<sub>2.5</sub> values by color with days exceeding 35 µg/m<sup>3</sup> denoted with a red or black icon. A dot indicates the day occurred in the warm season and a triangle indicates the day occurred in the cool season. The center of the figure indicates the location of the air quality monitoring site, and the location of the icon in relation to the center indicates the direction from which the wind was blowing on that day. An icon that is close to the center indicates a low average wind speed on that day. Higher wind speeds are indicated when the icon is further away from the center.

The pollution rose for the Sacramento County area, Figure 5, shows that the 24-hour PM<sub>2.5</sub> concentrations above 35 micrograms per cubic meter (µg/m<sup>3</sup>) are more likely when the prevailing wind directions are from the northwest and southeast. Additional pollution roses for the Sacramento urban area are included in Attachment 3. The pollution roses indicate the PM<sub>2.5</sub> level above 35 µg/m<sup>3</sup> generally occurred during time periods with a wind speed of 4 miles per hour or less. The pollution roses also indicate that the majority of days with high PM<sub>2.5</sub> in the Sacramento area are in the “cold” season.

Sacramento County, CA  
Pollution Rose, 2004-2006

Not in an existing NAA  
CSA: Sacramento--Arden-Arcade--Yuba City, CA-NV  
CBSA: Sacramento--Arden-Arcade--Roseville, CA

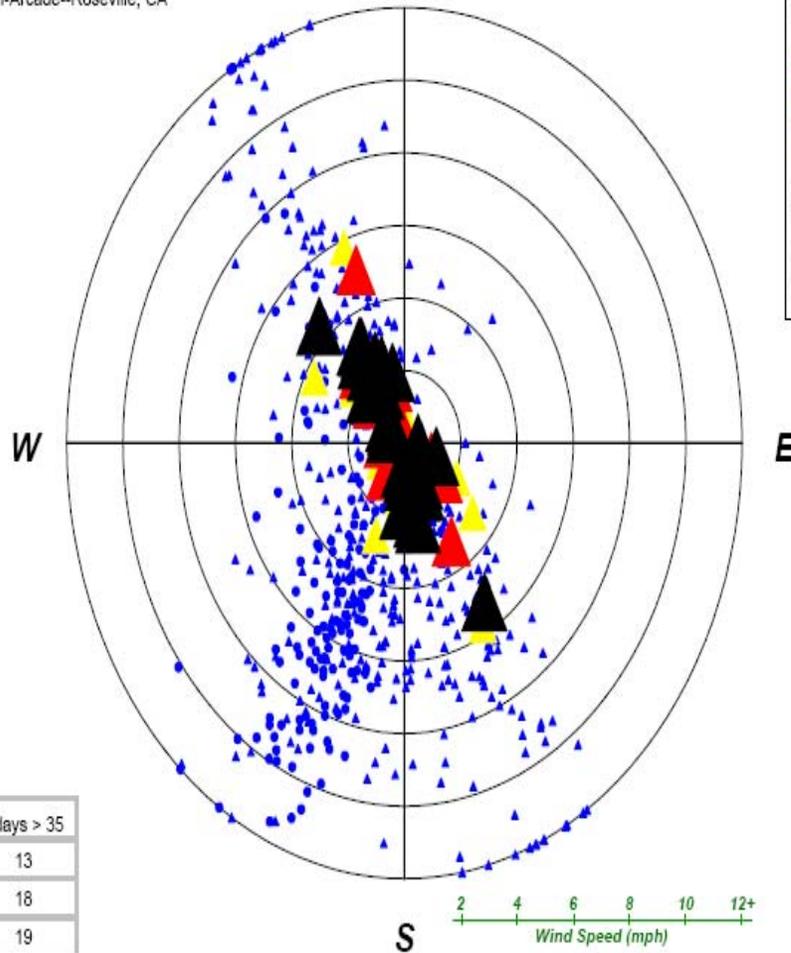
Site 060670006

**Concentration:**

- > 40  $\mu\text{g}/\text{m}^3$
- 35 - 40  $\mu\text{g}/\text{m}^3$
- 30 - 35  $\mu\text{g}/\text{m}^3$
- $\leq 30 \mu\text{g}/\text{m}^3$

**Season:**

- △ cool (Oct-Apr)
- warm (May-Sep)



Year	98th %-ile	# days > 35
2004	42.0	13
2005	49.0	18
2006	55.0	19
Design Value	49-NA	

13 exceedance(s) not plotted  
(due to missing or variable wind data)

Meteorological data from 9.9 miles away  
SACRAMENTO\_EXECUTIVE\_ARPT (ID=23232)

located in/ near Sacramento Metro, CA

Figure 5

California’s recommendation letter indicates that, “High  $\text{PM}_{2.5}$  concentrations in the Sacramento area appear to be dependent upon calm-to-light winds and not as dependent on wind direction. This suggests that there is enough activity within the Sacramento area to generate high  $\text{PM}_{2.5}$  concentrations under many conditions, and that high concentrations are not being caused by adjacent areas such as Placer, Sutter and Yolo Counties.”

EPA concurs with California that high  $\text{PM}_{2.5}$  concentrations in the Sacramento area appear to be dependent upon calm-to-light winds and are not as dependent on wind direction. While activity

in the Sacramento area may be sufficient to generate high PM<sub>2.5</sub> concentrations under many conditions, EPA does not agree that this indicates that adjacent areas do not contribute to high concentrations in the Sacramento area.

The meteorology factor is also considered in each county's Contributing Emissions Score because the method for deriving this metric included an analysis of trajectories of air masses for high PM<sub>2.5</sub> days. The Contributing Emissions Scores CES (Table 1) indicate that during days with high levels of PM<sub>2.5</sub> (winter days with calm-to-light winds), back trajectories show that nearby counties have the potential to contribute to high concentrations in the Sacramento area.

### **Factor 7: Geography/topography (mountain ranges or other air basin boundaries)**

The geography/topography analysis looks at physical features of the land that might have an effect on the airshed and, therefore, on the distribution of PM<sub>2.5</sub> within Sacramento County, and the surrounding area.

Sacramento County is bounded by the Sierra Nevada foothills to the northeast and the Sacramento-San Joaquin River Delta to the southwest. The lower Sacramento Valley extends through the western and central portions of the County. Elevations range from sea level in the southwest to approximately 400 feet above sea level in the eastern areas of the County. There are no distinguishing topographic features that would exclude any part of the Yolo or Solano counties. However, the eastern portions of Placer and El Dorado County counties extend beyond the ridge of the Sierra Nevada Mountains.

Because the Sacramento area has topographical features higher than the typical daytime height of the inversion layer, EPA considered the inversion height, as well as using the top of the mountain or ridgeline, to estimate the size of the area likely to have similar pollution conditions, and to determine an appropriate eastern boundary.

For the areas under consideration, high PM<sub>2.5</sub> concentrations mostly occur during stagnant conditions during winter, with radiant inversions. The cooling of the ground, as heat is radiated away creates an inversion, since air near the ground is cooler than that above. This inhibits mixing and confines pollutants to a relatively shallow layer near the ground. Ferreria and Shipp examined the meteorology of San Joaquin Valley PM<sub>2.5</sub> and PM<sub>10</sub> episodes, including inversion heights, typically based on aircraft temperature soundings. (During CRPAQS, radio acoustic sounding system (RASS) data were also available.) A typical value for maximum mixing height during high PM<sub>2.5</sub> conditions is 500 meters. Minimum mixing height can be 100 meters or less. To get a sense of the eastern edge of the area in which pollution could be confined by winter inversions, EPA examined the Sierra Foothills elevation contour that is 1500 feet above the Sacramento City center. This contour is represented in Figure 6.

EPA recognizes that an inversion height is not a rigid boundary extending through a fixed elevation. In reality the inversion would be partly terrain-following, and the degree of stagnation would be subject to additional influences at the foothill edges, such as strong diurnal slope flows. In any case, the mixing heights vary substantially by site and date, so any single height can provide only a scale for comparison, not a definitive value. Nevertheless, this contour gives a

rough sense of the area over which inversions may be enhancing pollution concentrations. The crest of the Sierra Nevada range is a more substantial barrier to pollution flow out of Sacramento Valley than any specific contour height, which only roughly gives the edge of the valley inversion.

In summary, topography is considered to be an important factor given that inversion layers during the winter when PM<sub>2.5</sub> exceedances typically occur, can contribute to higher pollution levels in the Sacramento Valley. In addition to affecting Sacramento County, these inversions also affect Yolo, Solano, Placer and El Dorado County. With respect to Yolo and Solano County, the entire area is within the Sacramento Valley and thereby influenced by winter-time inversion layers. Placer and El Dorado County are partly within the Sacramento Valley and, as shown in Figure 6, partly influenced by the inversion layer. In order to fully capture the extent to which Placer and El Dorado County could be affected by the inversion layer, EPA is proposing the crest of the Sierra Nevada Mountains as the eastern boundary of the nonattainment area.

#### **Factor 8: Jurisdictional boundaries (e.g., existing PM and ozone areas)**

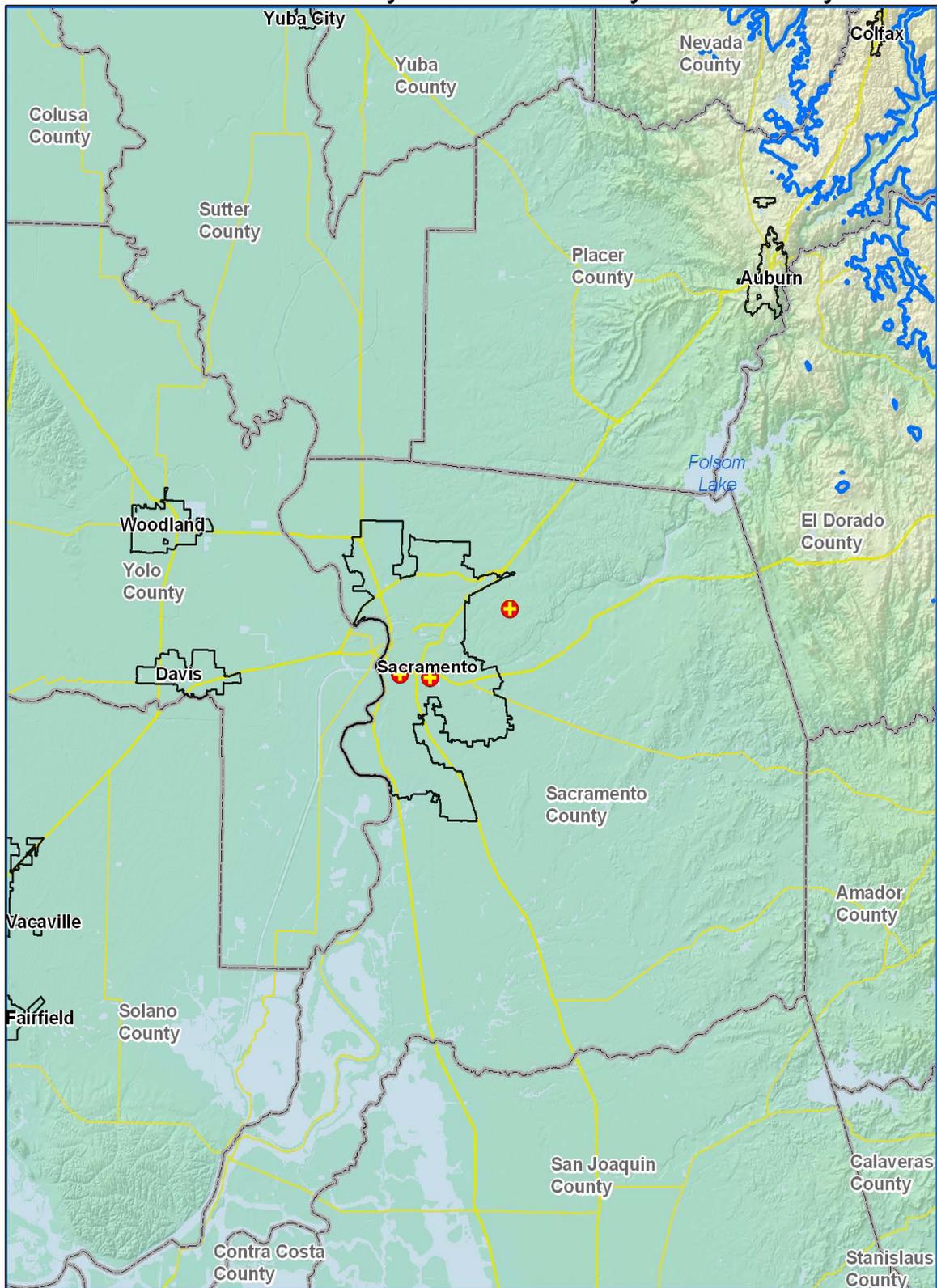
In evaluating the jurisdictional boundary factor, consideration should be given to existing boundaries and organizations that may facilitate air quality planning and the implementation of control measures to attain the standard. Areas designated as nonattainment (e.g., for PM<sub>2.5</sub> or 8-hour ozone standard) represent important boundaries for state air quality planning.

The analysis of jurisdictional boundaries considered the planning and organizational structure of the Sacramento area to determine if the implementation of controls in a potential nonattainment area can be carried out in a cohesive manner.

The jurisdictional boundaries that exist for the counties under consideration (see Figure 7) for the Sacramento nonattainment area are:

- Sacramento County – the Sacramento Metro Air Quality Management District
- Placer County – the Placer County Air Pollution Control District
- El Dorado – El Dorado County Air Quality Management District
- Yolo County – the Yolo Solano Air Quality Management District
- Solano County (western portion) – the Yolo Solano Air Quality Management District

# Sacramento Valley - Inversion Layer Boundary



- + Violating PM 2.5 monitor
- 1,500-foot Inversion Layer
- City Boundary
- County Boundary

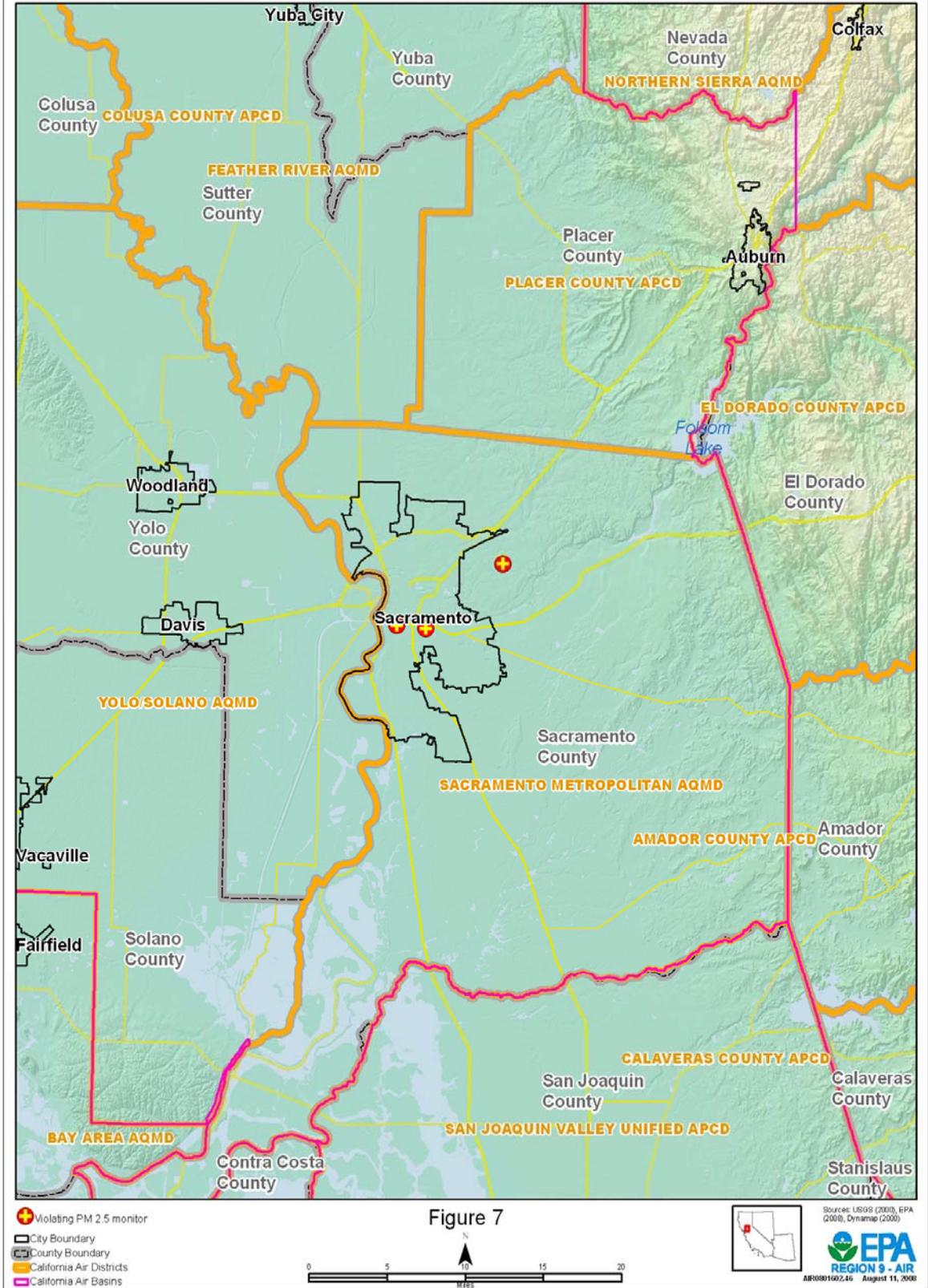
Figure 6



Sources: USGS (2000), EPA (2008), Dynamap (2000)



# Sacramento Valley - Air Districts, Air Basins



We also considered the existing Sacramento 8-hour ozone nonattainment area which includes all of the above counties, plus part of Sutter County. A goal in designating PM<sub>2.5</sub> nonattainment areas is to achieve a degree of consistency with ozone nonattainment areas.

Given the numerous jurisdictions involved and the goal of considering existing nonattainment area boundaries, EPA recommends that the PM<sub>2.5</sub> nonattainment area for the Sacramento area include all of Sacramento and Yolo Counties, and parts of Placer, El Dorado, and Solano Counties. EPA recommends including that part of Placer and El Dorado up to the Sierra Nevada mountain ridge line, which is the same as the boundary for the 8-hour ozone nonattainment area. EPA recommends including the eastern part of Solano County, which is also part of the existing Sacramento 8-hour ozone nonattainment area. The western part of Solano County is being recommended for a nonattainment designation for PM<sub>2.5</sub> as part of the Bay Area Air Quality Management District. Sutter County is being recommended for a PM<sub>2.5</sub> nonattainment designation as part of the Feather River Air Quality Management District.

#### **Factor 9: Level of control of emission sources**

This factor considers emission controls currently implemented for major sources in the Sacramento PM<sub>2.5</sub> nonattainment area.

The emission estimates in Table 1 (under Factor 1) include any control strategies implemented in the Sacramento area before 2005 that may influence emissions of any component of PM<sub>2.5</sub> emissions (i.e., total carbon, SO<sub>2</sub>, NO<sub>x</sub>, and crustal PM<sub>2.5</sub>).

## Attachment 2

### Description of the Contributing Emissions Score

The CES is a metric that takes into consideration emissions data, meteorological data, and air quality monitoring information to provide a relative ranking of counties in and near an area. Using this methodology, scores were developed for each county in and around the relevant metro area. The county with the highest contribution potential was assigned a score of 100, and other county scores were adjusted in relation to the highest county. The CES represents the relative maximum influence that emissions in that county have on a violating county. The CES, which reflects consideration of multiple factors, should be considered in evaluating the weight of evidence supporting designation decisions for each area.

The CES for each county was derived by incorporating the following significant information and variables that impact PM<sub>2.5</sub> transport:

- Major PM<sub>2.5</sub> components: total carbon (organic carbon (OC) and elemental carbon (EC)), SO<sub>2</sub>, NO<sub>x</sub>, and inorganic particles (crustal).
- PM<sub>2.5</sub> emissions for the highest (generally top 5%) PM<sub>2.5</sub> emission days (herein called “high days”) for each of two seasons, cold (Oct-Apr) and warm (May-Sept)
- Meteorology on high days using the NOAA HYSPLIT model for determining trajectories of air masses for specified days
- The “urban increment” of a violating monitor, which is the urban PM<sub>2.5</sub> concentration that is in addition to a regional background PM<sub>2.5</sub> concentration, determined for each PM<sub>2.5</sub> component
- Distance from each potentially contributing county to a violating county or counties

A more detailed description of the CES can be found at [http://www.epa.gov/ttn/naaqs/pm/pm25\\_2006\\_techinfo.html#C](http://www.epa.gov/ttn/naaqs/pm/pm25_2006_techinfo.html#C).

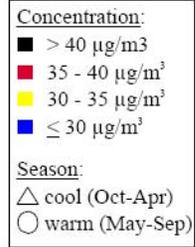
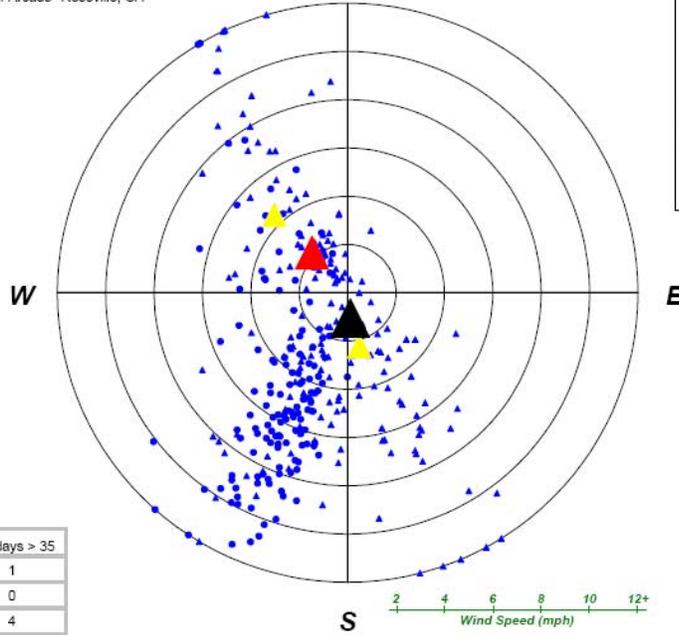
# ATTACHMENT 3

## POLLUTION ROSES FOR SACRAMENTO AREA

Yolo County, CA  
Pollution Rose, 2004-2006

Site 061131003

Not in an existing NAA  
CSA: Sacramento--Arden-Arcade--Yuba City, CA-NV  
CBSA: Sacramento--Arden-Arcade--Roseville, CA



Year	98th %-ile	# days > 35
2004	31.0	1
2005	24.0	0
2006	36.0	4
Design Value	30-A	

3 exceedance(s) not plotted  
(due to missing or variable wind data)

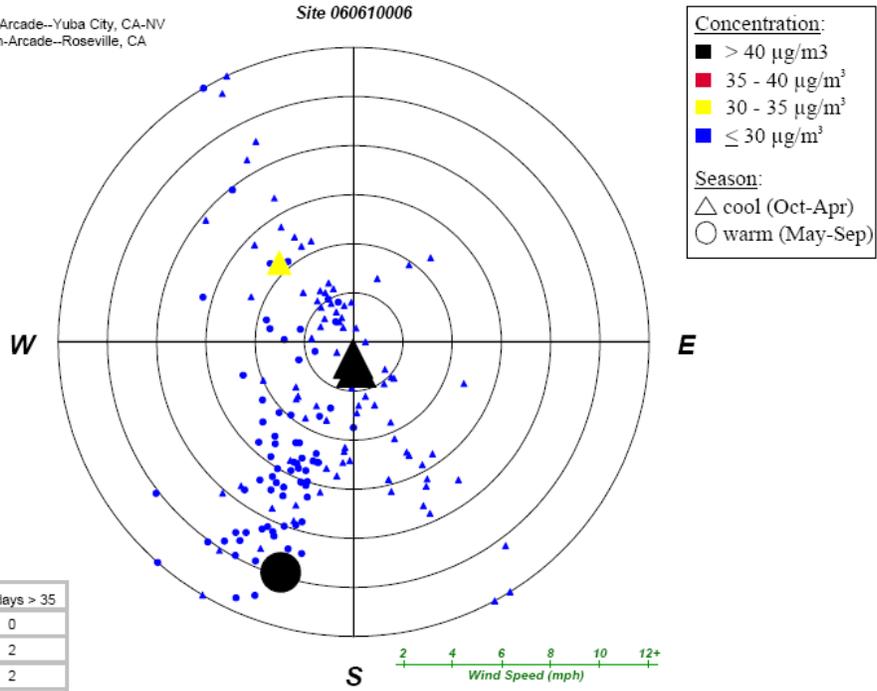
Meteorological data from 15.9 miles away  
SACRAMENTO\_EXECUTIVE\_ARPT (ID=23232)

located in/in near Sacramento Metro, CA

Placer County, CA  
Pollution Rose, 2004-2006

Not in an existing NAA  
CSA: Sacramento--Arden-Arcade--Yuba City, CA-NV  
CBSA: Sacramento--Arden-Arcade--Roseville, CA

Site 060610006



Year	98th %-ile	# days > 35
2004	30.0	0
2005	47.0	2
2006	36.0	2
Design Value	38-NA	

1 exceedance(s) not plotted  
(due to missing or variable wind data)

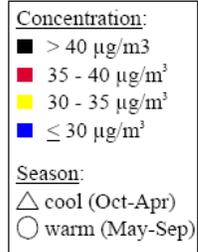
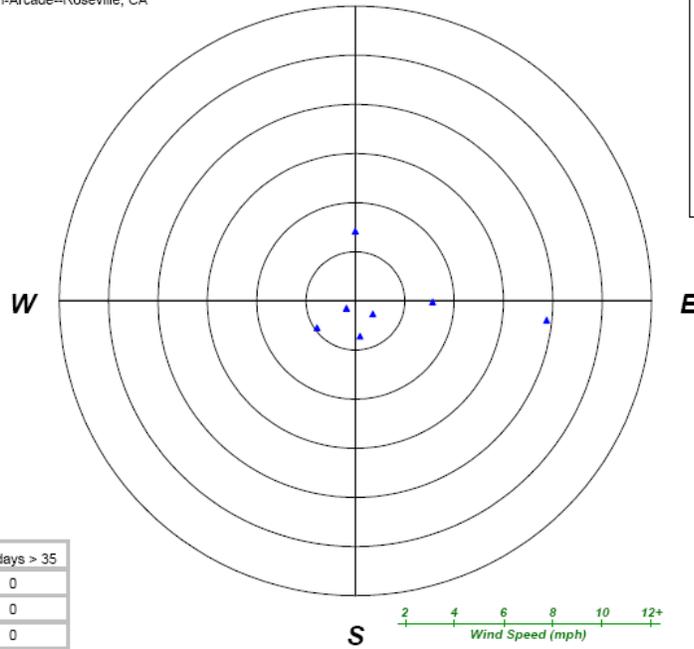
Meteorological data from 20.3 miles away  
SACRAMENTO\_EXECUTIVE\_ARPT (ID=23232)

located in/ near Sacramento Metro, CA

**El Dorado County, CA  
Pollution Rose, 2004-2006**

Not in an existing NAA  
CSA: Sacramento--Arden-Arcade--Yuba City, CA-NV  
CBSA: Sacramento--Arden-Arcade--Roseville, CA

Site 060170011



Year	98th %-ile	# days > 35
2004	20.0	0
2005	.	0
2006	.	0
Design Value	20-a	

No exceedances



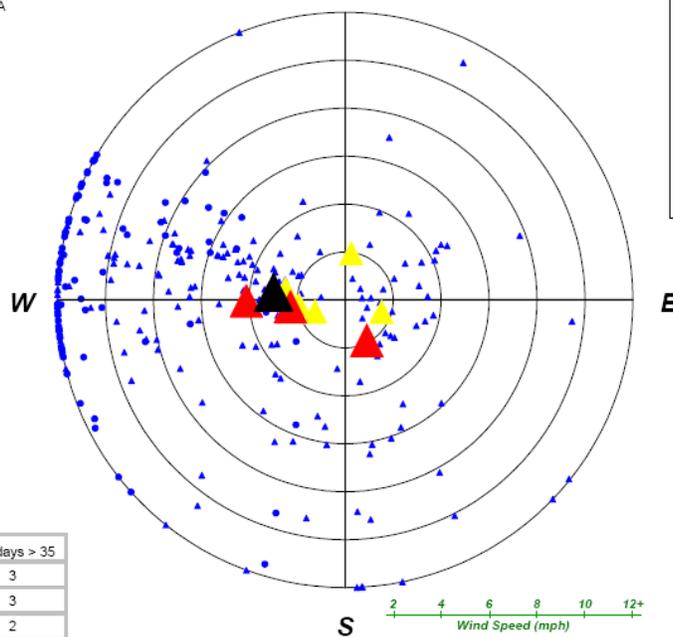
Meteorological data from 39.6 miles away  
RENO\_TAHOE\_INTERNATIONAL\_AP (ID=23185)

located in linear Sacramento Metro, CA

Solano County, CA  
Pollution Rose, 2004-2006

Not in an existing NAA  
CSA: San Jose-San Francisco-Oakland, CA  
CBSA: Vallejo-Fairfield, CA

Site 060950004



**Concentration:**  
 ■ > 40  $\mu\text{g}/\text{m}^3$   
 ■ 35 - 40  $\mu\text{g}/\text{m}^3$   
 ■ 30 - 35  $\mu\text{g}/\text{m}^3$   
 ■  $\leq 30 \mu\text{g}/\text{m}^3$

**Season:**  
 △ cool (Oct-Apr)  
 ○ warm (May-Sep)

Year	98th %-ile	# days > 35
2004	36.9	3
2005	35.6	3
2006	34.3	2
Design Value	36-NA	

4 exceedance(s) not plotted  
(due to missing or variable wind data)

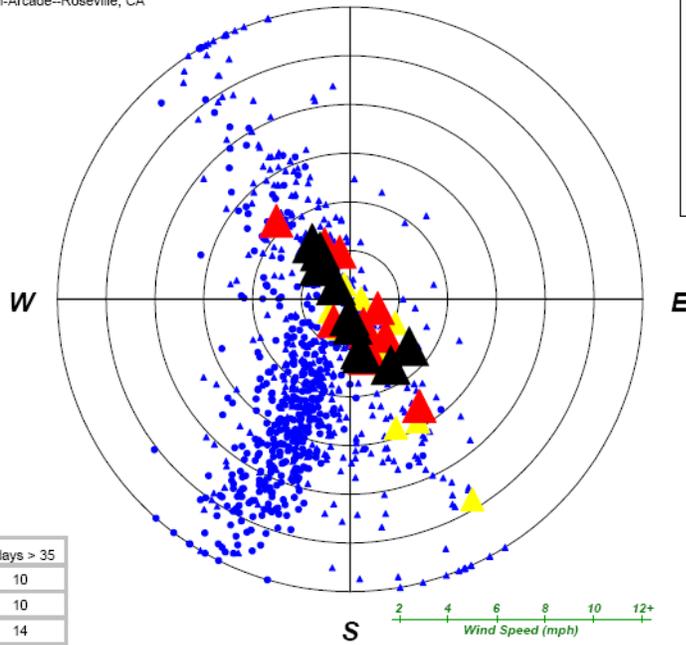
Meteorological data from 34.5 miles away  
SAN FRANCISCO\_INTL\_AP (ID=23234)

located in/linear Sacramento Metro, CA

Sacramento County, CA  
Pollution Rose, 2004-2006

Not in an existing NAA  
CSA: Sacramento--Arden-Arcade--Yuba City, CA-NV  
CBSA: Sacramento--Arden-Arcade--Roseville, CA

Site 060670010



**Concentration:**

- > 40  $\mu\text{g}/\text{m}^3$
- 35 - 40  $\mu\text{g}/\text{m}^3$
- 30 - 35  $\mu\text{g}/\text{m}^3$
- $\leq 30 \mu\text{g}/\text{m}^3$

**Season:**

- △ cool (Oct-Apr)
- warm (May-Sep)

Year	98th %-ile	# days > 35
2004	37.0	10
2005	47.0	10
2006	39.0	14
Design Value	41-NA	

12 exceedance(s) not plotted

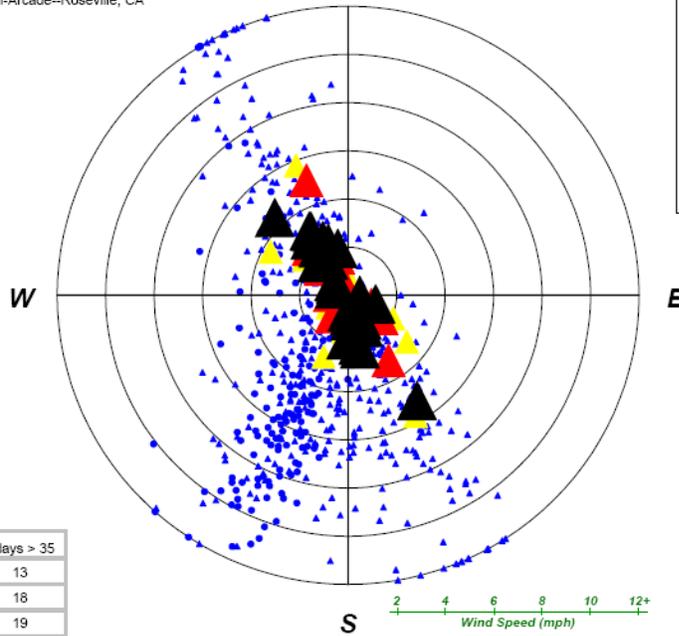
Meteorological data from 2.9 miles away  
SACRAMENTO\_EXECUTIVE\_ARPT (ID=23232)

located in/near San Francisco Bay Area, CA

Sacramento County, CA  
Pollution Rose, 2004-2006

Not in an existing NAA  
CSA: Sacramento--Arden-Arcade--Yuba City, CA-NV  
CBSA: Sacramento--Arden-Arcade--Roseville, CA

Site 060670006



Year	98th %-ile	# days > 35
2004	42.0	13
2005	49.0	18
2006	55.0	19
Design Value	49-NA	

13 exceedance(s) not plotted  
(due to missing or variable wind data)

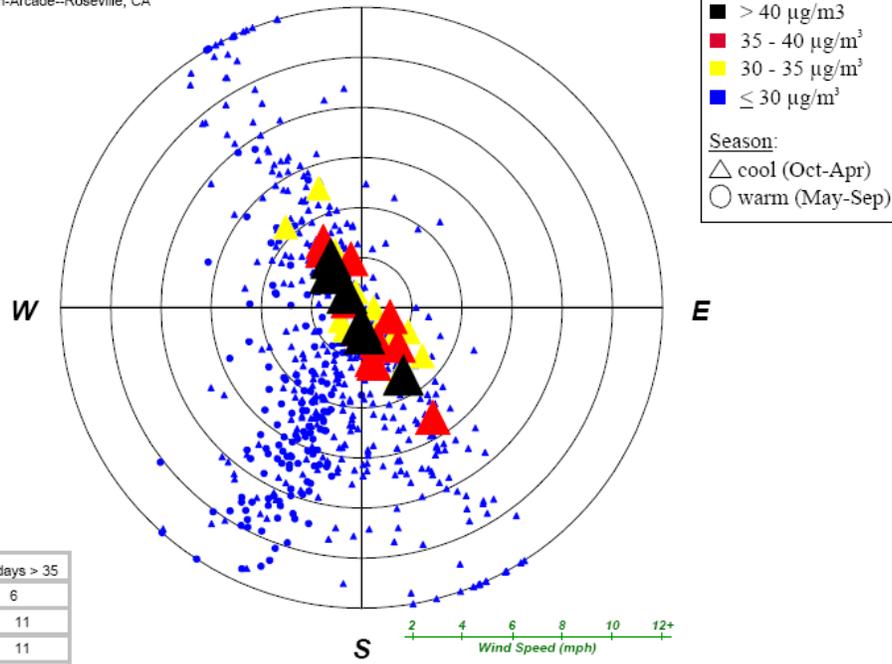
Meteorological data from 9.9 miles away  
SACRAMENTO\_EXECUTIVE\_ARPT (ID=23232)

located in/in near Sacramento Metro, CA

Sacramento County, CA  
Pollution Rose, 2004-2006

Not in an existing NAA  
CSA: Sacramento--Arden-Arcade--Yuba City, CA-NV  
CBSA: Sacramento--Arden-Arcade--Roseville, CA

Site 060674001



Year	98th %-ile	# days > 35
2004	35.0	6
2005	42.0	11
2006	39.0	11
Design Value	39-NA	

11 exceedance(s) not plotted  
(due to missing or variable wind data)

Meteorological data from 3.6 miles away  
SACRAMENTO\_EXECUTIVE\_ARPT (ID=23232)

located in/near Sacramento Metro, CA

## Attachment 1

### CALIFORNIA Area Designations For the 24-Hour Fine Particle National Ambient Air Quality Standard

The table below identifies the counties in California that EPA intends to designate as not attaining the 2006 24-hour fine particle (PM<sub>2.5</sub>) standard.<sup>1</sup> A county will be designated as nonattainment if it has an air quality monitor that is violating the standard or if the county is determined to be contributing to the violation of the standard.

Area	California Recommended Nonattainment Counties	EPA's Intended Nonattainment Counties
Butte County	Butte County - Partial	Butte County
Imperial County	Imperial County - Partial	Imperial County
Sacramento County	Sacramento County	Sacramento County Yolo County Placer County – Partial El Dorado County – Partial Solano County - Partial
San Francisco Bay Area	Sonoma County – Partial Napa County Marin County San Francisco County Contra Costa County Alameda County Santa Clara County San Mateo County Solano County - Partial	Sonoma County – Partial Napa County Marin County San Francisco County Contra Costa County Alameda County Santa Clara County San Mateo County Solano County - Partial
San Joaquin Valley Air Basin	San Joaquin County Stanislaus County Merced County Madera County Fresno County Kings County Tulare County Kern County - Partial	San Joaquin County Stanislaus County Merced County Madera County Fresno County Kings County Tulare County Kern County - Partial
South Coast Air Basin	Los Angeles County – Partial San Bernardino County Partial Riverside County – Partial Orange County	Los Angeles County – Partial San Bernardino County Partial Riverside County – Partial Orange County
Yuba County Sutter County	Yuba County – Partial Sutter County - Partial	Yuba County Sutter County

EPA intends to designate the remaining counties in the state as attainment/unclassifiable.

<sup>1</sup> EPA designated nonattainment areas for the 1997 fine particle standards in 2005. In 2006, the 24-hour PM<sub>2.5</sub> standard was revised from 65 micrograms per cubic meter (average of 98<sup>th</sup> percentile values for 3 consecutive years) to 35 micrograms per cubic meter; the level of the annual standard for PM<sub>2.5</sub> remained unchanged at 15 micrograms per cubic meter (average of annual averages for 3 consecutive years).

## **EPA Technical Analysis for San Francisco Bay Area**

Pursuant to section 107(d) of the Clean Air Act, EPA must designate as nonattainment those areas that violate the NAAQS and those areas that contribute to violations. This technical analysis for the San Francisco Bay Area identifies the counties with monitors that violate the 24-hour PM<sub>2.5</sub> standard and evaluates the counties that potentially contribute to fine particle concentrations in the area. EPA has evaluated these counties based on the weight of evidence of the following nine factors recommended in EPA guidance and any other relevant information:

- pollutant emissions
- air quality data
- population density and degree of urbanization
- traffic and commuting patterns
- growth
- meteorology
- geography and topography
- jurisdictional boundaries
- level of control of emissions sources

Figure 1 is a map of the counties in the area and other relevant information such as the locations and design values of air quality monitors, the metropolitan area boundary, and counties recommended as nonattainment by the State.

# San Francisco Bay Area, CA

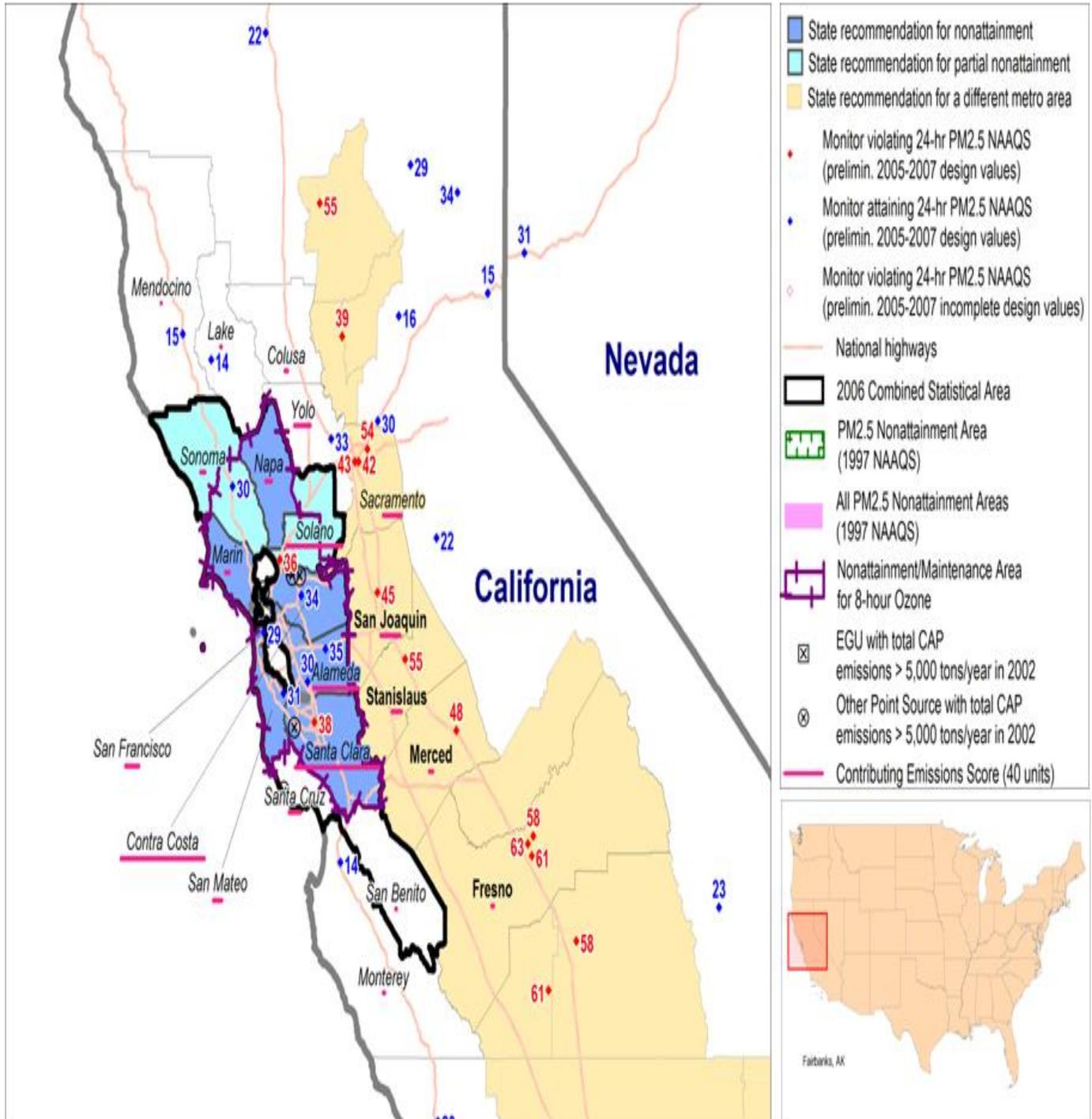


Figure 1

Counties labeled in bold reflect NAAs under 1997 NAAQS

The California Air Resources Board (CARB) sent a letter to EPA, dated December 17, 2008, recommending that southern Sonoma, Napa, Marin, Contra Costa, San Francisco, Alameda, San Mateo, Santa Clara and the western part of Solano Counties be designated as “nonattainment” for the 2006 24-hour PM<sub>2.5</sub> standard based on air quality data from 2004-2006. These data are from Federal Reference Method (FRM) and Federal Equivalent Method (FEM) monitors located in the state.

Air quality monitoring data on the composition of fine particle mass are available from the EPA Chemical Speciation Network and the IMPROVE monitoring network. Composition data was also provided by CARB for the San Jose monitoring site. Analysis of this data indicates that the days with the highest fine particle concentrations occur predominantly in the winter, and the average chemical composition of the highest days is typically characterized by high levels of organic carbon (54%) nitrate (30%), and sulfate (13%).

Based on EPA's 9-factor analysis described below, EPA believes that nine counties in California should be designated nonattainment for the 24-hour PM<sub>2.5</sub> air-quality standard as part of the San Francisco Bay Area nonattainment area, based upon currently available information. These counties are listed in the table below.

Area	State-Recommended Nonattainment Counties	EPA-Recommended Nonattainment Counties
Bay Area Air Basin	Sonoma (P), Napa, Marin, Contra Costa, San Francisco, Alameda, San Mateo, Santa Clara and Solano (P) Counties	Sonoma (P), Napa, Marin, Contra Costa, San Francisco, Alameda, San Mateo, Santa Clara and Solano (P) Counties

P = partial

In this proposed nonattainment area there are seven full counties and two partial counties. Western Solano County is included in the San Francisco Bay Area, but eastern Solano County is included in the Sacramento nonattainment area. All of Solano County is proposed as nonattainment but the county is split between two separate nonattainment areas. Southern Sonoma County is included in the San Francisco Bay Area nonattainment area, but the northern part of the County is excluded due to topography and its rural nature.

The following is a summary of the nine-factor analysis for the San Francisco Bay Area.

**Factor 1: Emissions data**

For this factor, EPA evaluated county level emission data for the following PM<sub>2.5</sub> components and precursor pollutants: “PM<sub>2.5</sub> emissions total,” “PM<sub>2.5</sub> emissions carbon,” “PM<sub>2.5</sub> emissions other,” “SO<sub>2</sub>,” “NO<sub>x</sub>,” “VOCs,” and “NH<sub>3</sub>.” “PM<sub>2.5</sub> emissions total” represents direct emissions of PM<sub>2.5</sub> and includes: “PM<sub>2.5</sub> emissions carbon,” “PM<sub>2.5</sub> emissions other”, primary sulfate (SO<sub>4</sub>), and primary nitrate. (Although primary sulfate and primary nitrate, which are emitted directly from stacks rather than forming in atmospheric reactions with SO<sub>2</sub> and NO<sub>x</sub>, are part of “PM<sub>2.5</sub> emissions total,” they are not shown on the template or data spreadsheet as separate

items). “PM<sub>2.5</sub> emissions carbon” represents the sum of organic carbon (OC) and elemental carbon (EC) emissions, and “PM<sub>2.5</sub> emissions other” represents other inorganic particles (crustal). Emissions of SO<sub>2</sub> and NO<sub>x</sub>, which are precursors of the secondary PM<sub>2.5</sub> components sulfate and nitrate, are also considered. VOCs (volatile organic compounds) and NH<sub>3</sub> (ammonia) are also potential PM<sub>2.5</sub> precursors and are included for consideration.

Emissions data were derived from the 2005 National Emissions Inventory (NEI), version 1. See [http://www.epa.gov/ttn/naaqs/pm/pm25\\_2006\\_techinfo.html](http://www.epa.gov/ttn/naaqs/pm/pm25_2006_techinfo.html).

EPA also considered the Contributing Emissions Score (CES) for each county. The CES is a metric that takes into consideration emissions data, meteorological data, and air quality monitoring information to provide a relative ranking of counties in and near an area. Note that this metric is not the exclusive way for consideration of data for these factors. A summary of the CES is included in attachment 2, and a more detailed description can be found at [http://www.epa.gov/ttn/naaqs/pm/pm25\\_2006\\_techinfo.html#C](http://www.epa.gov/ttn/naaqs/pm/pm25_2006_techinfo.html#C).

Table 1 shows emissions of PM<sub>2.5</sub> and precursor pollutants components (given in tons per year) and the CES for violating and potentially contributing counties in the San Francisco Bay Area.

County	State Recommended Nonattainment?	CES	PM <sub>2.5</sub> emissions total	PM <sub>2.5</sub> emissions carbon	PM <sub>2.5</sub> emissions other	SO <sub>2</sub>	NO <sub>x</sub>	VOCs	NH <sub>3</sub>
Sonoma	Yes (P)	5	2,179	1,224	955	2,851	15,064	13,411	2,697
Napa	Yes	7	611	329	282	1,132	4,251	4,199	600
Solano	Yes (P)	66	1,750	834	915	8,335	15,009	12,093	1,579
Marin	Yes	4	833	468	365	973	6,514	7,250	861
Contra Costa	Yes	100	4,061	1,999	2,061	18,115	44,059	27,508	3,149
San Francisco	Yes	16	2,362	1,388	975	1,979	22,711	13,511	570
Alameda	Yes	54	4,640	2,302	2,339	6,932	43,685	32,094	1,705
San Mateo	Yes	10	2,195	1,103	1,092	2,585	20,888	16,141	1,059
Santa Clara	Yes	100	5,284	2,372	2,912	7,008	44,714	36,471	2,234

P =partial. Data given is for entire County

Most of the counties have high levels of PM<sub>2.5</sub> emissions and PM<sub>2.5</sub> precursors, and should be included in the nonattainment area. Sonoma, Napa and Marin County have low CES values, and Napa and Marin County have relatively low total PM<sub>2.5</sub> emissions. Though Sonoma, Napa, and Marin do not have violating monitors, they are part of the same air basin, part of the San Francisco metropolitan area, and part of the Bay Area Air Quality Management District. The State recommended a designation of nonattainment for them, consistent with previous designations of this area.

## Factor 2: Air quality data

This factor considers the 24-hour PM<sub>2.5</sub> design values micrograms per cubic meter (µg/m<sup>3</sup>) for air quality monitors in counties in the San Francisco Bay Area based on data for the 2005-2007 period. A monitor's design value indicates whether that monitor attains a specified air quality standard. The 24-hour PM<sub>2.5</sub> standards are met when the 3-year average of a monitor's 98<sup>th</sup> percentile values are 35µg/m<sup>3</sup> or less. A design value is only valid if minimum data completeness criteria are met.

The 24-hour PM<sub>2.5</sub> design values for counties in the San Francisco Bay Area are shown in Table 2.

County	State Recommended Nonattainment?	24-hr PM <sub>2.5</sub> Design Values 2004-06 (µg/m <sup>3</sup> )	24-hr PM <sub>2.5</sub> Design Values 2005-07 (µg/m <sup>3</sup> )
Sonoma	Yes (P)	29	30
Napa	Yes	No data	No data
Solano	Yes (P)	36	36
Marin	Yes	No data	No data
Contra Costa	Yes	35	34
San Francisco	Yes	31	29
Alameda	Yes	34	35
San Mateo	Yes	29	31
Santa Clara	Yes	39	39
P = partial			

In the San Francisco Bay Area, Solano and Santa Clara Counties show a violation of the 24-hour PM<sub>2.5</sub> standard. Therefore, these counties are candidates for inclusion in the San Francisco Bay nonattainment area. However, this factor alone is not sufficient to eliminate the other counties in the San Francisco Bay Area as candidates for nonattainment status. EPA considers each county's CES values as well as other factors and circumstances when determining which counties to include in the San Francisco Bay Area nonattainment area.

Eligible monitors for providing design value data generally include State and Local Air Monitoring Stations (SLAMS) at population-oriented locations with a FRM or FEM monitor. All data from Special Purpose Monitors (SPM) using an FRM, FEM, or Alternative Reference Method (ARM) which has operated for more than 24 months is eligible for comparison to the relevant NAAQS, subject to the requirements given in the October 17, 2006 Revision to Ambient Air Monitoring Regulations (71 FR 61236). All monitors used to provide data must meet the monitor siting and eligibility requirements given in 71 FR 61236 to 61328 in order to be acceptable for comparison to the 24-hr PM<sub>2.5</sub> NAAQS for designation purposes.

**Factor 3: Population density and degree of urbanization (including commercial development)**

Table 3. Population			
County	State Recommended Nonattainment?	2005 Population	2005 Population Density (pop/sq mi)
Santa Clara	Yes	1,705,158	1313
Alameda	Yes	1,451,065	1933
Contra Costa	Yes	1,017,644	1341
San Francisco	Yes	741,025	15,700
San Mateo	Yes	701,175	1535
Sonoma	Yes (P)	466,970	294
Solano	Yes (P)	410,786	463
Marin	Yes	247,103	456
Napa	Yes	132,516	167
P = partial. Data given is for entire County			

Figure 2 “San Francisco Bay Area Local Emission Sources and Population Density” shows that population density in all the Bay Area counties is relatively high.

# San Francisco Bay Area Population Density, Truck and Commuting Traffic

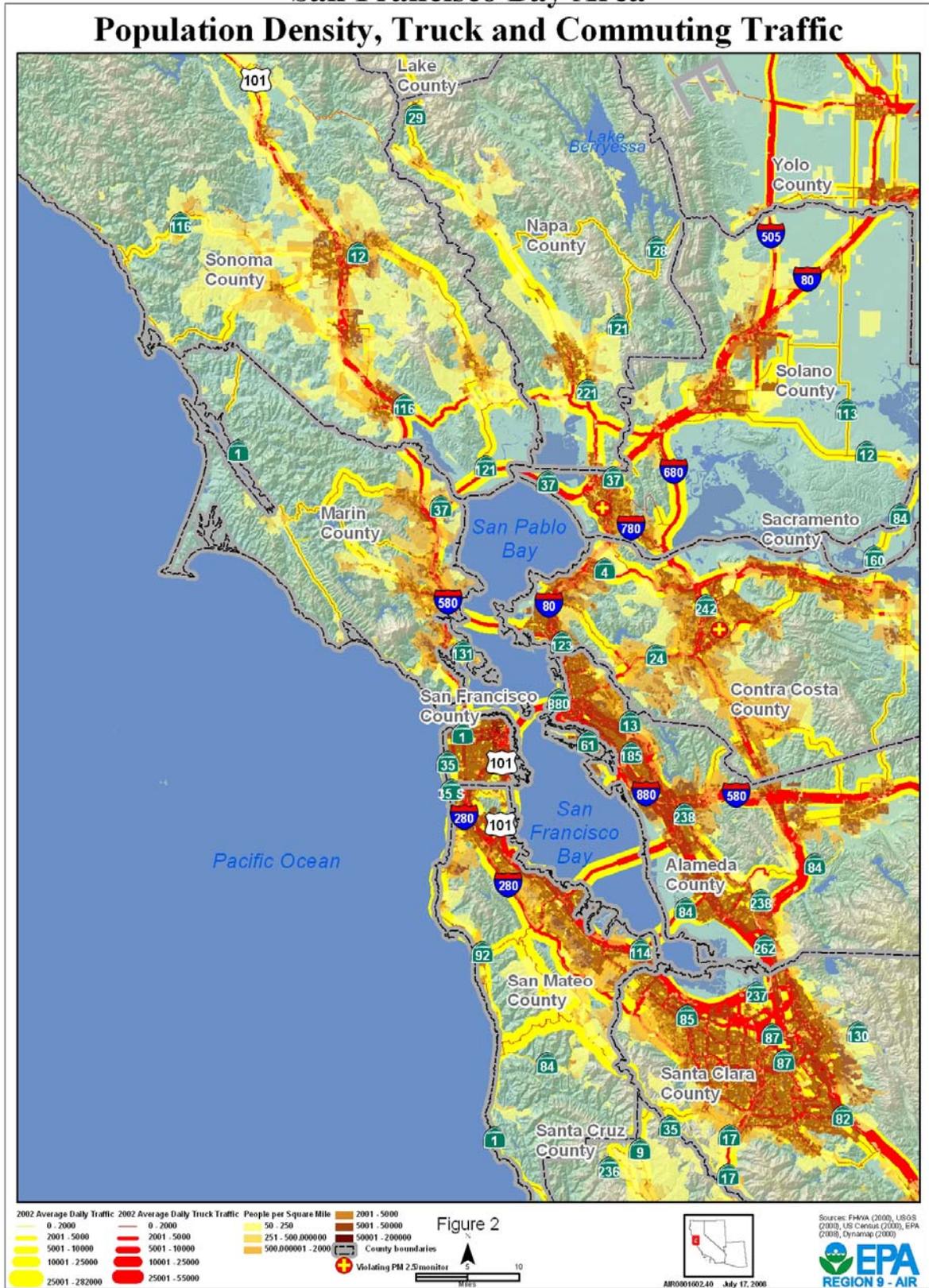


Figure 2

Table 3 shows the 2005 population for each county in the area being evaluated, as well as the population density for each county in that area. Population data gives an indication of whether it is likely that population-based emissions might contribute to violations of the 24-hour PM<sub>2.5</sub> standards. The population densities for the Bay Area counties are fairly high so, based on this factor, all the Bay Area counties should be included in the nonattainment area.

**Factor 4: Traffic and commuting patterns**

This factor considers the number of commuters in each county who drive to another county within the San Francisco Bay Area, the percent of total commuters in each county who commute to other counties within the San Francisco Bay Area, as well as the total Vehicle Miles Traveled (VMT) for each county in thousands of miles (see Table 4). A county with numerous commuters is generally an integral part of an urban area and is likely contributing to fine particle concentrations in the area.

County	State Recommended Nonattainment?	2005 VMT (1000s mi)	Number Commuting to any violating counties	Percent Commuting to any violating counties
Santa Clara	Yes	15,087	729,340	88 %
Alameda	Yes	9,732	74,150	11 %
San Mateo	Yes	6,820	56,070	16 %
Contra Costa	Yes	8,437	19,680	4%
San Francisco	Yes	3,657	16,630	4%
Sonoma	Yes (P)	4,761	2,770	1%
Marin	Yes	2,272	1,850	1%
Napa	Yes	1,212	4,380	8
Solano	Yes (P)	4,173	105,850	61%

Santa Clara, Solano, Alameda, and San Mateo Counties have the highest number of commuters into the violating areas in the San Francisco Bay Area which are Santa Clara and Solano. All of the Counties in the San Francisco Bay Area have substantial commuting so no Counties are being eliminated on the basis of this factor. It is clear that all the Bay Area counties have substantial commute traffic and should be included in the San Francisco Bay Area nonattainment area based on this factor.

The 2005 VMT data used for Table 4 and 5 of the 9-factor analysis has been derived using methodology similar to that described in “Documentation for the final 2002 Mobile National Emissions Inventory, Version 3, September 2007, prepared for the Emission Inventory Group, U.S. EPA. This document may be found at: [atftp://ftp.epa.gov/EmisInventory/2002finalnei/documentation/mobile/2002\\_mobile\\_nei\\_version\\_3\\_report\\_092807.pdf](http://ftp.epa.gov/EmisInventory/2002finalnei/documentation/mobile/2002_mobile_nei_version_3_report_092807.pdf). The 2005 VMT data were taken from documentation which is still draft, but which should be released in 2008.

### Factor 5: Growth rates and patterns

This factor considers population growth from 2000-2005 and growth in vehicle miles traveled (VMT) for 1996 -2005 for counties in the San Francisco Bay Area, as well as patterns of population and VMT growth. A county with rapid population or VMT growth is generally an integral part of an urban area and likely to be contributing to fine particle concentrations in the area.

Table 5 below shows population, population growth, VMT and VMT growth for counties that are included in the San Francisco Bay area.

County	Population (2005)	Population Density	2005 VMT (millions mi)	VMT % change (1996 to 2005)
Sonoma (P)	466,970	294	4,761	26%
Napa	132,516	167	1,212	46%
Solano (P)	410,786	463		19%
Marin	247,103	456	2,272	14%
Contra Costa	1,017,644	1341	8,437	32%
San Francisco	1,705,158	15,700	3,657	(38%)
Alameda	1,451,065	1933	9,732	(9%)
San Mateo	701,175	1535	6,820	27%
Santa Clara	1,705,644	1313	15,087	10%

P = partial. Data are for entire counties.

Napa, San Francisco and San Mateo Counties had a decrease in population from 2000 to 2005. While San Francisco had a corresponding decrease in VMT growth from 1996 – 2005, San Mateo County had a significant (27%) increase in VMT, as did Napa County (46%). The increase in VMT growth in suburban counties, coupled with the decrease in VMT for San Francisco and Alameda, indicate there has been a shift from the major population centers to the suburbs.

Based on these statistics, it would appear that, although there are shifting populations among the counties in the San Francisco Bay Area, both the population and VMT numbers are significant indicating that a large amount of the population is exposed to the high emissions levels represented by the violating monitors in Solano and Santa Clara monitors and therefore none of these candidates can be dropped from consideration of a PM<sub>2.5</sub> nonattainment designation.

### Factor 6: Meteorology (weather/transport patterns)

For this factor, EPA considered data from National Weather Service instruments in the area. Wind direction and wind speed data for 2004-2006 were analyzed, with an emphasis on “high PM<sub>2.5</sub> days” for each of two seasons (an October-April “cold” season and a May-September

“warm” season). These high days are defined as days where any FRM or FEM air quality monitors had 24-hour PM<sub>2.5</sub> concentrations above 95% on a frequency distribution curve of PM<sub>2.5</sub> 24-hour values, or were 24-hr values exceeded 35.1 µg/m<sup>3</sup>.

For each air quality monitoring site, EPA developed a “pollution rose” to understand the prevailing wind direction and wind speed on the days with highest fine particle concentrations. The figure identifies 24-hour PM<sub>2.5</sub> values by color; days exceeding 35 µg/m<sup>3</sup> are denoted with a red or black icon. A dot indicates the day occurred in the warm season; a triangle indicates the day occurred in the cool season. The center of the figure indicates the location of the air quality monitoring site, and the location of the icon in relation to the center indicates the direction from which the wind was blowing on that day. An icon that is close to the center indicates a low average wind speed on that day. Higher wind speeds are indicated when the icon is further away from the center.

The pollution rose for Santa Clara County, site 060850005, shown in Figure 3, indicates that elevated levels of particulate matter occur during the cool season during time periods when the winds are light, consistent with the analysis submitted by California, below. The additional pollution roses for the San Francisco Bay Area, included in Attachment 3, show similar results.

The State letter from the California Air Resources Board (CARB) to EPA discusses conditions lead to high PM<sub>2.5</sub>. The coastal zones tend to be more windy and cooler in the summer than the hotter drier interior regions with a reversal in the winter months. Precipitation is characterized with dry summers and wet winters. In winter, the Pacific High weakens and shifts southward, and winter storms become frequent. During winter periods when the Pacific High becomes dominant, inversions become strong, winds are light and pollution potential is high. These periods are characterized by winds that flow out of the Central Valley into the Bay Area and often include tule fog.

The meteorology data support the analysis submitted by California and support inclusion of all the Bay Area counties into the nonattainment area.

The meteorology factor is also considered in each county’s Contributing Emissions Score because the method for deriving this metric included an analysis of trajectories of air masses for high PM<sub>2.5</sub> days.

#### **Factor 7: Geography/topography (mountain ranges or other air basin boundaries)**

The geography/topography analysis looks at physical features of the land that might have an effect on the air shed and, therefore, on the distribution of PM<sub>2.5</sub> over the San Francisco Bay Area.

The San Francisco Air Basin encompasses approximately 5,430 square miles and consists of all of Alameda, Contra Costa, Marin, Napa, San Francisco, San Mateo and Santa Clara Counties, the southern half of Sonoma County, and the western portion of Solano County.

The region is characterized by complex terrain, consisting of coastal mountain ranges, rugged hillsides, and inland valleys and bays. Elevations can range from sea level to 1500 feet. However, the commuting patterns and the truck traffic among the San Francisco Bay area

counties, indicates that topography does not constitute an impediment to the transport of PM<sub>2.5</sub> emissions in the San Francisco Bay Area. Therefore on that basis, none of the counties in the San Francisco Bay Area can be dropped from consideration for a PM<sub>2.5</sub> nonattainment designation. The exception is the northern half of Sonoma County which is distinguished from the southern part of the county by its topography and rural nature.

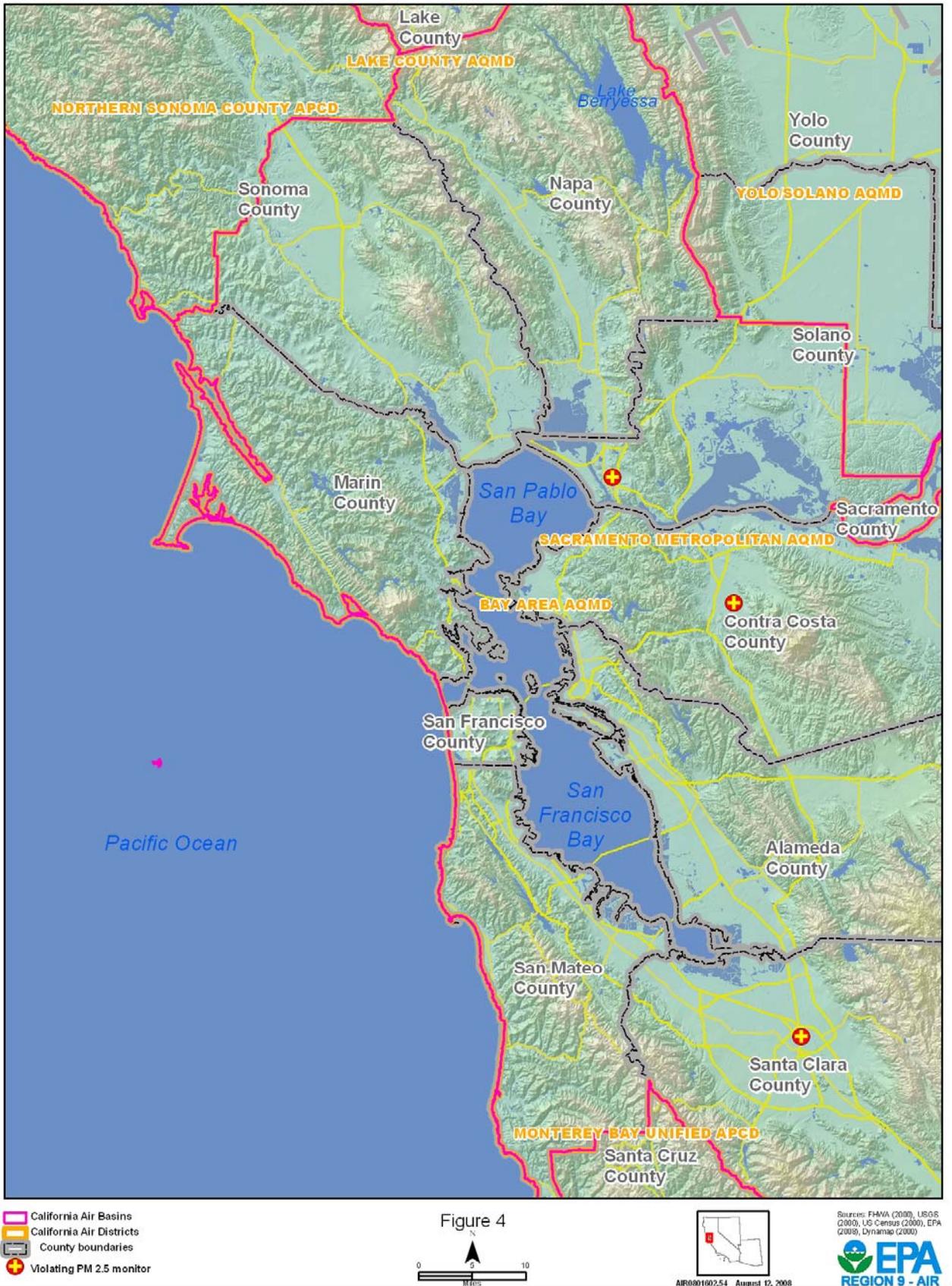
**Factor 8: Jurisdictional boundaries (e.g., existing PM and ozone areas)**

In evaluating the jurisdictional boundary factor, consideration should be given to existing boundaries and organizations that may facilitate air quality planning and the implementation of control measures to attain the standard. Areas designated as nonattainment (e.g for PM<sub>2.5</sub> or 8-hour ozone standard) represent important boundaries for state air quality planning.

The analysis of jurisdictional boundaries considered the planning and organizational structure of the San Francisco Bay Area to determine if the implementation of controls in a potential nonattainment area can be carried out in a cohesive manner.

See Figure 4: “San Francisco Bay Area – Air Districts, Air Basins, ozone Nonattainment Areas.”

# San Francisco Bay Area - Air Districts, Air Basins



The major jurisdictional boundary in the San Francisco Bay Area is the area encompassed by the Bay Area Air Quality Management District (BAAQMD) whose boundaries include the San Francisco metropolitan area. The boundaries of the proposed PM<sub>2.5</sub> nonattainment area would be consistent with the existing 8-hour ozone nonattainment area including parts of Sonoma and Solano Counties. All of the nine counties (including parts of Sonoma and Solano Counties) in the San Francisco Bay Area are within the existing 8-hour ozone nonattainment area. The BAAQMD is the air quality agency responsible for preparing the PM<sub>2.5</sub> State Implementation Plan. Additionally, the eastern part of Solano County is included in the Yolo-Solano District which EPA is also proposing be designated nonattainment for PM<sub>2.5</sub>.

**Factor 9: Level of control of emission sources**

This factor considers emission controls currently implemented for major sources in the San Francisco Bay Area.

The emission estimates on Table 1 (under Factor 1) include any control strategies implemented by the states in the San Francisco Bay area before 2005 that may influence emissions of any component of PM<sub>2.5</sub> emissions (i.e., total carbon, SO<sub>2</sub>, NO<sub>x</sub>, and crustal PM<sub>2.5</sub>).

## Attachment 2

### Description of the Contributing Emissions Score

The CES is a metric that takes into consideration emissions data, meteorological data, and air quality monitoring information to provide a relative ranking of counties in and near an area. Using this methodology, scores were developed for each county in and around the relevant metro area. The county with the highest contribution potential was assigned a score of 100, and other county scores were adjusted in relation to the highest county. The CES represents the relative maximum influence that emissions in that county have on a violating county. The CES, which reflects consideration of multiple factors, should be considered in evaluating the weight of evidence supporting designation decisions for each area.

The CES for each county was derived by incorporating the following significant information and variables that impact  $PM_{2.5}$  transport:

- Major  $PM_{2.5}$  components: total carbon (organic carbon (OC) and elemental carbon (EC)),  $SO_2$ ,  $NO_x$ , and inorganic particles (crustal).
- $PM_{2.5}$  emissions for the highest (generally top 5%)  $PM_{2.5}$  emission days (herein called “high days”) for each of two seasons, cold (Oct-Apr) and warm (May-Sept)
- Meteorology on high days using the NOAA HYSPLIT model for determining trajectories of air masses for specified days
- The “urban increment” of a violating monitor, which is the urban  $PM_{2.5}$  concentration that is in addition to a regional background  $PM_{2.5}$  concentration, determined for each  $PM_{2.5}$  component
- Distance from each potentially contributing county to a violating county or counties

A more detailed description of the CES can be found at [http://www.epa.gov/ttn/naaqs/pm/pm25\\_2006\\_techinfo.html#C](http://www.epa.gov/ttn/naaqs/pm/pm25_2006_techinfo.html#C).

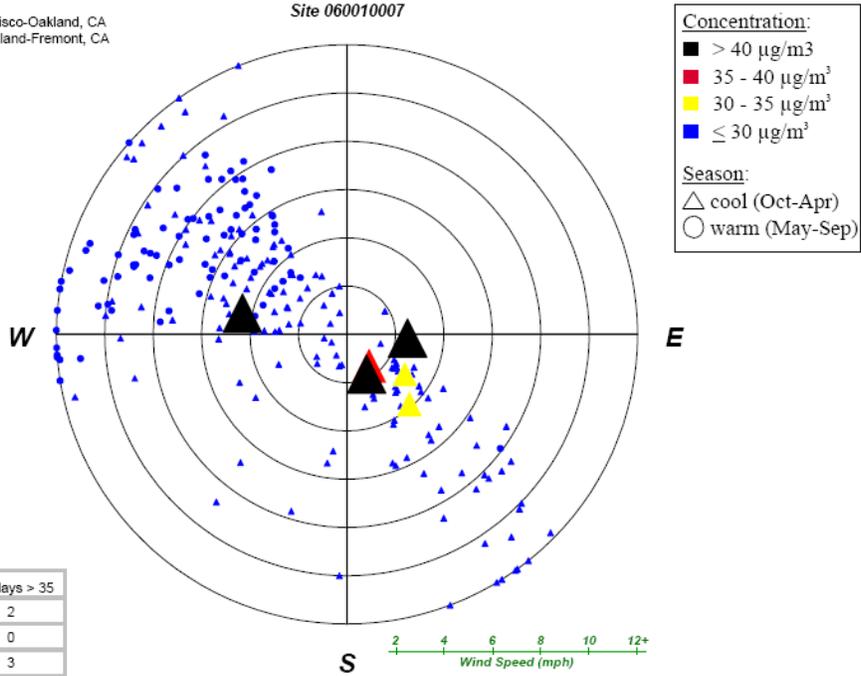
# ATTACHMENT 3

## POLLUTION ROSES FOR SAN FRANCISCO BAY AREA

Alameda County, CA  
Pollution Rose, 2004-2006

Not in an existing NAA  
CSA: San Jose-San Francisco-Oakland, CA  
CBSA: San Francisco-Oakland-Fremont, CA

Site 060010007



Year	98th %-ile	# days > 35
2004	35.3	2
2005	28.7	0
2006	36.6	3
Design Value	34-A	

1 exceedance(s) not plotted  
(due to missing or variable wind data)

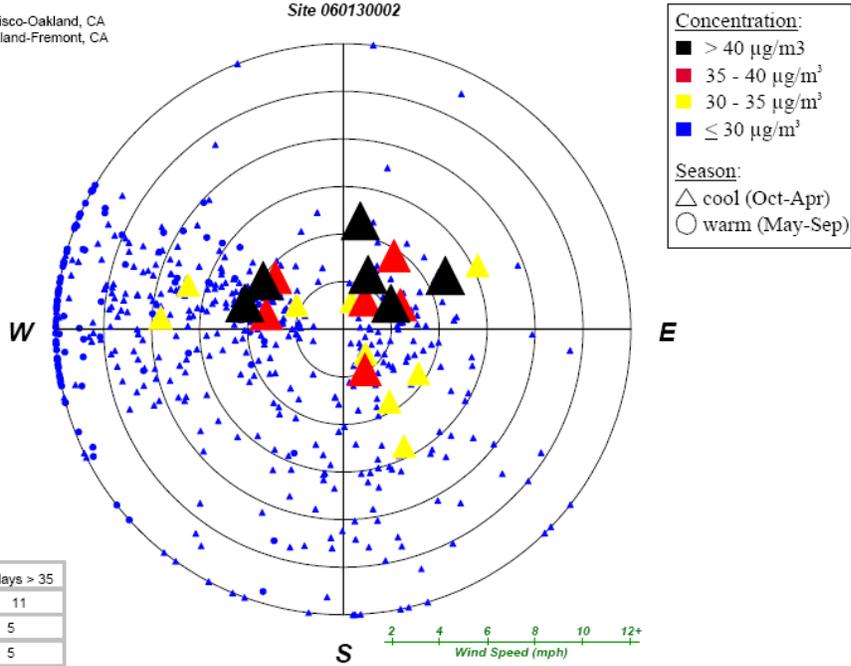
Meteorological data from 32.7 miles away  
STOCKTON\_METROPOLITAN\_ARPT (ID=23237)

located in/near San Francisco Bay Area, CA

Contra Costa County, CA  
Pollution Rose, 2004-2006

Not in an existing NAA  
CSA: San Jose-San Francisco-Oakland, CA  
CBSA: San Francisco-Oakland-Fremont, CA

Site 060130002



Year	98th %-ile	# days > 35
2004	38.1	11
2005	33.4	5
2006	33.6	5
Design Value	35-A	

9 exceedance(s) not plotted  
(due to missing or variable wind data)

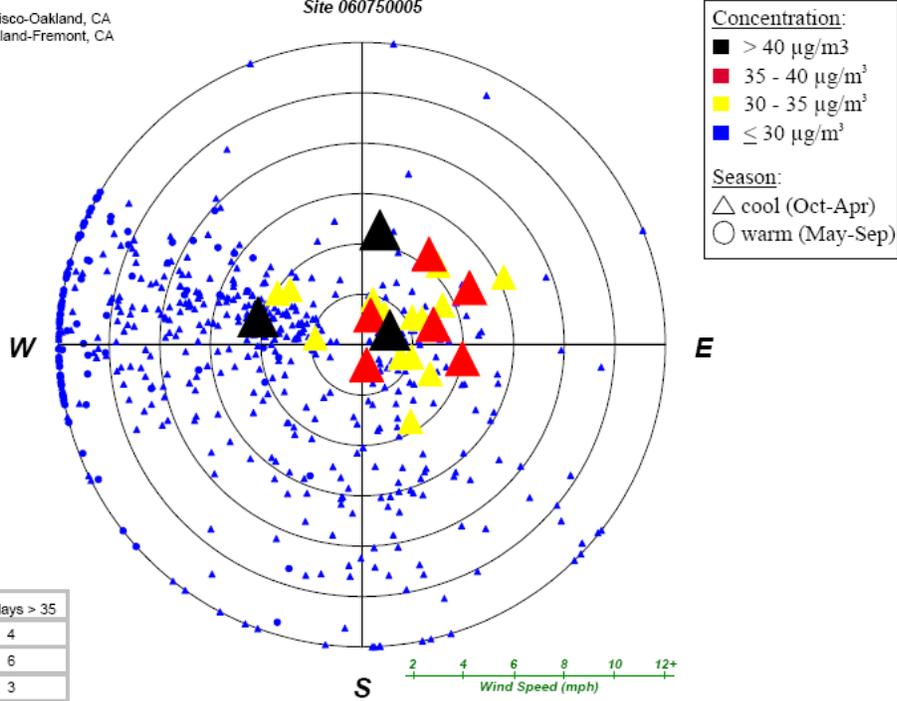
Meteorological data from 29.5 miles away  
SAN FRANCISCO\_INTL\_AP (ID=23234)

located in/near San Francisco Bay Area, CA

San Francisco County, CA  
Pollution Rose, 2004-2006

Not in an existing NAA  
CSA: San Jose-San Francisco-Oakland, CA  
CBSA: San Francisco-Oakland-Fremont, CA

Site 060750005



Year	98th %-ile	# days > 35
2004	32.2	4
2005	32.6	6
2006	27.8	3
Design Value	31-A	

4 exceedance(s) not plotted  
(due to missing or variable wind data)

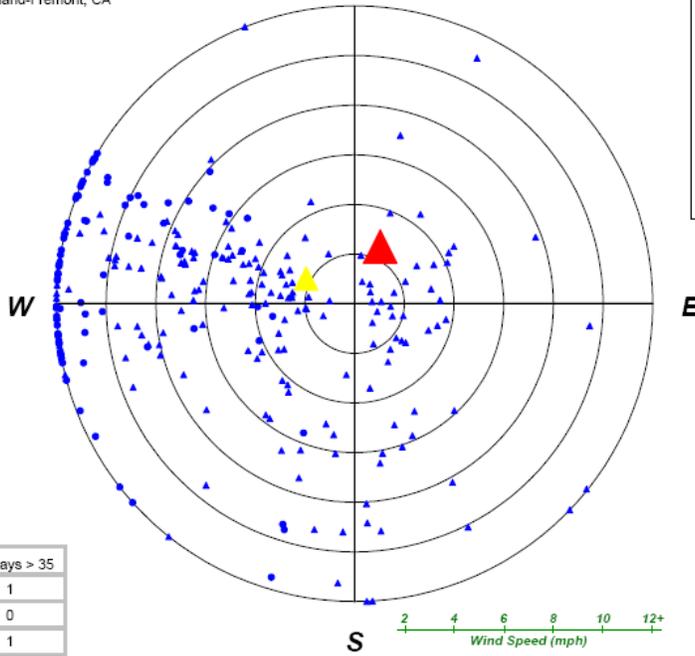
Meteorological data from 10.4 miles away  
SAN\_FRANCISCO\_INTL\_AP (ID=23234)

located in/ near San Francisco Bay Area, CA

San Mateo County, CA  
Pollution Rose, 2004-2006

Not in an existing NAA  
CSA: San Jose-San Francisco-Oakland, CA  
CBSA: San Francisco-Oakland-Fremont, CA

Site 060811001



**Concentration:**

- > 40  $\mu\text{g}/\text{m}^3$
- 35 - 40  $\mu\text{g}/\text{m}^3$
- 30 - 35  $\mu\text{g}/\text{m}^3$
- $\leq 30 \mu\text{g}/\text{m}^3$

**Season:**

- △ cool (Oct-Apr)
- warm (May-Sep)

Year	98th %-ile	# days > 35
2004	27.9	1
2005	29.4	0
2006	30.9	1
Design Value	29-A	

1 exceedance(s) not plotted  
(due to missing or variable wind data)

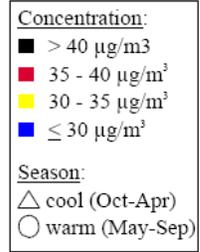
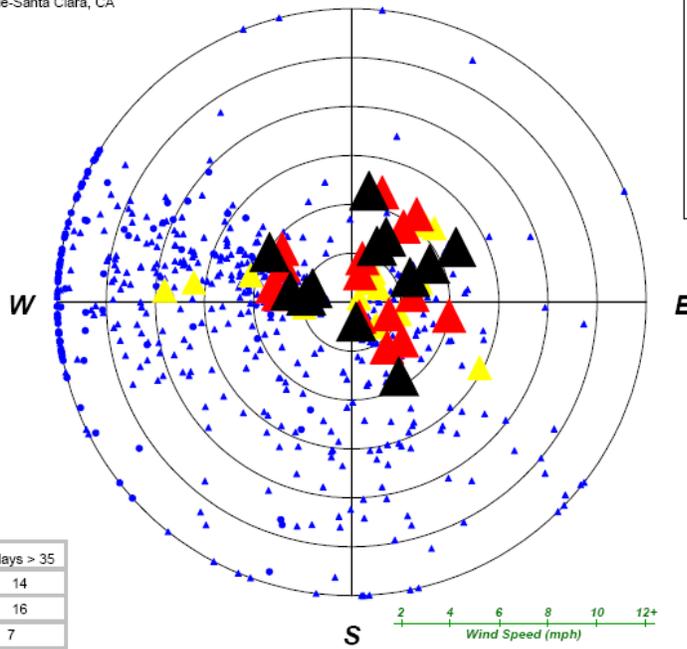
Meteorological data from 13.5 miles away  
SAN\_FRANCISCO\_INTL\_AP (ID=23234)

located in/near San Francisco Bay Area, CA

Santa Clara County, CA  
Pollution Rose, 2004-2006

Not in an existing NAA  
CSA: San Jose-San Francisco-Oakland, CA  
CBSA: San Jose-Sunnyvale-Santa Clara, CA

Site 060850005



Year	98th %-ile	# days > 35
2004	39.8	14
2005	39.8	16
2006	36.0	7
Design Value	39-NA	

10 exceedance(s) not plotted  
(due to missing or variable wind data)

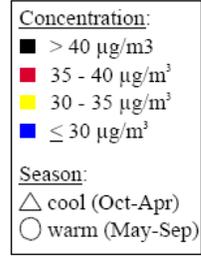
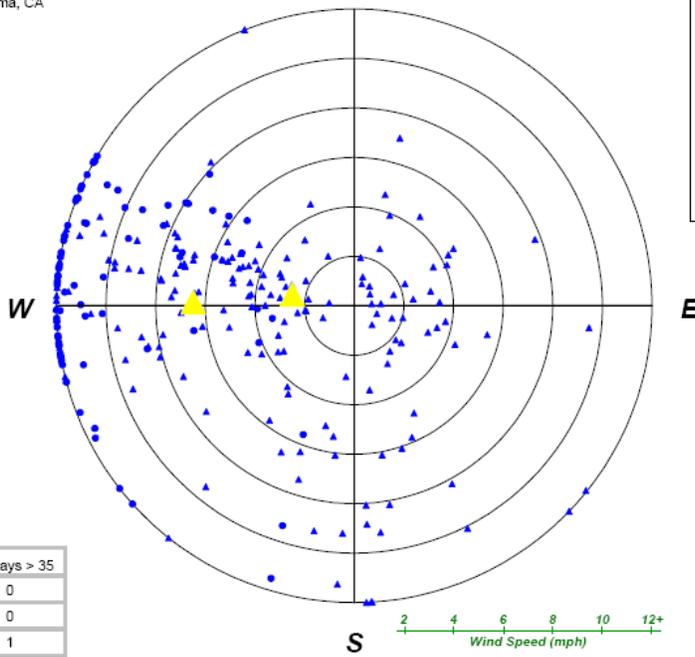
Meteorological data from 32.6 miles away  
SAN\_FRANCISCO\_INTL\_AP (ID=23234)

located in linear San Francisco Bay Area, CA

Sonoma County, CA  
Pollution Rose, 2004-2006

Not in an existing NAA  
CSA: San Jose-San Francisco-Oakland, CA  
CBSA: Santa Rosa-Petaluma, CA

Site 060970003



Year	98th %-ile	# days > 35
2004	25.2	0
2005	29.7	0
2006	31.2	1
Design Value	29-A	

1 exceedance(s) not plotted  
(due to missing or variable wind data)

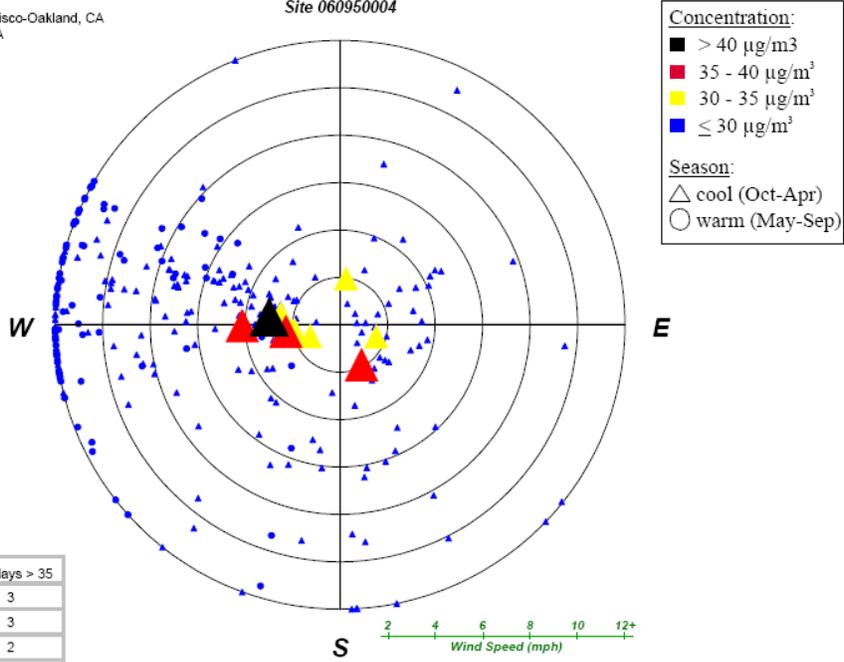
Meteorological data from 59.9 miles away  
SAN FRANCISCO\_INTL\_AP (ID=23234)

located in/near San Francisco Bay Area, CA

Solano County, CA  
Pollution Rose, 2004-2006

Not in an existing NAA  
CSA: San Jose-San Francisco-Oakland, CA  
CBSA: Vallejo-Fairfield, CA

Site 060950004



Year	98th %-ile	# days > 35
2004	36.9	3
2005	35.6	3
2006	34.3	2
Design Value	36-NA	

4 exceedance(s) not plotted  
(due to missing or variable wind data)

Meteorological data from 34.5 miles away  
SAN FRANCISCO\_INTL\_AP (ID=23234)

located in near San Joaquin Valley, CA

## Attachment 1

### CALIFORNIA Area Designations For the 24-Hour Fine Particle National Ambient Air Quality Standard

The table below identifies the counties in California that EPA intends to designate as not attaining the 2006 24-hour fine particle (PM<sub>2.5</sub>) standard.<sup>1</sup> A county will be designated as nonattainment if it has an air quality monitor that is violating the standard or if the county is determined to be contributing to the violation of the standard.

Area	California Recommended Nonattainment Counties	EPA's Intended Nonattainment Counties
Butte County	Butte County - Partial	Butte County
Imperial County	Imperial County - Partial	Imperial County
Sacramento County	Sacramento County	Sacramento County Yolo County Placer County – Partial El Dorado County – Partial Solano County - Partial
San Francisco Bay Area	Sonoma County – Partial Napa County Marin County San Francisco County Contra Costa County Alameda County Santa Clara County San Mateo County Solano County - Partial	Sonoma County – Partial Napa County Marin County San Francisco County Contra Costa County Alameda County Santa Clara County San Mateo County Solano County - Partial
San Joaquin Valley Air Basin	San Joaquin County Stanislaus County Merced County Madera County Fresno County Kings County Tulare County Kern County - Partial	San Joaquin County Stanislaus County Merced County Madera County Fresno County Kings County Tulare County Kern County - Partial
South Coast Air Basin	Los Angeles County – Partial San Bernardino County Partial Riverside County – Partial Orange County	Los Angeles County – Partial San Bernardino County Partial Riverside County – Partial Orange County
Yuba County Sutter County	Yuba County – Partial Sutter County - Partial	Yuba County Sutter County

EPA intends to designate the remaining counties in the state as attainment/unclassifiable.

<sup>1</sup> EPA designated nonattainment areas for the 1997 fine particle standards in 2005. In 2006, the 24-hour PM<sub>2.5</sub> standard was revised from 65 micrograms per cubic meter (average of 98<sup>th</sup> percentile values for 3 consecutive years) to 35 micrograms per cubic meter; the level of the annual standard for PM<sub>2.5</sub> remained unchanged at 15 micrograms per cubic meter (average of annual averages for 3 consecutive years).

## **EPA Technical Analysis for San Joaquin Valley Air Basin**

Pursuant to section 107(d) of the Clean Air Act, EPA must designate as nonattainment those areas that violate the NAAQS and those areas that contribute to violations. This technical analysis for the San Joaquin Valley Air Basin identifies the counties with monitors that violate the 24-hour PM<sub>2.5</sub> standard and evaluates the counties that potentially contribute to fine particle concentrations in the area. EPA has evaluated these counties based on the weight of evidence of the following nine factors recommended in EPA guidance and any other relevant information:

- pollutant emissions
- air quality data
- population density and degree of urbanization
- traffic and commuting patterns
- growth
- meteorology
- geography and topography
- jurisdictional boundaries
- level of control of emissions sources

Figure 1 is a map of the counties in the area and other relevant information such as the locations and design values of air quality monitors, the metropolitan area boundary, and counties recommended as nonattainment by the State.

# San Joaquin Valley, CA

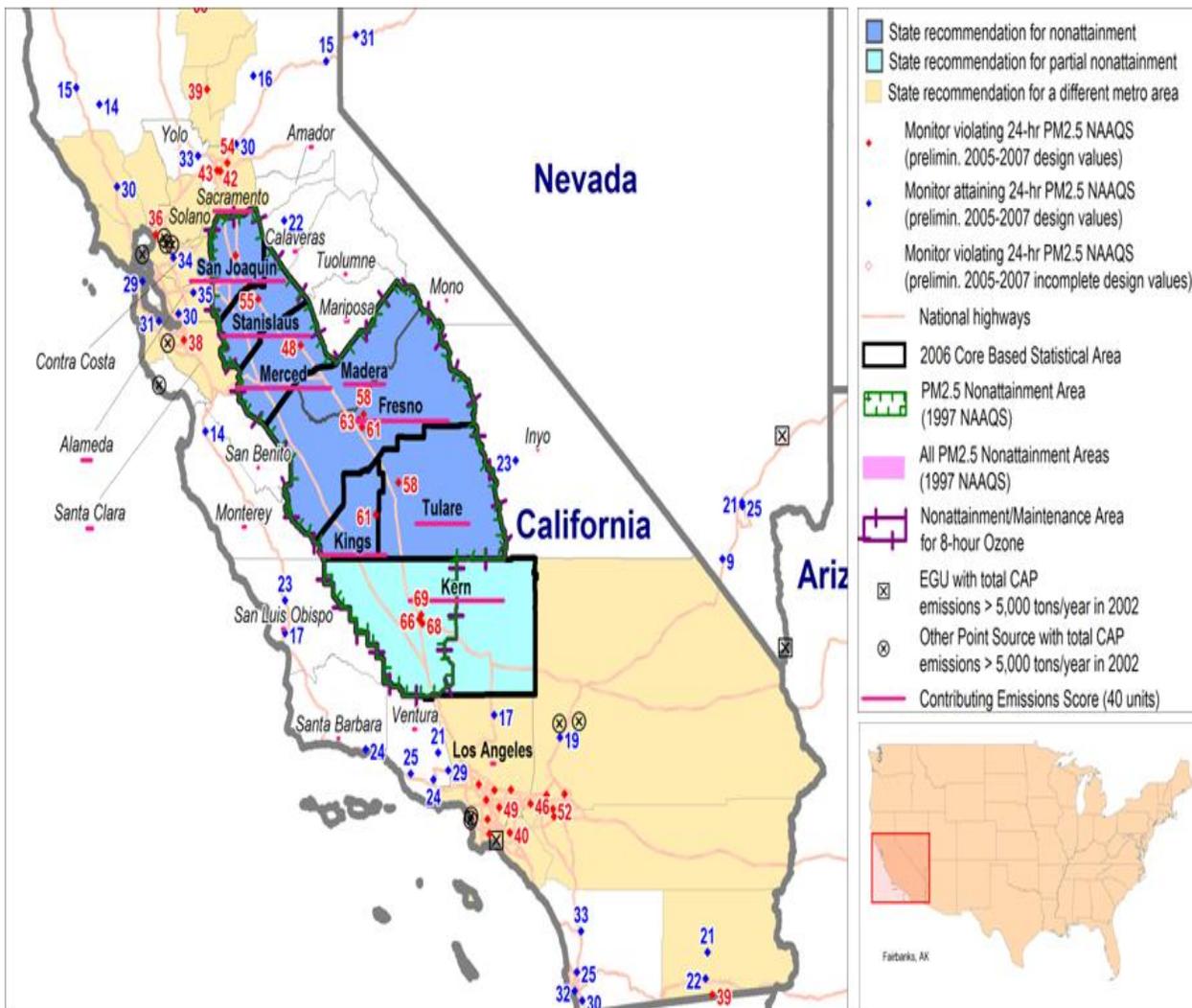


Figure 1

Counties labeled in bold reflect NAAs under 1997 NAAQS

For this area, EPA previously established PM<sub>2.5</sub> nonattainment boundaries for the 1997 PM<sub>2.5</sub> NAAQS that included 7 full counties and 1 partial county. The full counties are San Joaquin, Stanislaus, Merced, Madera, Fresno, Kings, and Tulare. Kern is the only partial county. The San Joaquin Valley (SJV) is hemmed in by mountain ranges and is very flat. The mountains surrounding the SJV form a bowl trapping air pollutants in the SJV. All of the counties, with the exception of Kern, are fully included in the existing San Joaquin PM<sub>2.5</sub> nonattainment area. Western Kern County is associated with developed areas (e.g., Bakersfield, CA) and is located within the flat valley area so it is included in the existing PM<sub>2.5</sub> nonattainment area.

Eastern Kern County is separated from western Kern County by the Sierra Nevada and Tehachapi Mountain Ranges at elevations up to 7,500 feet. Eastern Kern County is a vast arid desert while the western portion of Kern County is part of the urbanized, agricultural, and industrial SJV. East Kern is located above the inversion layer which traps air pollutants in the SJV and thus, experiences different weather from the SJV. Consequently, eastern Kern County is not included as part of the SJV nonattainment area.

In a letter to EPA dated December 17, 2007, the California Air Resources Board (CARB) recommended that the same counties be designated as “nonattainment” for the 2006 24-hour PM<sub>2.5</sub> standard based on air quality data from 2004-2006. These data are from Federal Reference Method (FRM) and Federal Equivalent Method (FEM) monitors located in the state.

Air quality monitoring data on the composition of fine particle mass are available from the EPA Chemical Speciation Network and the IMPROVE monitoring network. Analysis of these data indicates that the days with the highest fine particle concentrations occur predominantly in the winter, and the average chemical composition of the highest days is typically characterized by high levels of nitrate (61%) followed by organic carbon (29%).

Based on EPA's 9-factor analysis described below, EPA believes that 8 counties in California, the same counties as previously designated for PM<sub>2.5</sub>, should be designated nonattainment for the 24-hour PM<sub>2.5</sub> air-quality standard as part of the San Joaquin Valley Air Basin nonattainment area, based upon currently available information. These counties are listed in the table below.

Area	State-Recommended Nonattainment Counties	EPA-Recommended Nonattainment Counties
San Joaquin Valley Air Basin	San Joaquin, Stanislaus, Merced, Madera, Fresno, Kings, Tulare, Kern (P) counties	San Joaquin, Stanislaus, Merced, Madera, Fresno, Kings, Tulare, Kern (P) counties

P = partial

The following is a summary of the 9-factor analysis for the San Joaquin Valley Air Basin.

**Factor 1: Emissions data**

For this factor, EPA evaluated county level emission data for the following PM<sub>2.5</sub> components and precursor pollutants: “PM<sub>2.5</sub> emissions total,” “PM<sub>2.5</sub> emissions carbon,” “PM<sub>2.5</sub> emissions other,” “SO<sub>2</sub>,” “NO<sub>x</sub>,” “VOCs,” and “NH<sub>3</sub>.” “PM<sub>2.5</sub> emissions total” represents direct emissions of PM<sub>2.5</sub> and includes: “PM<sub>2.5</sub> emissions carbon,” “PM<sub>2.5</sub> emissions other”, primary sulfate (SO<sub>4</sub>), and primary nitrate. (Although primary sulfate and primary nitrate, which are emitted directly from stacks rather than forming in atmospheric reactions with SO<sub>2</sub> and NO<sub>x</sub>, are part of “PM<sub>2.5</sub> emissions total,” they are not shown in Table 1 as separate items). “PM<sub>2.5</sub> emissions carbon” represents the sum of organic carbon (OC) and elemental carbon (EC) emissions, and “PM<sub>2.5</sub> emissions other” represents other inorganic particles (crustal). Emissions of SO<sub>2</sub> and NO<sub>x</sub>, which are precursors of the secondary PM<sub>2.5</sub> components sulfate and nitrate, are also considered. VOCs (volatile organic compounds) and NH<sub>3</sub> (ammonia) are also potential PM<sub>2.5</sub> precursors and are included for consideration.

Emissions data were derived from the 2005 National Emissions Inventory (NEI), version 1. See [http://www.epa.gov/ttn/naaqs/pm/pm25\\_2006\\_techinfo.html](http://www.epa.gov/ttn/naaqs/pm/pm25_2006_techinfo.html).

EPA also considered the Contributing Emissions Score (CES) for each county. The CES is a metric that takes into consideration emissions data, meteorological data, and air quality monitoring information to provide a relative ranking of counties in and near an area. Note that this metric is not the exclusive way for consideration of data for these factors. A summary of the CES is included in attachment 2, and a more detailed description can be found at [http://www.epa.gov/ttn/naaqs/pm/pm25\\_2006\\_techinfo.html#C](http://www.epa.gov/ttn/naaqs/pm/pm25_2006_techinfo.html#C).

Table 1 shows emissions of PM<sub>2.5</sub> and precursor pollutants components (given in tons per year) and the CES for violating and potentially contributing counties in the San Joaquin Valley Air Basin. Counties that are part of the San Joaquin Valley Air Basin nonattainment area for the 1997 PM<sub>2.5</sub> NAAQS are shown in boldface. Counties are listed in descending order by CES.

Table 1. PM <sub>2.5</sub> Related Emissions (tons per year) and Contributing Emissions Score									
County	State Recommended Non-attainment?	CES	PM <sub>2.5</sub> emissions total	PM <sub>2.5</sub> emissions carbon	PM <sub>2.5</sub> emissions other	SO <sub>2</sub>	NO <sub>x</sub>	VOCs	NH <sub>3</sub>
<b>Fresno</b>	Yes	100	8,491	4,523]	3,968	5,698	36,411	39,369	18,182
<b>Kern</b>	Yes (P)	100	6,437	3,184	3,251	3,428	61,191	39,039	9,881
<b>Merced</b>	Yes	100	1,926	823	1,104	998	13,427	11,285	10,251
<b>San Joaquin</b>	Yes	100	3,308	1,577	1,730	3,087	29,663	19,051	20,262
<b>Stanislaus</b>	Yes	92	2,260	1,069	1,191	2,125	19,006	17,251	15,580
<b>Kings</b>	Yes	70	1,268	457	811	600	6,772	6,678	7,102
<b>Tulare</b>	Yes	56	3,682	1,833	1,849	1,476	17,881	19,465	18,871
<b>Madera</b>	Yes	43	2,074	1,071	1,003	768	10,772	8,672	4,469

Data provided in Table 1 applies to entire Counties. In the case of Kern County, although the State recommended only part of the County, the data is given for the entire County. P = partial

Fresno, Kern, Merced and San Joaquin Counties had violating monitors which makes them candidates for a PM<sub>2.5</sub> nonattainment designation. Stanislaus, Kings, Tulare and Madera Counties have relatively high CES values, even though the data for their PM<sub>2.5</sub> emission components are lower than the other counties.

Based on emissions levels and CES values, all the Counties in the San Joaquin Valley Air Basin are candidates for a 24-hour PM<sub>2.5</sub> nonattainment designation and, therefore, require further analysis.

**Factor 2: Air quality data**

This factor considers the 24-hour PM<sub>2.5</sub> design values in micrograms per cubic meter (µg/m<sup>3</sup>) for air quality monitors in counties in the San Joaquin Valley Air Basin based on data for the 2005-2007 period. A monitor’s design value indicates whether that monitor attains a specified air quality standard. The 24-hour PM<sub>2.5</sub> standards are met when the 3-year average of a monitor’s 98<sup>th</sup> percentile values are 35 µg/m<sup>3</sup> or less. A design value is only valid if minimum data completeness criteria are met.

The 24-hour PM<sub>2.5</sub> design values for counties in the San Joaquin Valley are shown in Table 2.

Table 2. Air Quality Data			
County	State Recommended Nonattainment?	24-hr PM 2.5 Design Value 2004-06 (µg/m <sup>3</sup> )	24-hr PM 2.5 Design Values 2005-07 (µg/m <sup>3</sup> )
Fresno County	Yes	59	63
Kern County	Yes (P)	64	69
Merced County	Yes	45	48
San Joaquin County	Yes	41	45
Stanislaus County	Yes	51	55
Kings County	Yes	58	61
Tulare County	Yes	56	58
Madera County	Yes	No data available	No data available
Data provided in Table 1 applies to entire Counties. In the case of Kern County, although the State recommended only part of the County, the data is given for the entire County.			

P = partial

Fresno, Kern, Merced, San Joaquin, Stanislaus, Kings and Tulare Counties in California show a violation of the 24-hour PM<sub>2.5</sub> standard. Therefore, these counties, which represent most of the counties in the San Joaquin Air Basin, are candidates for inclusion in the San Joaquin Valley Air Basin nonattainment area. There is no data for Madera County. These high design values argue for keeping all the counties in the San Joaquin Valley Air Basin within the nonattainment area.

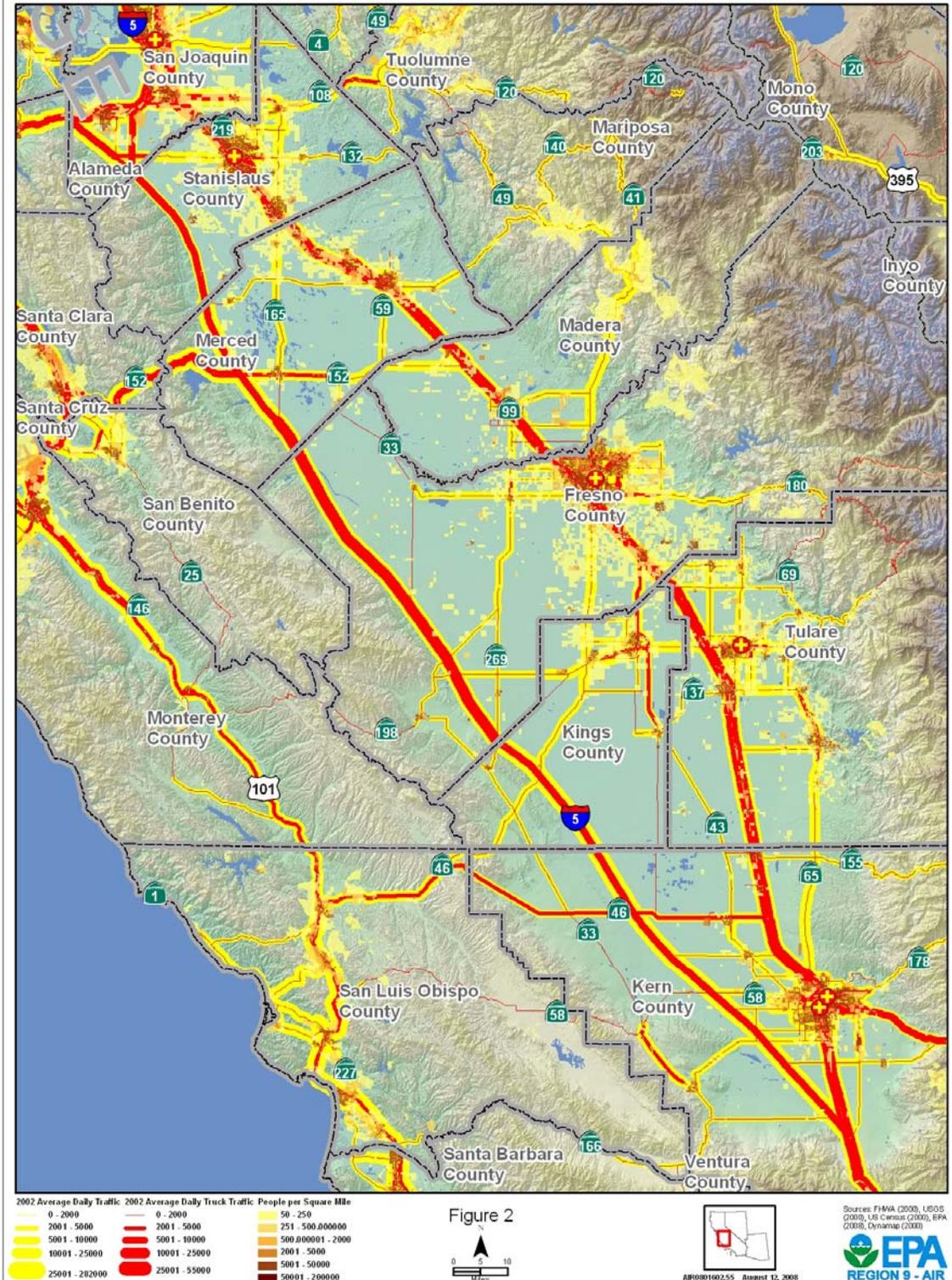
Eligible monitors for providing design value data generally include State and Local Air Monitoring Stations (SLAMS) at population-oriented locations with a FRM or FEM monitor. All data from Special Purpose Monitors (SPM) using an FRM, FEM, or Alternative Reference Method (ARM) which has operated for more than 24 months is eligible for comparison to the

relevant NAAQS, subject to the requirements given in the October 17, 2006 Revision to Ambient Air Monitoring Regulations (71 FR 61236). All monitors used to provide data must meet the monitor siting and eligibility requirements given in 71 FR 61236 to 61328 in order to be acceptable for comparison to the 24-hour PM<sub>2.5</sub> NAAQS for designation purposes.

**Factor 3: Population density and degree of urbanization (including commercial development)**

Table 3 and Figure 2 shows the 2005 population for each county in the area being evaluated, as well as the population density for each county in that area. Population data gives an indication of whether it is likely that population-based emissions might contribute to violations of the 24-hour PM<sub>2.5</sub> standards.

# San Joaquin Valley Population Density, Truck and Commuting Traffic



County	State Recommended Nonattainment?	2005 Population	2005 Population Density (pop/sq mi)
Fresno	Yes	878,089	146
Kern	Yes (P)	756,981	93
Merced	Yes	242,249	123
San Joaquin	Yes	664,796	466
Stanislaus	Yes	505,492	334
Kings	Yes	143,467	103
Tulare	Yes	411,131	85
Madera	Yes	142,530	66

P = partial

As shown in this table and the map in Figure 2, Fresno County has the largest population in the Basin, although it does not have the highest population density. San Joaquin has a high population density, along with dense population. Kern and Tulare Counties, while having a high population, have relatively small population densities. Since population density per square mile may relate to the size of the County, the population numbers shown does not rule out any of the counties as a candidate for a PM<sub>2.5</sub> nonattainment status. Population growth has caused the San Joaquin Valley to rank with Los Angeles and Houston in most measures of air pollution.

Based on the combination of population and population density numbers above, all of the Counties in the San Joaquin Valley Air Basin should be included as candidates for the PM<sub>2.5</sub> nonattainment designation.

#### **Factor 4: Traffic and commuting patterns**

This factor considers the number of commuters in each county who drive to another county within the San Joaquin Valley Air Basin, the percent of total commuters in each county who commute to other counties within the San Joaquin Valley Air Basin, as well as the total Vehicle Miles Traveled (VMT) for each county in thousands of miles (see Table 4). A county with numerous commuters is generally an integral part of an urban area and is likely contributing to fine particle concentrations in the area.

County	State Recommended Non-attainment?	2005 VMT (1000s mi)	Number Commuting to any violating counties	Percent Commuting to any violating counties
Fresno	Yes	8,038	284,230	96%
Kern	Yes (P)	8,929	225,500	98%
Merced	Yes	3,064	69,950	95%
San Joaquin	Yes	6,334	184,720	95%
Stanislaus	Yes	4,519	158,710	98%
Kings	Yes	2,069	40,800	98%
Tulare	Yes	4,221	129,360	99%
Madera	Yes	1,571	11,590	97%
P = partial				

The listing of Counties on Table 4 reflects a ranking based on the number of people commuting to other Counties. The data in Table 4 indicate that there is significant daily commuting among the Counties in the San Joaquin Valley Air Basin. In addition, there is significant daily truck traffic throughout the Basin.

Interstate 5 (I-5) and State Route 99 (SR 99) each run along the entire length of the San Joaquin Valley. I-5 runs in the western valley, bypassing major population centers (including Fresno, currently the largest U.S. city without an Interstate highway), while SR 99 runs through them.

SR 58 is a freeway in Bakersfield. Along most of its route until its terminus in Barstow, SR 58 is an extremely important and very heavily traveled route for truckers from the valley and the Bay Area to cross the Sierra Nevada and leave California (by way of I-15 or I-40) without having to climb Donner Pass or contend with the traffic congestion in Los Angeles.

Other important highways in the valley include SR 46 and SR 41, which respectively link the California Central Coast with Bakersfield and Fresno; SR 33, which runs south to north along the valley's western rim and provides a connection to Ventura and Santa Barbara over the Santa Ynez Mountains; and SR 152, an important commuter route linking Silicon Valley with its fast-growing exurbs such as Los Banos.

Given the significant amount of commuting within the San Joaquin Valley Air Basin, and the heavily traveled truck routes, all of the counties within the San Joaquin Valley Air Basin are candidates for a PM<sub>2.5</sub> nonattainment status.

The 2005 VMT data used for Tables 4 and 5 of the 9-factor analysis has been derived using methodology similar to that described in “Documentation for the final 2002 Mobile National Emissions Inventory, Version 3, September 2007, prepared for the Emission Inventory Group, U.S. EPA. This document may be found at:

atftp://ftp.epa.gov/EmisInventory/2002finalnei/documentation/mobile/2002\_mobile\_nei\_version\_3\_report\_092807.pdf. The 2005 VMT data were taken from documentation which is still draft, but which should be released in 2008.

**Factor 5: Growth rates and patterns**

This factor considers population growth for 2000-2005 and growth in vehicle miles traveled for 1996-2005 for counties in the San Joaquin Valley Air Basin, as well as patterns of population and VMT growth. A county with rapid population or VMT growth is generally an integral part of an urban area and likely to be contributing to fine particle concentrations in the area.

Table 5 below shows population, population growth, VMT and VMT growth for counties that are included in the San Joaquin Valley Air Basin.

County	Population (2005)	Population Density 2005	Population % change (2000 - 2005)	2005 VMT (millions mi)	VMT % change 1996 to 2005
Fresno	878,089	146	9%	8,038	21%
Kern	756,981	93	14%	8,929	59%
Merced	242,249	123	14%	3,064	63%
San Joaquin	664,796	466	17%	6,334	35%
Stanislaus	505,492	334	12%	4,519	35%
Kings	143,467	103	10%	2,069	47%
Tulare	411,131	85	11%	4,211	38%
Madera	142,530	66	15%	1,571	42%

All of the counties had population increases during the years 2000 – 2005. In all cases, the percentage increase of VMT during the same period is significantly higher.

Given the growth in population and the significant increase in VMT, all of the counties are candidates for a PM<sub>2.5</sub> nonattainment designation based on this factor.

**Factor 6: Meteorology (weather/transport patterns)**

The San Joaquin Valley has hot, dry summers and cool winters characterized by dense tule fog. The rainy season occurs from November through April. The San Joaquin Valley is hemmed in by mountains and rarely has strong winds to disperse smog or other pollutants.

For this factor, EPA considered data from National Weather Service instruments in the area. Wind direction and wind speed data for 2004-2006 were analyzed, with an emphasis on “high PM<sub>2.5</sub> days” for each of two seasons (an October-April “cold” season and a May-September “warm” season). These high days are defined as days where any FRM or FEM air quality

monitors had 24-hour  $PM_{2.5}$  concentrations above 95% on a frequency distribution curve of  $PM_{2.5}$  24-hour values, or where 24-hour values exceeded  $35.1 \mu\text{g}/\text{m}^3$ .

For each air quality monitoring site, EPA developed a “pollution rose” to understand the prevailing wind direction and wind speed on the days with highest fine particle concentrations. The figures identify 24-hour  $PM_{2.5}$  values by color; days exceeding  $35 \mu\text{g}/\text{m}^3$  are denoted with a red or black icon. A dot indicates the day occurred in the warm season; a triangle indicates the day occurred in the cool season. The center of the figure indicates the location of the air quality monitoring site, and the location of the icon in relation to the center indicates the direction from which the wind was blowing on that day. An icon that is close to the center indicates a low average wind speed on that day. Higher wind speeds are indicated when the icon is further away from the center.

The pollution roses for Fresno County site 060190008 and Kern County, site 060290014, shown in Figures 3 and 4 indicate that elevated levels of particulate matter occur predominately during the cool season during time periods when the winds are light, and from the northwest or southeast. The additional pollutant roses for the San Joaquin Valley Air Basin, included in Attachment 3, show similar results. The meteorology for San Joaquin Valley supports the inclusion of all the counties in the  $PM_{2.5}$  nonattainment area.

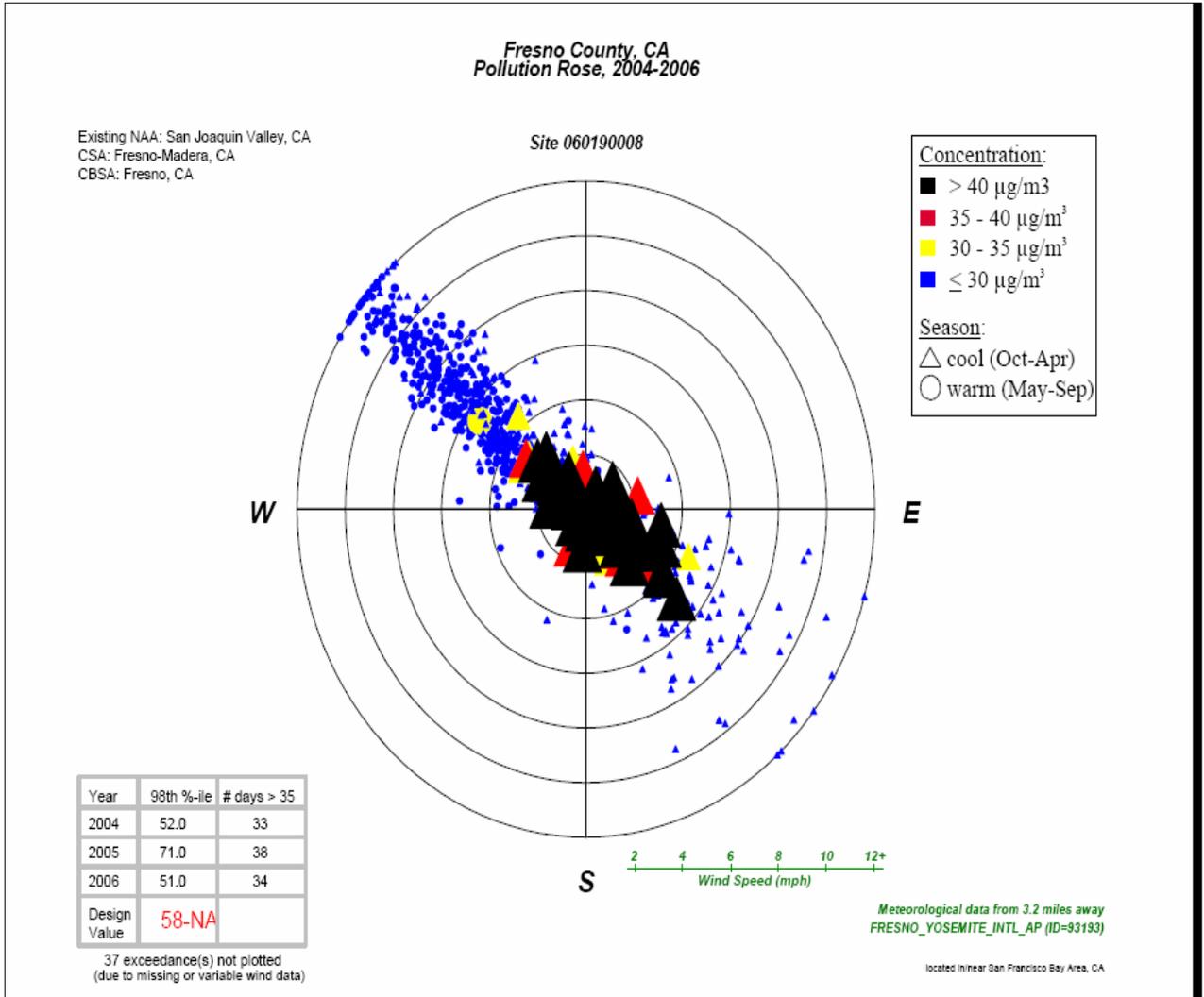
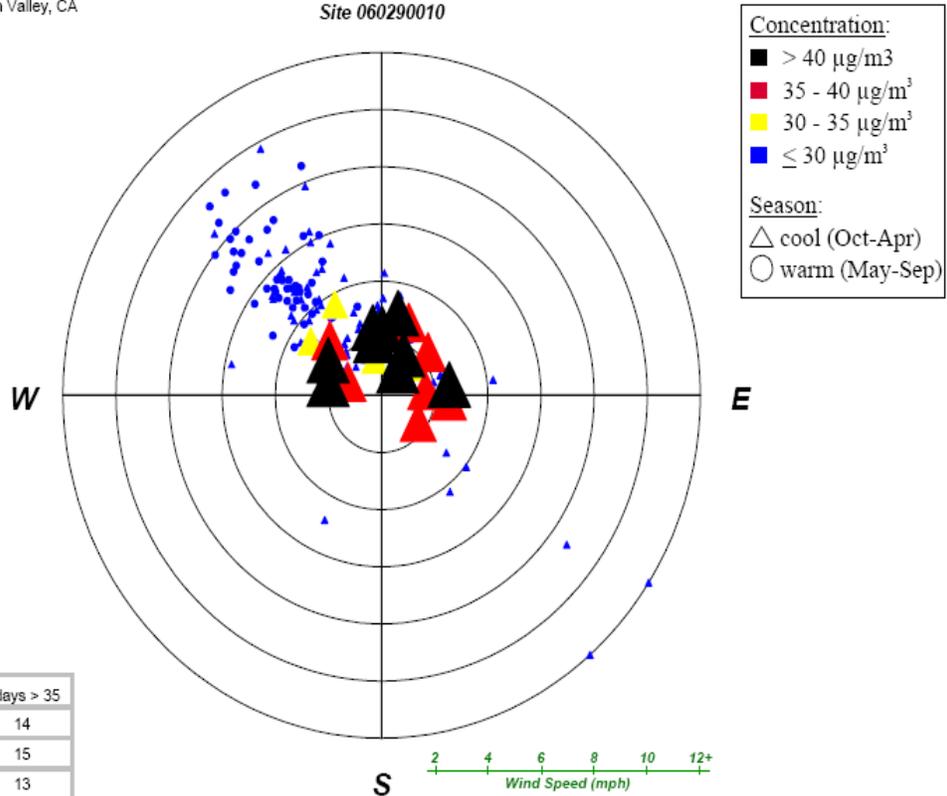


Figure 3

Kern County, CA  
Pollution Rose, 2004-2006

Existing NAA: San Joaquin Valley, CA  
CSA: none  
CBSA: Bakersfield, CA

Site 060290010



Year	98th %-ile	# days > 35
2004	53.9	14
2005	74.9	15
2006	64.4	13
Design Value	64-NA	

26 exceedance(s) not plotted  
(due to missing or variable wind data)

Meteorological data from 2.9 miles away  
BAKERSFIELD\_MEADOWS\_FIELD (ID=23155)

located in near San Joaquin Valley, CA

Figure 4

The meteorology factor is also considered in each county’s Contributing Emissions Score because the method for deriving this metric included an analysis of trajectories of air masses for high PM<sub>2.5</sub> days.

**Factor 7: Geography/topography (mountain ranges or other air basin boundaries)**

The San Joaquin Valley extends from the Sacramento-San Joaquin Delta in the north to the Tehachapi Mountains in the south, and from the various California coastal ranges (from the Diablo in the north to the Santa Ynez in the south) in the west to the Sierra Nevada in the east (see Figure 2).

The San Joaquin Valley is hemmed in by mountains and rarely has strong winds to disperse smog and other pollutants. The San Joaquin Valley has long suffered from some of the United States' worst air pollution. This pollution, exacerbated by stagnant weather, comes

mainly from diesel-and gasoline-fueled vehicles and agricultural operations such as dairies and field-tilling.

Consideration of this factor supports the proposed nonattainment boundary for the San Joaquin Valley.

**Factor 8: Jurisdictional boundaries (e.g., existing PM and ozone areas)**

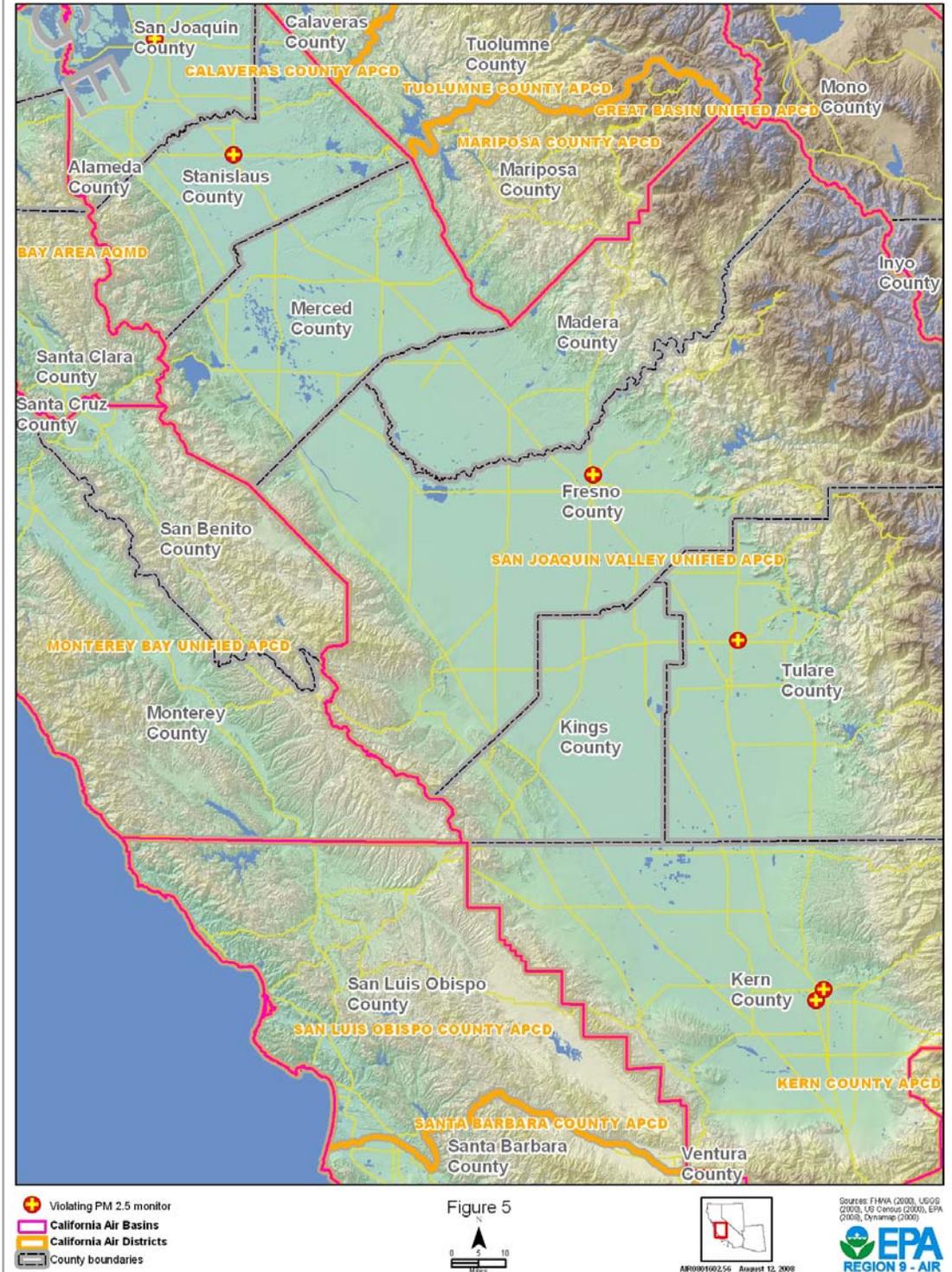
In evaluating the jurisdictional boundary factor, consideration should be given to existing boundaries and organizations that may facilitate air quality planning and the implementation of control measures to attain the standard. Areas designated as nonattainment (e.g., for PM<sub>2.5</sub> or 8-hour ozone standard) represent important boundaries for state air quality planning. See Figure 3.

The analysis of jurisdictional boundaries considered the planning and organizational structure of the San Joaquin Valley to determine if the implementation of controls in a potential nonattainment area can be carried out in a cohesive manner.

The major jurisdictional boundary in the San Joaquin Valley is the San Joaquin Air Pollution Control District which has jurisdiction over all of Fresno, Kings, Madera, Merced, San Joaquin, Stanislaus, Tulare, and the western portion of Kern counties. Counties with air-quality monitors that violate the 1997 PM<sub>2.5</sub> NAAQS include Fresno, Kings, Madera, Merced, San Joaquin, Stanislaus, and Tulare.

Areas designated as 8-hour ozone nonattainment areas are also important boundaries for State air-quality planning. Fresno, Kings, Madera, Merced, San Joaquin, Stanislaus, Tulare, and the western portion of Kern Counties were included in the 8-hour ozone nonattainment area associated with the San Joaquin Valley Air Basin. These are the same counties that are being considered for a PM<sub>2.5</sub> nonattainment designation. A goal in designating PM<sub>2.5</sub> nonattainment areas is to achieve a degree of consistency with ozone nonattainment areas. Comparison of ozone areas with potential PM<sub>2.5</sub> nonattainment areas, therefore, gives added weight to the designation of Fresno, Kings, Madera, Merced, San Joaquin, Stanislaus, Tulare Counties and western Kern County as nonattainment for PM<sub>2.5</sub>.

# San Joaquin Valley - Air Basins and Air Districts



**Factor 9: Level of control of emission sources**

This factor considers emission controls currently implemented for major sources in the San Joaquin Valley Air Basin.

The emission estimates on Table 1 (under Factor 1) include any control strategies implemented by the state in the San Joaquin Valley Air Basin before 2005 that may influence emissions of any component of PM<sub>2.5</sub> emissions (i.e., total carbon, SO<sub>2</sub>, NO<sub>x</sub>, and crustal PM<sub>2.5</sub>).

There are five coal-fired EGUs in San Joaquin Valley but all of them are located within the proposed PM<sub>2.5</sub> nonattainment boundaries and have existing controls which are accounted for in Table 1.

## Attachment 2

### Description of the Contributing Emissions Score

The CES is a metric that takes into consideration emissions data, meteorological data, and air quality monitoring information to provide a relative ranking of counties in and near an area. Using this methodology, scores were developed for each county in and around the relevant metro area. The county with the highest contribution potential was assigned a score of 100, and other county scores were adjusted in relation to the highest county. The CES represents the relative maximum influence that emissions in that county have on a violating county. The CES, which reflects consideration of multiple factors, should be considered in evaluating the weight of evidence supporting designation decisions for each area.

The CES for each county was derived by incorporating the following significant information and variables that impact PM<sub>2.5</sub> transport:

- Major PM<sub>2.5</sub> components: total carbon (organic carbon (OC) and elemental carbon (EC)), SO<sub>2</sub>, NO<sub>x</sub>, and inorganic particles (crustal).
- PM<sub>2.5</sub> emissions for the highest (generally top 5%) PM<sub>2.5</sub> emission days (herein called “high days”) for each of two seasons, cold (Oct-Apr) and warm (May-Sept)
- Meteorology on high days using the NOAA HYSPLIT model for determining trajectories of air masses for specified days
- The “urban increment” of a violating monitor, which is the urban PM<sub>2.5</sub> concentration that is in addition to a regional background PM<sub>2.5</sub> concentration, determined for each PM<sub>2.5</sub> component
- Distance from each potentially contributing county to a violating county or counties

A more detailed description of the CES can be found at [http://www.epa.gov/ttn/naaqs/pm/pm25\\_2006\\_techinfo.html#C](http://www.epa.gov/ttn/naaqs/pm/pm25_2006_techinfo.html#C).

# ATTACHMENT 3

## POLLUTION ROSES FOR SAN JOAQUIN VALLEY AIR BASIN

San Joaquin County, CA  
Pollution Rose, 2004-2006

Existing NAA: San Joaquin Valley, CA  
CSA: none  
CBSA: Stockton, CA

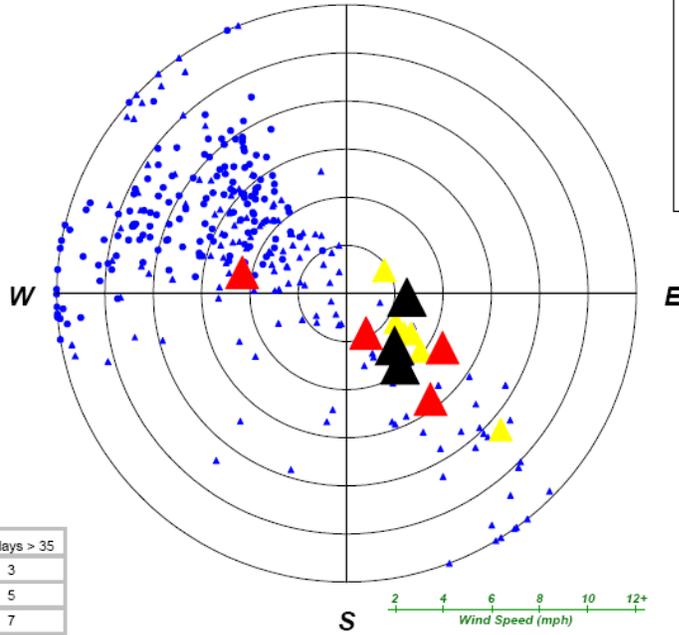
Site 060771002

**Concentration:**

- > 40  $\mu\text{g}/\text{m}^3$
- 35 - 40  $\mu\text{g}/\text{m}^3$
- 30 - 35  $\mu\text{g}/\text{m}^3$
- $\leq 30 \mu\text{g}/\text{m}^3$

**Season:**

- △ cool (Oct-Apr)
- warm (May-Sep)



Year	98th %-ile	# days > 35
2004	36.0	3
2005	44.0	5
2006	42.0	7
Design Value	41-NA	

8 exceedance(s) not plotted  
(due to missing or variable wind data)

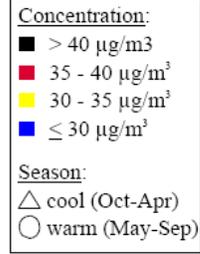
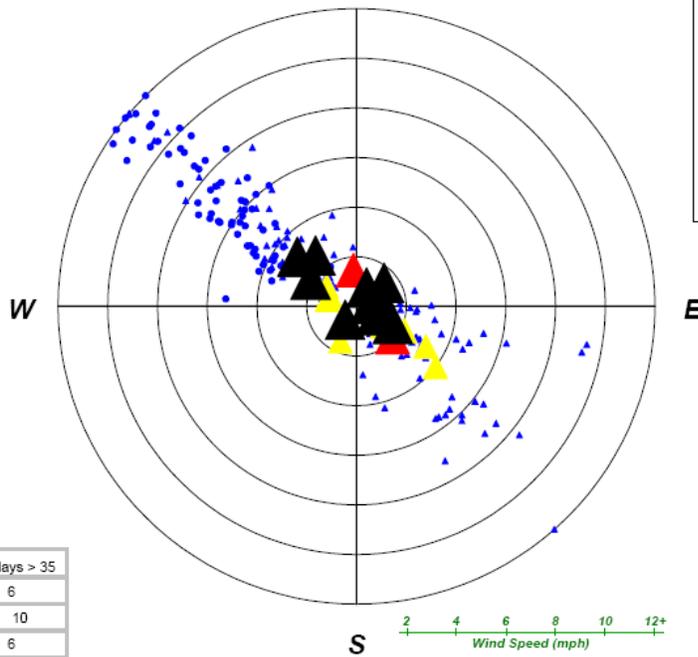
Meteorological data from 3.6 miles away  
STOCKTON\_METROPOLITAN\_ARPT (ID=23237)

located in near Sacramento Metro, CA

Merced County, CA  
Pollution Rose, 2004-2006

Existing NAA: San Joaquin Valley, CA  
CSA: none  
CBSA: Merced, CA

Site 060472510



Year	98th %-ile	# days > 35
2004	43.0	6
2005	48.3	10
2006	43.8	6
Design Value	45-NA	

8 exceedance(s) not plotted  
(due to missing or variable wind data)

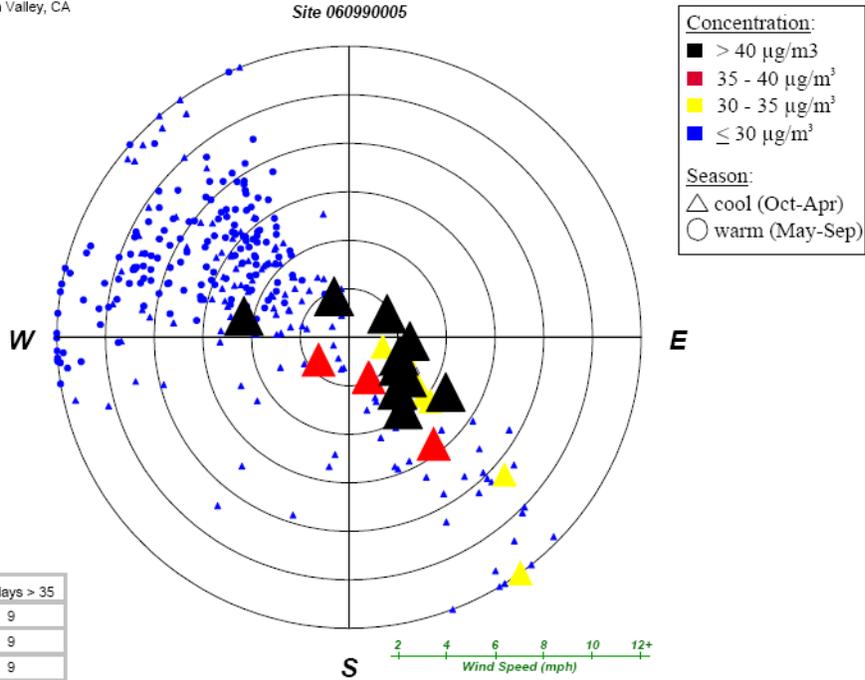
Meteorological data from 56.4 miles away  
FRESNO\_YOSEMITE\_INTL\_AP (ID=93193)

located in/near San Francisco Bay Area, CA

Stanislaus County, CA  
Pollution Rose, 2004-2006

Existing NAA: San Joaquin Valley, CA  
CSA: none  
CBSA: Modesto, CA

Site 060990005



Year	98th %-ile	# days > 35
2004	45.0	9
2005	55.0	9
2006	52.0	9
Design Value	51-NA	

14 exceedance(s) not plotted  
(due to missing or variable wind data)

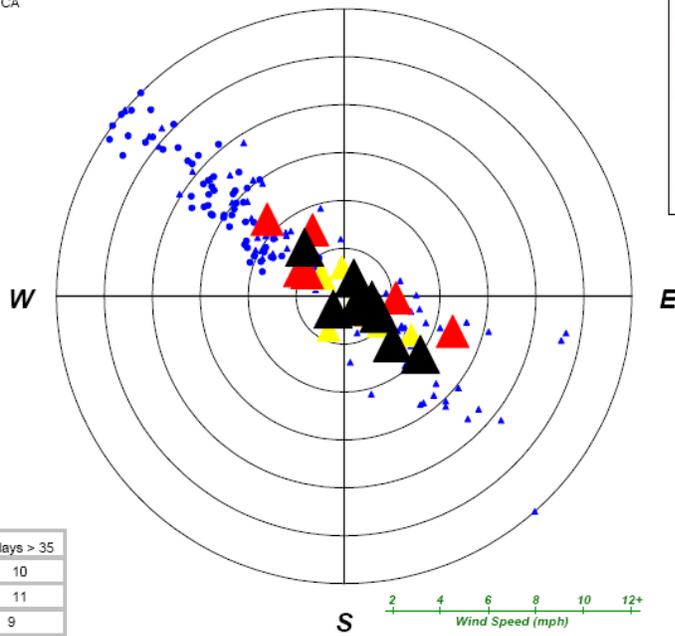
Meteorological data from 22.7 miles away  
STOCKTON\_METROPOLITAN\_ARPT (ID=23237)

located in near San Francisco Bay Area, CA

Kings County, CA  
Pollution Rose, 2004-2006

Existing NAA: San Joaquin Valley, CA  
CSA: none  
CBSA: Hanford-Corcoran, CA

Site 060310004



**Concentration:**

- > 40  $\mu\text{g}/\text{m}^3$
- 35 - 40  $\mu\text{g}/\text{m}^3$
- 30 - 35  $\mu\text{g}/\text{m}^3$
- $\leq 30 \mu\text{g}/\text{m}^3$

**Season:**

- △ cool (Oct-Apr)
- warm (May-Sep)

Year	98th %-ile	# days > 35
2004	49.4	10
2005	74.5	11
2006	50.1	9
Design Value	58-NA	

12 exceedance(s) not plotted  
(due to missing or variable wind data)



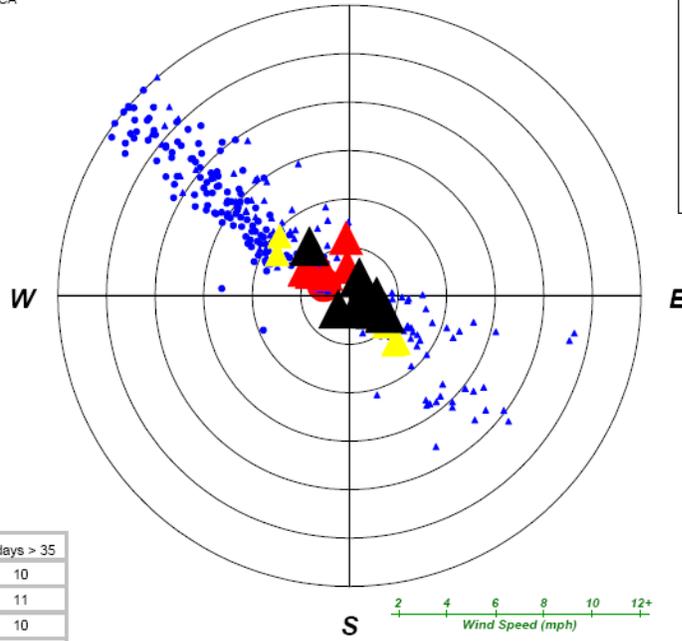
Meteorological data from 46.7 miles away  
FRESNO\_YOSEMITE\_INTL\_AP (ID=93193)

located in/linear San Joaquin Valley, CA

Tulare County, CA  
Pollution Rose, 2004-2006

Existing NAA: San Joaquin Valley, CA  
CSA: none  
CBSA: Visalia-Porterville, CA

Site 061072002



**Concentration:**  
 ■ > 40 µg/m<sup>3</sup>  
 ■ 35 - 40 µg/m<sup>3</sup>  
 ■ 30 - 35 µg/m<sup>3</sup>  
 ■ ≤ 30 µg/m<sup>3</sup>

**Season:**  
 △ cool (Oct-Apr)  
 ○ warm (May-Sep)

Year	98th %-ile	# days > 35
2004	54.0	10
2005	65.0	11
2006	50.0	10
Design Value	56-NA	

15 exceedance(s) not plotted  
(due to missing or variable wind data)

Meteorological data from 38.2 miles away  
FRESNO\_YOSEMITE\_INTL\_AP (ID=93193)

located in/near San Joaquin Valley, CA

## Attachment 1

### CALIFORNIA Area Designations For the 24-Hour Fine Particle National Ambient Air Quality Standard

The table below identifies the counties in California that EPA intends to designate as not attaining the 2006 24-hour fine particle (PM<sub>2.5</sub>) standard.<sup>1</sup> A county will be designated as nonattainment if it has an air quality monitor that is violating the standard or if the county is determined to be contributing to the violation of the standard.

Area	California Recommended Nonattainment Counties	EPA's Intended Nonattainment Counties
Butte County	Butte County - Partial	Butte County
Imperial County	Imperial County - Partial	Imperial County
Sacramento County	Sacramento County	Sacramento County Yolo County Placer County – Partial El Dorado County – Partial Solano County - Partial
San Francisco Bay Area	Sonoma County – Partial Napa County Marin County San Francisco County Contra Costa County Alameda County Santa Clara County San Mateo County Solano County - Partial	Sonoma County – Partial Napa County Marin County San Francisco County Contra Costa County Alameda County Santa Clara County San Mateo County Solano County - Partial
San Joaquin Valley Air Basin	San Joaquin County Stanislaus County Merced County Madera County Fresno County Kings County Tulare County Kern County - Partial	San Joaquin County Stanislaus County Merced County Madera County Fresno County Kings County Tulare County Kern County - Partial
South Coast Air Basin	Los Angeles County – Partial San Bernardino County Partial Riverside County – Partial Orange County	Los Angeles County – Partial San Bernardino County Partial Riverside County – Partial Orange County
Yuba County Sutter County	Yuba County – Partial Sutter County - Partial	Yuba County Sutter County

EPA intends to designate the remaining counties in the state as attainment/unclassifiable.

<sup>1</sup> EPA designated nonattainment areas for the 1997 fine particle standards in 2005. In 2006, the 24-hour PM<sub>2.5</sub> standard was revised from 65 micrograms per cubic meter (average of 98<sup>th</sup> percentile values for 3 consecutive years) to 35 micrograms per cubic meter; the level of the annual standard for PM<sub>2.5</sub> remained unchanged at 15 micrograms per cubic meter (average of annual averages for 3 consecutive years).

## **EPA Technical Analysis for the South Coast Air Basin**

Pursuant to section 107(d) of the Clean Air Act, EPA must designate as nonattainment those areas that violate the NAAQS and those areas that contribute to violations. This technical analysis for South Coast Air Basin identifies the counties with monitors that violate the 24-hour PM<sub>2.5</sub> standard and evaluates the counties that potentially contribute to fine particle concentrations in the area. EPA has evaluated these counties based on the weight of evidence of the following nine factors recommended in EPA guidance and any other relevant information:

- pollutant emissions
- air quality data
- population density and degree of urbanization
- traffic and commuting patterns
- growth
- meteorology
- geography and topography
- jurisdictional boundaries
- level of control of emissions sources

Figure 1 is a map of the counties in the area and other relevant information such as the locations and design values of air quality monitors, the metropolitan area boundary, and counties recommended as nonattainment by the State.

# Los Angeles-South Coast Air Basin, CA

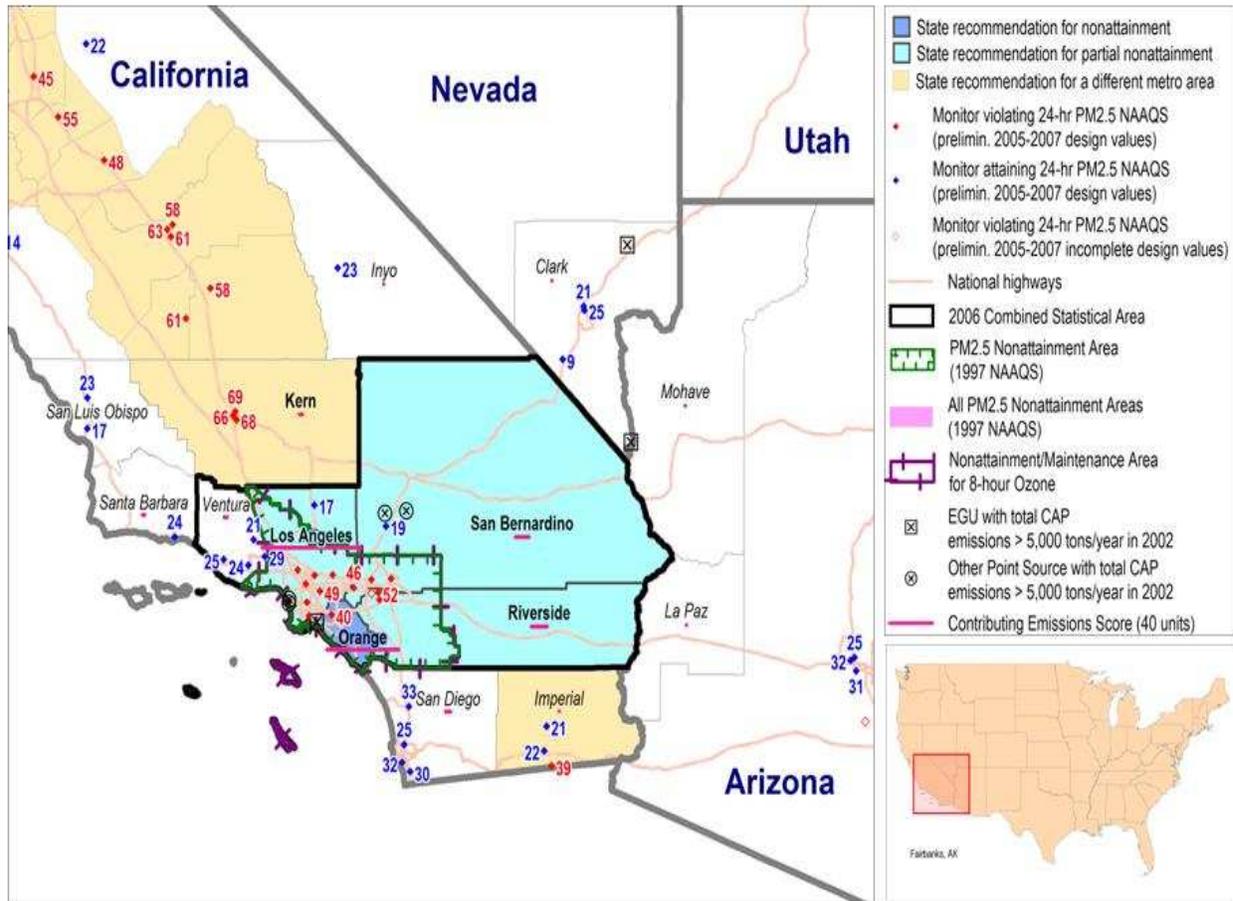


Figure 1

Counties labeled in bold reflect NAAs under 1997 NAAQS

For this area, EPA previously established PM<sub>2.5</sub> nonattainment boundaries for the 1997 PM<sub>2.5</sub> NAAQS that included one full and three partial counties. Orange County is included in its entirety. Parts of Los Angeles, San Bernardino and Riverside Counties are included. This area is consistent with the jurisdiction of the South Coast Air Quality Management District which oversees air quality in the Los Angeles metropolitan area. This area does not include the more rural eastern portions of Los Angeles, San Bernardino and Riverside Counties, which are separated from the western portion of these counties by the San Gabriel and San Bernardino mountain ranges that crest at over 10,000 feet. In addition, the rural parts of these counties are located large distances away from the Los Angeles metropolitan area.

The California Air Resources Board (CARB) sent a letter to EPA, dated December 17, 2007, recommending that the same counties be designated as “nonattainment” for the 2006 24-hour PM<sub>2.5</sub> standard based on air quality data from 2004-2006. These data are from Federal Reference Method (FRM) and Federal Equivalent Method (FEM) monitors located in the state.

Air quality monitoring data on the composition of fine particle mass are available from the EPA Chemical Speciation Network and the IMPROVE monitoring network. Analysis of these data indicates that the days with the highest fine particle concentrations occur both in the warm season and cold seasons. In the warm season, the average chemical composition of the highest days is nitrate (44%), carbon (28%) and sulfate (26%). In the cold season, the average chemical composition of the highest days is nitrate (60%), carbon (23%) and sulfate (15%).

Based on EPA's 9-factor analysis described below, EPA believes that Los Angeles, Riverside, San Bernardino and Orange counties in California, the same counties as previously designated for PM<sub>2.5</sub> should be designated nonattainment for the 24-hour PM<sub>2.5</sub> air-quality standard as part of the Los Angeles South Coast Air Basin nonattainment area, based upon currently available information. This recommendation is consistent with CARB's recommendation. These counties are listed in the table below.

Area	State-Recommended Nonattainment Counties	EPA-Recommended Nonattainment Counties
South Coast Air Basin	Riverside (P), San Bernardino (P), Los Angeles (P) and Orange Counties.	Riverside (P), San Bernardino (P), Los Angeles (P) and Orange Counties
P = partial		

The following is a summary of the 9-factor analysis for the South Coast Air Basin.

**Factor 1: Emissions data**

For this factor, EPA evaluated county level emission data for the following PM<sub>2.5</sub> components and precursor pollutants: “PM<sub>2.5</sub> emissions total,” “PM<sub>2.5</sub> emissions carbon,” “PM<sub>2.5</sub> emissions other,” “SO<sub>2</sub>,” “NO<sub>x</sub>,” “VOCs,” and “NH<sub>3</sub>.” “PM<sub>2.5</sub> emissions total” represents direct emissions of PM<sub>2.5</sub> and includes: “PM<sub>2.5</sub> emissions carbon,” “PM<sub>2.5</sub> emissions other”, primary sulfate (SO<sub>4</sub>), and primary nitrate. (Although primary sulfate and primary nitrate, which are emitted

directly from stacks rather than forming in atmospheric reactions with SO<sub>2</sub> and NO<sub>x</sub>, are part of “PM<sub>2.5</sub> emissions total,” they are not shown on Table 1 as separate items). “PM<sub>2.5</sub> emissions carbon” represents the sum of organic carbon (OC) and elemental carbon (EC) emissions, and “PM<sub>2.5</sub> emissions other” represents other inorganic particles (crustal). Emissions of SO<sub>2</sub> and NO<sub>x</sub>, which are precursors of the secondary PM<sub>2.5</sub> components sulfate and nitrate, are also considered. VOCs (volatile organic compounds) and NH<sub>3</sub> (ammonia) are also potential PM<sub>2.5</sub> precursors and are included for consideration.

Emissions data were derived from the 2005 National Emissions Inventory (NEI), version 1. See [http://www.epa.gov/ttn/naaqs/pm/pm25\\_2006\\_techinfo.html](http://www.epa.gov/ttn/naaqs/pm/pm25_2006_techinfo.html).

EPA also considered the Contributing Emissions Score (CES) for each county. The CES is a metric that takes into consideration emissions data, meteorological data, and air quality monitoring information to provide a relative ranking of counties in and near an area. Note that this metric is not the exclusive way for consideration of data for these factors. A summary of the CES is included in attachment 2, and a more detailed description can be found at [http://www.epa.gov/ttn/naaqs/pm/pm25\\_2006\\_techinfo.html#C](http://www.epa.gov/ttn/naaqs/pm/pm25_2006_techinfo.html#C).

Table 1 shows emissions of PM<sub>2.5</sub> and precursor pollutants components (given in tons per year) and the CES for violating and potentially contributing counties in the Los Angeles/South Coast Air Basin. Counties are listed in descending order by CES.

Table 1. PM <sub>2.5</sub> Related Emissions (tons per year) and Contributing Emissions Score									
County	State Recommended Nontainment?	CES	PM <sub>2.5</sub> Emission Total	PM <sub>2.5</sub> emissions carbon	PM <sub>2.5</sub> emissions other	SO <sub>2</sub>	NO <sub>x</sub>	VOCs	NH <sub>3</sub>
Los Angeles	Yes (P)	100	16,764	10,780	5,984	31,620	272,971	191,280	12,156
Orange County	Yes	73	4,960	3,265	1,694	9,149	63,417	64,446	3,444
Riverside	Yes (P)	16	5,314	2,899	2,415	4,451	58,229	38,262	4,733
San Bernardino	Yes (P)	14	12,043	5,055	6,988	3,792	96,578	51,873	3,592
P = partial. Data given is for entire County									

Los Angeles has the highest CES value and the highest PM<sub>2.5</sub> emissions, and precursor emissions, by far. Orange County has a CES of 73 which argues for it being included as a candidate for a PM<sub>2.5</sub> nonattainment designation. San Bernardino and Riverside Counties, while having lower CES, have significant PM<sub>2.5</sub> emissions. Based on both emissions levels and CES values, parts of Los Angeles, Riverside, San Bernardino Counties and all of Orange County in California are candidates for a 24-hour PM<sub>2.5</sub> nonattainment designation and, therefore, require further analysis.

Table 1 indicates that there is a significant emissions of nitrogen oxides (NO<sub>x</sub>) and volatile organic compounds (VOCs) in these counties. These pollutants are precursors to the formation of PM<sub>2.5</sub>. On-road vehicles, combined with the amount of Vehicle Miles Traveled (VMT) are the largest emission sources of these two pollutants. Data included in the “2006 Estimated Annual

Average Emissions Inventories”, available from the California Air Resources Board, indicate that for all the counties in the South Coast Air Basin, mobile sources constitute a major portion of the PM<sub>2.5</sub> emissions total.

Based on emission levels and CES values, Riverside, San Bernardino, Los Angeles and Orange Counties are candidates for a 24-hour PM<sub>2.5</sub> nonattainment designation.

**Factor 2: Air quality data**

This factor considers the 24-hour PM<sub>2.5</sub> design values in micrograms per cubic meter (µg/m<sup>3</sup>) for air quality monitors in counties in the Los Angeles South Coast Air Basin based on data for the 2005-2007 period. A monitor’s design value indicates whether that monitor attains a specified air quality standard. The 24-hour PM<sub>2.5</sub> standards are met when the 3-year average of a monitor’s 98<sup>th</sup> percentile values are 35 µg/m<sup>3</sup> or less. A design value is only valid if minimum data completeness criteria are met.

The PM<sub>2.5</sub> violating monitors in the South Coast Air Basin are shown in Figure 2. Los Angeles has four violating monitors, Orange County has one, San Bernardino County has two and Riverside County has three. The 24-hour PM<sub>2.5</sub> design values for counties in the South Coast Air Basin are shown in Table 2.

County	State Recommended Nonattainment?	24-hr PM <sub>2.5</sub> Design Values 2004-06 (µg/m <sup>3</sup> )	24-hr PM <sub>2.5</sub> Design Values 2005-07 (µg/m <sup>3</sup> )
Los Angeles	Yes (P)	50	49
Orange	Yes	44	40
Riverside	Yes (P)	57	52
San Bernardino	Yes (P)	55	46
P = partial			

Parts of Los Angeles, Riverside, San Bernardino and all of Orange County show a violation of the 24-hour PM<sub>2.5</sub> standard. Although the design values of all four of these counties decreased from the 2004 – 2006 to 2005 – 2007 periods, they are still above the PM<sub>2.5</sub> standard. Based on the data, these counties have the worst air quality for PM<sub>2.5</sub> in the country. Therefore, these counties are candidates for inclusion in the South Coast Air Basin nonattainment area. EPA considered each County’s CES as well as other factors and circumstances when determining which counties to include in the South Coast Air Basin nonattainment area.

Eligible monitors for providing design value data generally include State and Local Air Monitoring Stations (SLAMS) at population-oriented locations with a FRM or FEM monitor. All data from Special Purpose Monitors (SPM) using an FRM, FEM, or Alternative Reference Method (ARM) which has operated for more than 24 months is eligible for comparison to the relevant NAAQS, subject to the requirements given in the October 17, 2006 Revision to Ambient

Air Monitoring Regulations (71 FR 61236). All monitors used to provide data must meet the monitor siting and eligibility requirements given in 71 FR 61236 to 61328 in order to be acceptable for comparison to the 24-hr PM<sub>2.5</sub> NAAQS for designation purposes.

**Factor 3:**

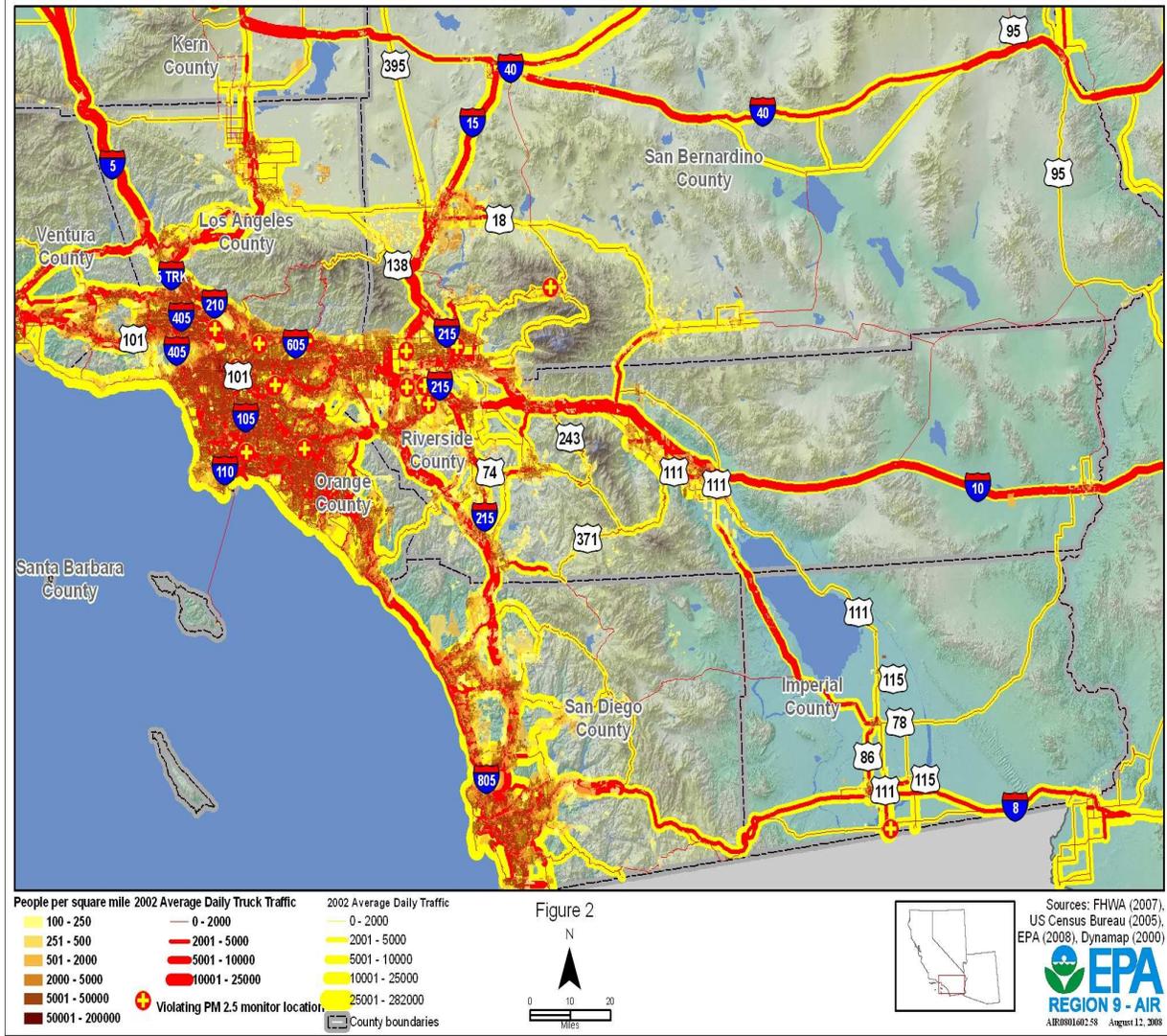
Table 3 shows the 2005 population for each county in the area being evaluated, as well as the population density for each county in that area. Population data gives an indication of whether it is likely that population-based emissions might contribute to violations of the 24-hour PM<sub>2.5</sub> standards. See Figure 2.

Table 3. Population			
County	State Recommended Nonattainment?	2005 Population	2005 Population Density (pop/sq mi)
Los Angeles	Yes (P)	9,941,197	2,429
Orange	Yes	2,992,642	3,738
Riverside	Yes (P)	1,945,392	266
San Bernardino	Yes (P)	1,964,511	98
P = partial. Data given is for entire County			

As shown on the attached map, this area is one of the most densely populated areas in the western United States. The 2005 population is extremely high for all four counties. Los Angeles County is densely populated with 2,429 people per square mile. Orange County has even more people, with 3,738 people per square mile. Southwestern San Bernardino County and western Riverside Counties are densely populated near the metropolitan area, but due to large rural areas show less population density.

Western Los Angeles, Orange County, Southwestern San Bernardino County and Western Riverside County are high-ranking counties for a nonattainment designation based on this factor and are also high-ranking counties based on Factors 1 and 2 and the CES.

# South Coast Air Basin - Population Density and Commuting Traffic



#### Factor 4: Traffic and commuting patterns

This factor considers the number of commuters in each county who drive to another county within the Los Angeles/South Coast Air Basin, the percent of total commuters in each county who commute to other counties within the Los Angeles/South Coast Air Basin, as well as the total Vehicle Miles Traveled (VMT) for each county in thousands of miles (see Table 5). A county with numerous commuters is generally an integral part of an urban area and is likely contributing to fine particle concentrations in the area.

County	State Recommended Non-attainment?	2005 VMT (1,000s mi)	Number Commuting to any violating counties	Percent Commuting to any violating counties
<b>Los Angeles</b>	Yes (P)	69,539	3,793,620	98%
<b>Orange</b>	Yes	23,466	1,297,190	99%
<b>Riverside</b>	Yes (P)	19,731	566,630	96%
<b>San Bernardino</b>	Yes (P)	17,810	650,210	99%

The listing of counties on Table 4 reflects a ranking based on the number of people commuting to other counties. The counties that are in the nonattainment area for the 1997 PM<sub>2.5</sub> NAAQS are shown in boldface.

All four counties have heavy commuter traffic constituting between 96% and 99% commuting to violating counties. The VMT numbers are extremely large for the entire area. As shown on the attached map, average daily truck traffic is also heavy, from 25,000 to 55,000 trucks on the highways in all four counties.

Based on this Factor and Factors 1, 2 and 3, the counties in the South Coast Air Basin are candidates for a PM<sub>2.5</sub> designation.

The 2005 VMT data used for Table 5 and 6 of the 9-factor analysis has been derived using methodology similar to that described in "Documentation for the final 2002 Mobile National Emissions Inventory, Version 3, September 2007, prepared for the Emission Inventory Group, U.S. EPA. This document may be found at: [atftp://ftp.epa.gov/EmisInventory/2002finalnei/documentation/mobile/2002\\_mobile\\_nei\\_version\\_3\\_report\\_092807.pdf](atftp://ftp.epa.gov/EmisInventory/2002finalnei/documentation/mobile/2002_mobile_nei_version_3_report_092807.pdf).

The 2005 VMT data were taken from documentation which is still draft, but which should be released in 2008.

#### Factor 5: Growth rates and patterns

This factor considers population growth for 2000-2005 and vehicle miles traveled for 1996-2005 for counties in the Los Angeles/South Coast Air Basin, as well as patterns of population and

VMT growth. A county with rapid population or VMT growth is generally an integral part of an urban area and likely to be contributing to fine particle concentrations in the area.

Table 5 below shows population, population growth, VMT and VMT growth for counties that are included in the South Coast Air Basin area.

Table 5. Population and VMT Growth and Percent Change					
County	Population (2005)	Population Density (2005)	Population % change (2000 - 2005)	2005 VMT (millions mi)	VMT % change 1996 to 2005
Los Angeles (P)	9,941,197	2,429	4%	69,539	(8)
Orange	2,992,642	3,738	5%	23,466	15%
Riverside (P)	1,945,392	266	25%	19,731	49%
San Bernardino (P)	1,964,511	98	14%	17,810	7%
P = partial. Data given for entire County					

Based on the data in Table 5, Riverside County had a high percentage of population change from 2000 to 2005, and an extremely high percentage of VMT change from 1996-2005. San Bernardino County had a significant increase in population from 2000-2005 with an increase in VMT for 1996-2005. While Los Angeles and Orange Counties had a small population increase during the 2000 – 2005 period, Orange County had a significant increase in VMT while Los Angeles had a decrease for the period 1996-2005.

The South Coast Air Basin has a heavy concentration of industrial facilities, several airports, two major international ports, and a dense freeway and surface street network. Approximately 43% of all Californians live in this area, and drive 40% of all the vehicle miles traveled in the state. Overall, the area is experiencing increasing population growth and traffic volumes, so all counties in the South Coast Air Basin are candidates for a PM<sub>2.5</sub> nonattainment designation for this factor.

**Factor 6: Meteorology (weather/transport patterns)**

For this factor, EPA considered data from National Weather Service instruments in the area. Wind direction and wind speed data for 2004-2006 were analyzed, with an emphasis on “high PM<sub>2.5</sub> days” for each of two seasons (an October-April “cold” season and a May-September “warm” season). These high days are defined as days where any FRM or FEM air quality monitors had 24-hour PM<sub>2.5</sub> concentrations above 95% on a frequency distribution curve of PM<sub>2.5</sub> 24-hour values, or where 24-hour values exceeded 35.1 µg/m<sup>3</sup>. See Figure 3.

For each air quality monitoring site, EPA developed a “pollution rose” to understand the prevailing wind direction and wind speed on the days with highest fine particle concentrations. The figure identifies 24-hour PM<sub>2.5</sub> values by color; days exceeding 35 µg/m<sup>3</sup> are denoted with a red or black icon. A dot indicates the day occurred in the warm season; a triangle indicates the day occurred in the cool season. The center of the figure indicates the location of the air quality monitoring site, and the location of the icon in relation to the center indicates the direction from

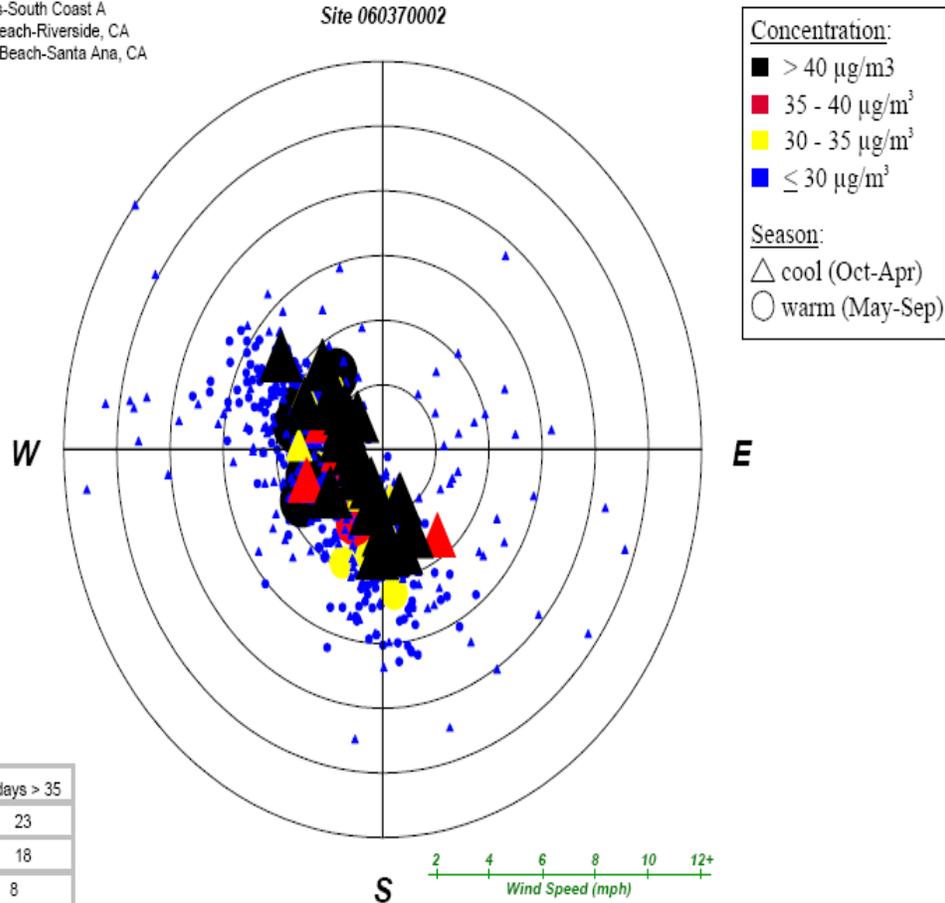
which the wind was blowing on that day. An icon that is close to the center indicates a low average wind speed on that day. Higher wind speeds are indicated when the icon is farther away from the center.

The pollution rose for Los Angeles County, site 060370002, shown below in Figure 3, indicates that elevated levels of particulate matter occur predominately during the cool season, during time periods when the winds are light. The additional pollution roses for the South Coast Air Basin, included in Attachment 3 show similar results.

Los Angeles County, CA  
Pollution Rose, 2004-2006

Existing NAA: Los Angeles-South Coast A  
CSA: Los Angeles-Long Beach-Riverside, CA  
CBSA: Los Angeles-Long Beach-Santa Ana, CA

Site 060370002



Year	98th %-ile	# days > 35
2004	53.8	23
2005	53.2	18
2006	38.4	8
Design Value	48-NA	

15 exceedance(s) not plotted  
(due to missing or variable wind data)

Meteorological data from 25.6 miles away  
LONG\_BEACH\_DAUGHERTY\_FLD (ID=23129)

located in/near San Joaquin Valley, CA

The meteorology indicates that all four counties should be included in the South Coast Air Basin nonattainment area. Consideration of this factor supports the recommended nonattainment area for the South Coast area.

The meteorology factor is also considered in each county's Contributing Emissions Score (CES) because the method for deriving this metric included an analysis of trajectories of air masses for high  $\text{PM}_{2.5}$  days.

**Factor 7: Geography/topography (mountain ranges or other air basin boundaries)**

The geography/topography analysis looks at physical features of the land that might have an effect on the air shed and, therefore, on the distribution of PM<sub>2.5</sub> over the South Coast Air Basin.

The South Coast Air Basin forms a low plain, bordered on the west by the Pacific Ocean, and surrounded on the other sides by mountains which channel and confine the airflow. The San Gabriel Mountains lie to the north; the San Bernardino Mountains lie to the north and east, the San Jacinto Mountains to the southeast and the Santa Ana Mountains to the south. In addition to the mountain ranges, sunny warm weather and stagnant winds trap smog in the South Coast Air Basin area.

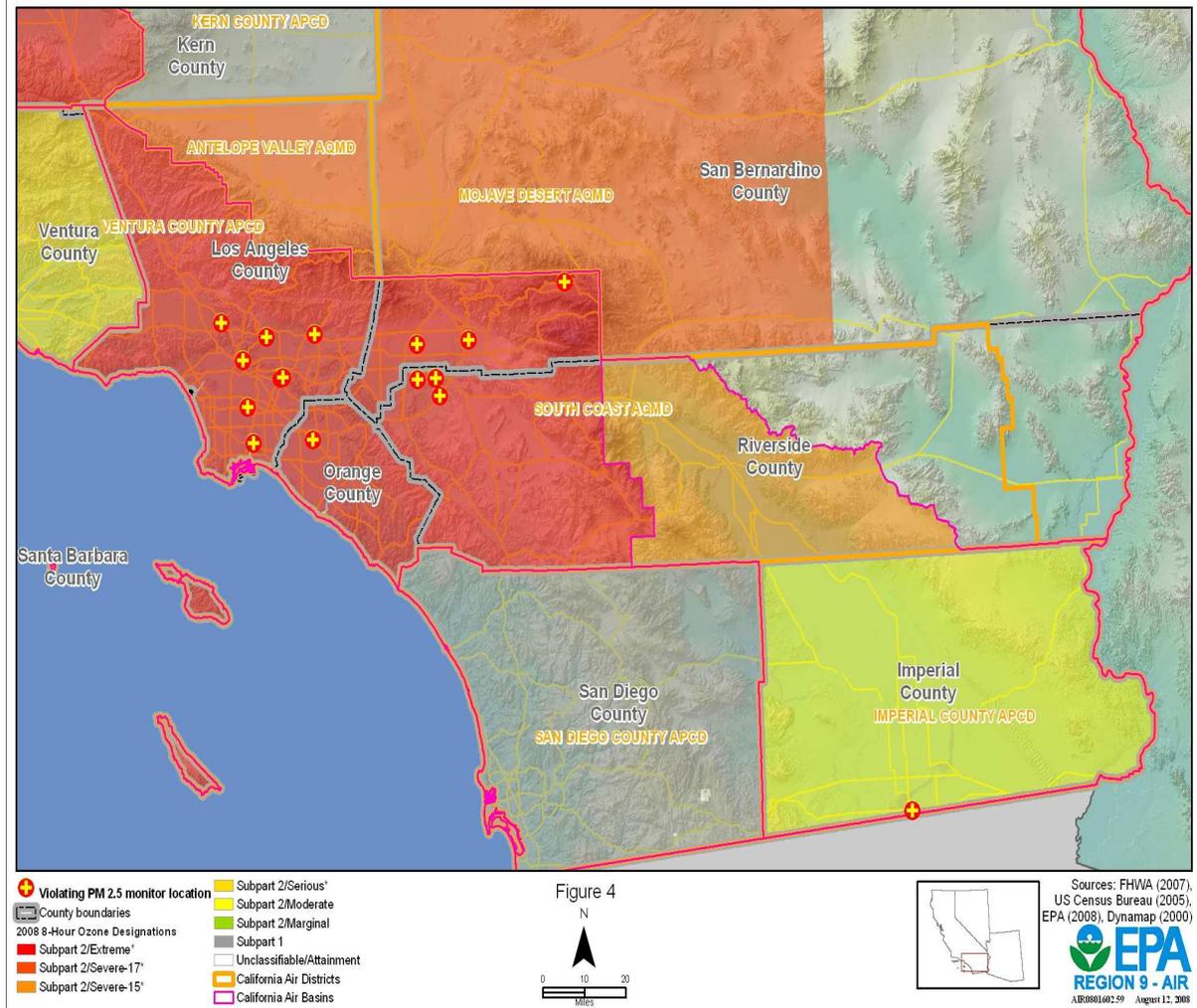
Consideration of this factor supports the recommended nonattainment area for the South Coast area.

**Factor 8: Jurisdictional boundaries (e.g., existing PM and ozone areas)**

In evaluating the jurisdictional boundary factor, consideration should be given to existing boundaries and organizations that may facilitate air quality planning and the implementation of control measures to attain the standard. Areas designated as nonattainment (e.g., for PM<sub>2.5</sub> or 8-hour ozone standard) represent important boundaries for state air quality planning. See Figure 4.

A goal in designating PM<sub>2.5</sub> nonattainment areas is to achieve a degree of consistency with existing PM<sub>2.5</sub> and ozone nonattainment areas. The major jurisdictional boundary in the South Coast Air Basin, which is currently nonattainment for both the 1997 PM<sub>2.5</sub> and 8-hour ozone standards, is the South Coast Air Quality Management District (SCAQMD). SCAQMD includes Orange County, and parts of Los Angeles, Riverside and San Bernardino Counties. Since SCAQMD will be the responsible planning agency for all three standards, this argues for making the 2006 PM<sub>2.5</sub> nonattainment area consistent with the existing nonattainment boundaries for SCAQMD. (See Figure 4)

# South Coast Air Basin - Air Districts, Air Basins, Ozone Nonattainment Areas



## Factor 9: Level of control of emission sources

This factor considers emission controls currently implemented for major sources in the Los Angeles/South Coast Air Basin area.

The emission estimates on Table 1 (under Factor 1) include any control strategies implemented by the SCAQMD in the South Coast Air Basin before 2005 that may influence emissions of any component of PM<sub>2.5</sub> emissions (i.e., total carbon, SO<sub>2</sub>, NO<sub>x</sub>, and crustal PM<sub>2.5</sub>).

## Attachment 2

### Description of the Contributing Emissions Score

The CES is a metric that takes into consideration emissions data, meteorological data, and air quality monitoring information to provide a relative ranking of counties in and near an area. Using this methodology, scores were developed for each county in and around the relevant metro area. The county with the highest contribution potential was assigned a score of 100, and other county scores were adjusted in relation to the highest county. The CES represents the relative maximum influence that emissions in that county have on a violating county. The CES, which reflects consideration of multiple factors, should be considered in evaluating the weight of evidence supporting designation decisions for each area.

The CES for each county was derived by incorporating the following significant information and variables that impact PM<sub>2.5</sub> transport:

- Major PM<sub>2.5</sub> components: total carbon (organic carbon (OC) and elemental carbon (EC)), SO<sub>2</sub>, NO<sub>x</sub>, and inorganic particles (crustal).
- PM<sub>2.5</sub> emissions for the highest (generally top 5%) PM<sub>2.5</sub> emission days (herein called “high days”) for each of two seasons, cold (Oct-Apr) and warm (May-Sept)
- Meteorology on high days using the NOAA HYSPLIT model for determining trajectories of air masses for specified days
- The “urban increment” of a violating monitor, which is the urban PM<sub>2.5</sub> concentration that is in addition to a regional background PM<sub>2.5</sub> concentration, determined for each PM<sub>2.5</sub> component
- Distance from each potentially contributing county to a violating county or counties

A more detailed description of the CES can be found at [http://www.epa.gov/ttn/naaqs/pm/pm25\\_2006\\_techinfo.html#C](http://www.epa.gov/ttn/naaqs/pm/pm25_2006_techinfo.html#C).

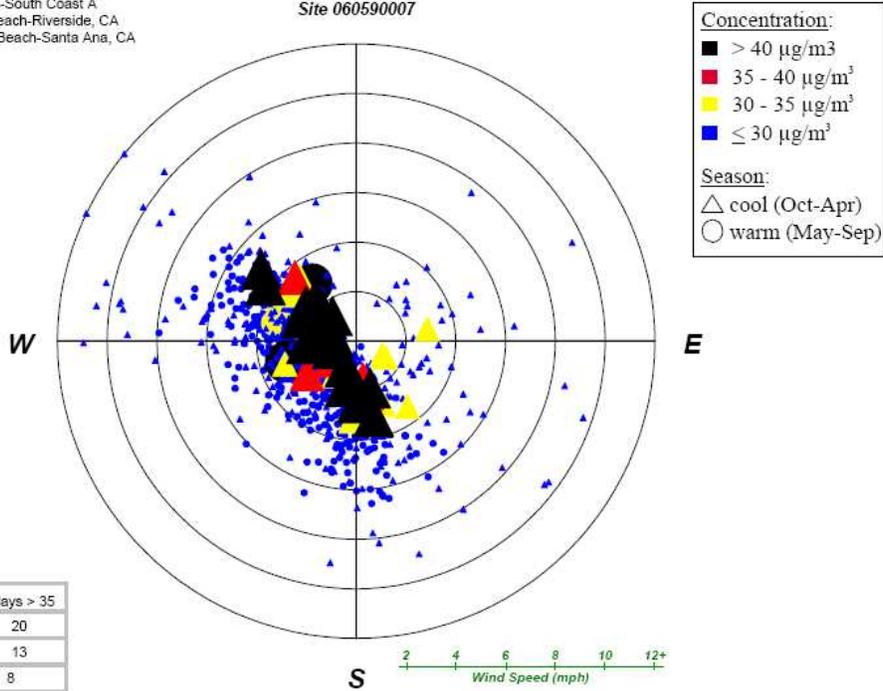
# ATTACMMENT 3

## POLLUTION ROSES FOR SOUTH COAST AIR BASIN

Orange County, CA  
Pollution Rose, 2004-2006

Existing NAA: Los Angeles-South Coast A  
2SA: Los Angeles-Long Beach-Riverside, CA  
2BSA: Los Angeles-Long Beach-Santa Ana, CA

Site 060590007



Year	98th %-ile	# days > 35
2004	48.2	20
2005	41.8	13
2006	40.5	8
Design Value	44-NA	

8 exceedance(s) not plotted  
(due to missing or variable wind data)

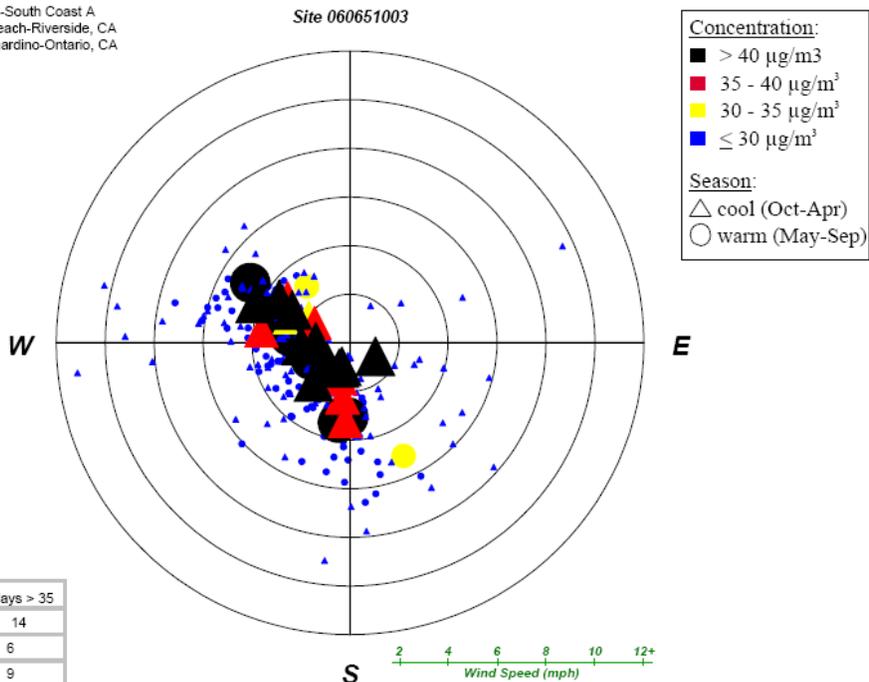
Meteorological data from 12.2 miles away  
LONG\_BEACH\_DAUGHERTY\_FLD (ID=23129)

located in/near Los Angeles-South Coast A

Riverside County, CA  
Pollution Rose, 2004-2006

Existing NAA: Los Angeles-South Coast A  
CSA: Los Angeles-Long Beach-Riverside, CA  
CBSA: Riverside-San Bernardino-Ontario, CA

Site 060651003



Year	98th %-ile	# days > 35
2004	53.7	14
2005	41.0	6
2006	47.7	9
Design Value	47-NA	

6 exceedance(s) not plotted  
(due to missing or variable wind data)

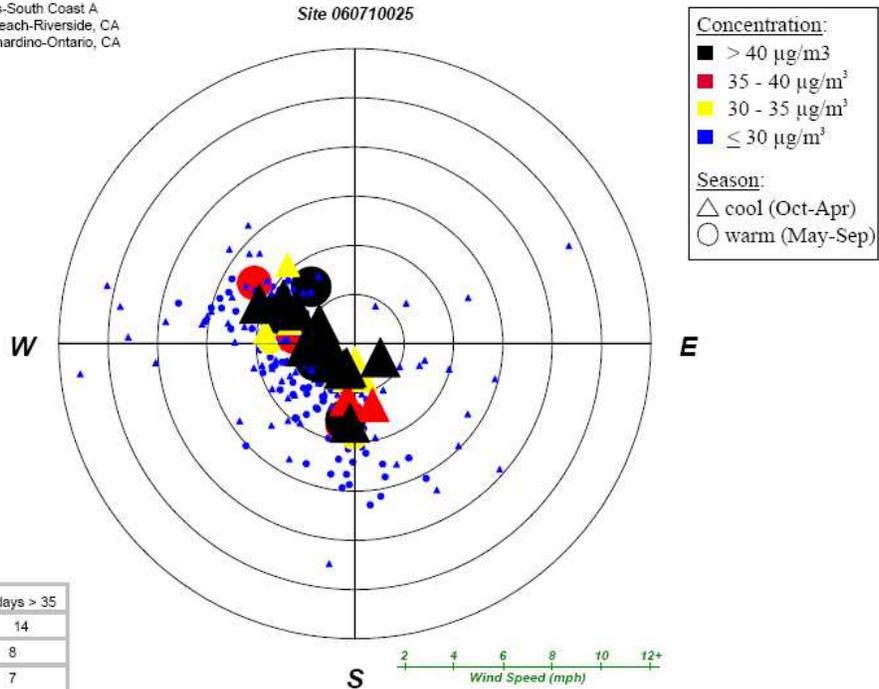
Meteorological data from 43.9 miles away  
LONG\_BEACH\_DAUGHERTY\_FLD (ID=23129)

located in/in near Los Angeles-South Coast A/

San Bernardino County, CA  
Pollution Rose, 2004-2006

Existing NAA: Los Angeles-South Coast A  
CSA: Los Angeles-Long Beach-Riverside, CA  
CBSA: Riverside-San Bernardino-Ontario, CA

Site 060710025



Year	98th %-ile	# days > 35
2004	59.9	14
2005	49.5	8
2006	41.5	7
Design Value	50-NA	

5 exceedance(s) not plotted  
(due to missing or variable wind data)

Meteorological data from 30.5 miles away  
LONG\_BEACH\_DAUGHERTY\_FLD (ID=23129)

located in/near Los Angeles-South Coast A)

## Attachment 1

### CALIFORNIA Area Designations For the 24-Hour Fine Particle National Ambient Air Quality Standard

The table below identifies the counties in California that EPA intends to designate as not attaining the 2006 24-hour fine particle (PM<sub>2.5</sub>) standard.<sup>1</sup> A county will be designated as nonattainment if it has an air quality monitor that is violating the standard or if the county is determined to be contributing to the violation of the standard.

Area	California Recommended Nonattainment Counties	EPA's Intended Nonattainment Counties
Butte County	Butte County - Partial	Butte County
Imperial County	Imperial County - Partial	Imperial County
Sacramento County	Sacramento County	Sacramento County Yolo County Placer County – Partial El Dorado County – Partial Solano County - Partial
San Francisco Bay Area	Sonoma County – Partial Napa County Marin County San Francisco County Contra Costa County Alameda County Santa Clara County San Mateo County Solano County - Partial	Sonoma County – Partial Napa County Marin County San Francisco County Contra Costa County Alameda County Santa Clara County San Mateo County Solano County - Partial
San Joaquin Valley Air Basin	San Joaquin County Stanislaus County Merced County Madera County Fresno County Kings County Tulare County Kern County - Partial	San Joaquin County Stanislaus County Merced County Madera County Fresno County Kings County Tulare County Kern County - Partial
South Coast Air Basin	Los Angeles County – Partial San Bernardino County Partial Riverside County – Partial Orange County	Los Angeles County – Partial San Bernardino County Partial Riverside County – Partial Orange County
Yuba County Sutter County	Yuba County – Partial Sutter County - Partial	Yuba County Sutter County

EPA intends to designate the remaining counties in the state as attainment/unclassifiable.

<sup>1</sup> EPA designated nonattainment areas for the 1997 fine particle standards in 2005. In 2006, the 24-hour PM<sub>2.5</sub> standard was revised from 65 micrograms per cubic meter (average of 98<sup>th</sup> percentile values for 3 consecutive years) to 35 micrograms per cubic meter; the level of the annual standard for PM<sub>2.5</sub> remained unchanged at 15 micrograms per cubic meter (average of annual averages for 3 consecutive years).

## **EPA Technical Analysis for Yuba and Sutter Counties**

Pursuant to section 107(d) of the Clean Air Act, EPA must designate as nonattainment those areas that violate the NAAQS and those areas that contribute to violations. This technical analysis for Yuba and Sutter Counties identifies the counties with monitors that violate the 24-hour PM<sub>2.5</sub> standard and evaluates the counties that potentially contribute to fine particle concentrations in the area. EPA has evaluated these counties based on the weight of evidence of the following nine factors recommended in EPA guidance and any other relevant information:

- pollutant emissions
- air quality data
- population density and degree of urbanization
- traffic and commuting patterns
- growth
- meteorology
- geography and topography
- jurisdictional boundaries
- level of control of emissions sources

Figure 1 is a map of the counties in the area and other relevant information such as the locations and design values of air quality monitors, the metropolitan area boundary, and counties recommended as nonattainment by the State.

## Yuba and Sutter Counties, CA

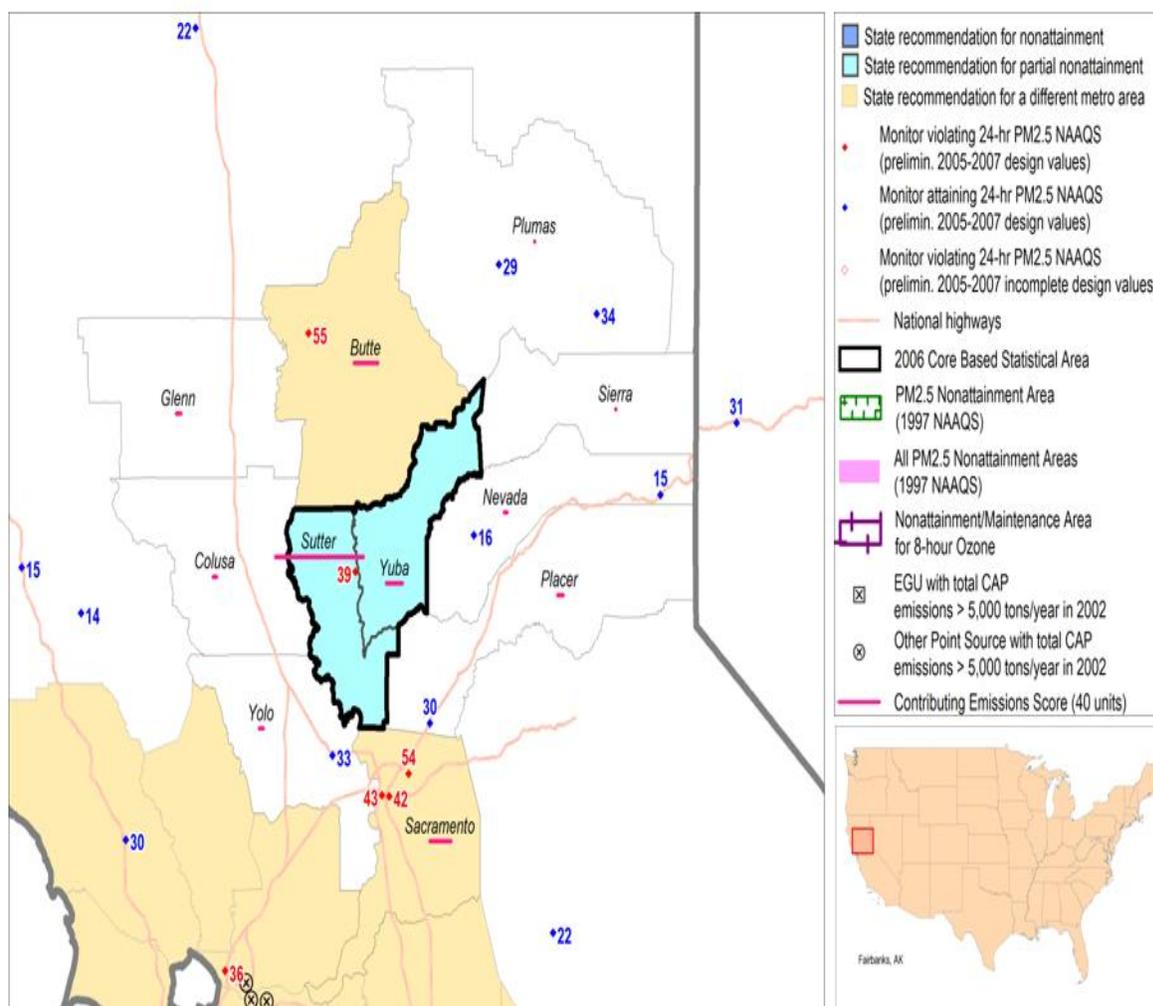


Figure 1  
Counties labeled in bold reflect NAAAs under 1997 NAAQS

The California Air Resources Board (CARB) sent a letter to EPA, dated December 17, 2007, recommending that Yuba City and the City of Marysville be designated as “nonattainment” for the 2006 24-hour PM<sub>2.5</sub> standard based on the most recent three years of air quality data that were available in December 2007. These data are from a Federal Reference Method (FRM) monitor located in Yuba City, California.

Air quality monitoring data on the composition of fine particle mass are available from the EPA Chemical Speciation Network and the IMPROVE monitoring network, as well as from the Chico monitoring site. Analysis of these data indicates that the days with the highest fine particle

concentrations occur predominantly in the cold season, and the average chemical composition of the highest days is characterized by high levels of organic carbon (e.g., 70%).

Based on EPA's 9-factor analysis described below, EPA believes that Yuba County and Sutter County in California should be designated nonattainment for the 24-hour PM<sub>2.5</sub> air-quality standard, based upon currently available information. These counties are listed in the table below.

Area	State-Recommended Nonattainment Counties	EPA-Recommended Nonattainment Counties
City of Marysville	Yuba County (partial)	Yuba County
Yuba City	Sutter County (partial)	Sutter County

The following is a summary of the 9-factor analysis for Yuba and Sutter Counties.

Several factors led EPA to recommend a significantly larger PM<sub>2.5</sub> nonattainment area than recommended by California. The recommended boundary does not include the population that would be contributing to and potentially exposed to high levels of PM<sub>2.5</sub> represented by the Yuba City design value, nor does it address transport that can occur from traffic and other sources within the relatively flat, valley floor of the Sacramento Valley. Another significant consideration in expanding the nonattainment area was that the State relied on future mobile source controls at a statewide level to address NO<sub>x</sub> emissions and, therefore, discounted mobile sources as an important consideration in their analysis. EPA believes that there is a significant contribution from mobile sources, both commuting and commercial truck traffic, in Yuba and Sutter Counties.

The State recommended designating a portion of Yuba and Sutter Counties as nonattainment. EPA has taken this request under consideration, but finds that the information provided to date does not adequately support a partial county designation. Accordingly, all of Yuba and Sutter counties are included in EPA's intended designation. EPA will consider any additional information provided by the State in making final decisions on the designations.

**Factor 1: Emissions data**

For this factor, EPA evaluated county level emission data for the following PM<sub>2.5</sub> components and precursor pollutants: "PM<sub>2.5</sub> emissions total," "PM<sub>2.5</sub> emissions carbon," "PM<sub>2.5</sub> emissions other," "SO<sub>2</sub>," "NO<sub>x</sub>," "VOCs," and "NH<sub>3</sub>." "PM<sub>2.5</sub> emissions total" represents direct emissions of PM<sub>2.5</sub> and includes: "PM<sub>2.5</sub> emissions carbon," "PM<sub>2.5</sub> emissions other", primary sulfate (SO<sub>4</sub>), and primary nitrate. (Although primary sulfate and primary nitrate, which are emitted directly from stacks rather than forming in atmospheric reactions with SO<sub>2</sub> and NO<sub>x</sub>, are part of "PM<sub>2.5</sub> emissions total," they are not shown on Table 1 as separate items). "PM<sub>2.5</sub> emissions carbon" represents the sum of organic carbon (OC) and elemental carbon (EC) emissions, and "PM<sub>2.5</sub> emissions other" represents other inorganic particles (crustal). Emissions of SO<sub>2</sub> and NO<sub>x</sub>, which are precursors of the secondary PM<sub>2.5</sub> components sulfate and nitrate, are also considered. VOCs (volatile organic compounds) and NH<sub>3</sub> (ammonia) are also potential PM<sub>2.5</sub> precursors and are included for consideration.

Emissions data were derived from the 2005 National Emissions Inventory (NEI), version 1. See [http://www.epa.gov/ttn/naaqs/pm/pm25\\_2006\\_techinfo.html](http://www.epa.gov/ttn/naaqs/pm/pm25_2006_techinfo.html).

EPA also considered the Contributing Emissions Score (CES) for each county. The CES is a metric that takes into consideration emissions data, meteorological data, and air quality monitoring information to provide a relative ranking of counties in and near an area. Note that this metric is not the exclusive way for consideration of data for these factors. A summary of the CES is included in attachment 2, and a more detailed description can be found at [http://www.epa.gov/ttn/naaqs/pm/pm25\\_2006\\_techinfo.html#C](http://www.epa.gov/ttn/naaqs/pm/pm25_2006_techinfo.html#C).

Table 1 shows emissions of PM<sub>2.5</sub> and precursor pollutants components (given in tons per year) and the CES for violating and potentially contributing counties in Yuba and Sutter Counties. Summarized in the following table are PM<sub>2.5</sub> emissions data taken from the NEI for Yuba and Sutter County. The table includes direct PM<sub>2.5</sub> emissions, both total emissions and the carbon fraction, and emissions of PM<sub>2.5</sub> precursors, such as Sulfur Dioxide (SO<sub>2</sub>), Nitrogen Oxides (NO<sub>x</sub>), Ammonia (NH<sub>3</sub>) and Volatile Organic Compounds (VOCs).

County	State Recommended NA?	CES	PM <sub>2.5</sub> emissions Total	PM <sub>2.5</sub> Emissions Carbon	PM <sub>2.5</sub> Emission other	SO <sub>x</sub>	NO <sub>x</sub>	VOCs	NH <sub>3</sub>
Yuba	Yes (P)	18	677	372	305	372	3,342	3,357	3,342
Sutter	Yes (P)	100	1,805	801	1,004	189	5,878	4,314	1,590

P = partial

Additional data considered in EPA's analysis of this factor are summarized in the following table derived from the California Air Resources Board Almanac of Emissions and Air Quality Data (<http://www.arb.ca.gov/Aqd/almanac/almanac.htm>). The following table further defines, in tons per day, the type of area sources contributing to PM<sub>2.5</sub> emissions in Yuba and Sutter Counties. Area sources include residential fuel combustion, farming operations, construction/demolition, paved road dust, unpaved road dust, fugitive windblown dust, fires, managed burning and disposal and cooking. As is indicated, area sources represent the largest percentage of primary PM<sub>2.5</sub> emissions (approximately 70%) and the balance is divided between stationary and mobile sources.

<b>SOURCE</b>	<b>Sutter County</b>	<b>Yuba County</b>
Residential Fuel Combustion	0.63	0.62
Farming Operations	0.78	0.22
Construction/Demolition	0.06	0.02
Paved Road Dust	0.23	0.17
Unpaved Road Dust	0.23	0.28
Fugitive Windblown Dust	0.18	0.03
Fires	0.00	0.00
Managed Burning & Disposal	0.60	0.63
Cooking	0.03	0.02
Total Area Wide	2.75	2.00
Area Wide percent of total	64%	78%
Total All	4.31	2.55

Source: ARB Almanac website (2006) <http://www.arb.ca.gov/ei/maps/statemap/cntymap.htm>

Given the significance of NO<sub>x</sub> emissions in the formation of the PM<sub>2.5</sub>, EPA also considered emissions provided in the CARB Recommendation letter under this factor, along with the NO<sub>x</sub> data from NEI summarized in Table 1. The following table summarizes NO<sub>x</sub> emissions from stationary, area, and mobile source categories for 2006, 2010 and 2020.

<b>Sutter County</b>	<b>2006</b>	<b>2010</b>	<b>2020</b>
Stationary Sources	3.6	3.9	3.9
Area Sources	0.9	0.8	0.8
Mobile Sources	14.3	12.9	6.9
<b>Yuba County</b>			
Stationary Sources	0.7	0.7	0.7
Area Sources	0.5	0.5	0.5
Mobile Sources	6.2	6.6	4.9

Source: California Air Resources Board in their letter of December 17, 2007  
Note: Although provided by CARB, the 2010 and 2020 data was not relied on for this analysis.

Finally, speciation data from the Chico air monitoring station was considered in evaluating this factor as a way to link emission sources to high PM<sub>2.5</sub> levels. There was no such data for the Yuba monitor, so we considered another monitor that appeared representative. As shown in the pie chart below, the chemical makeup of PM<sub>2.5</sub> in Chico is dominated by organic carbon and ammonium nitrate when the highest concentrations occur, which is during the winter months (i.e., November through February).

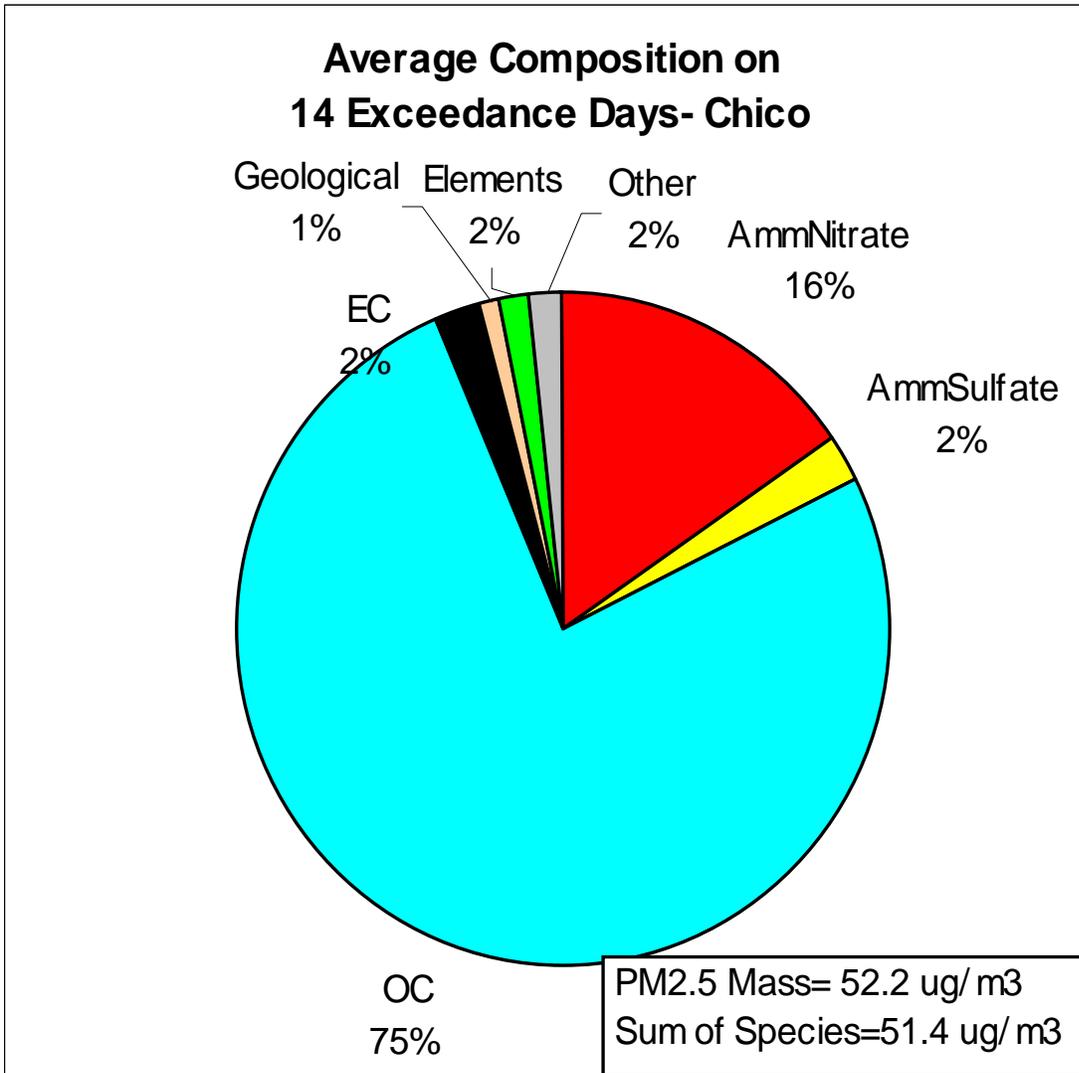


Figure 2

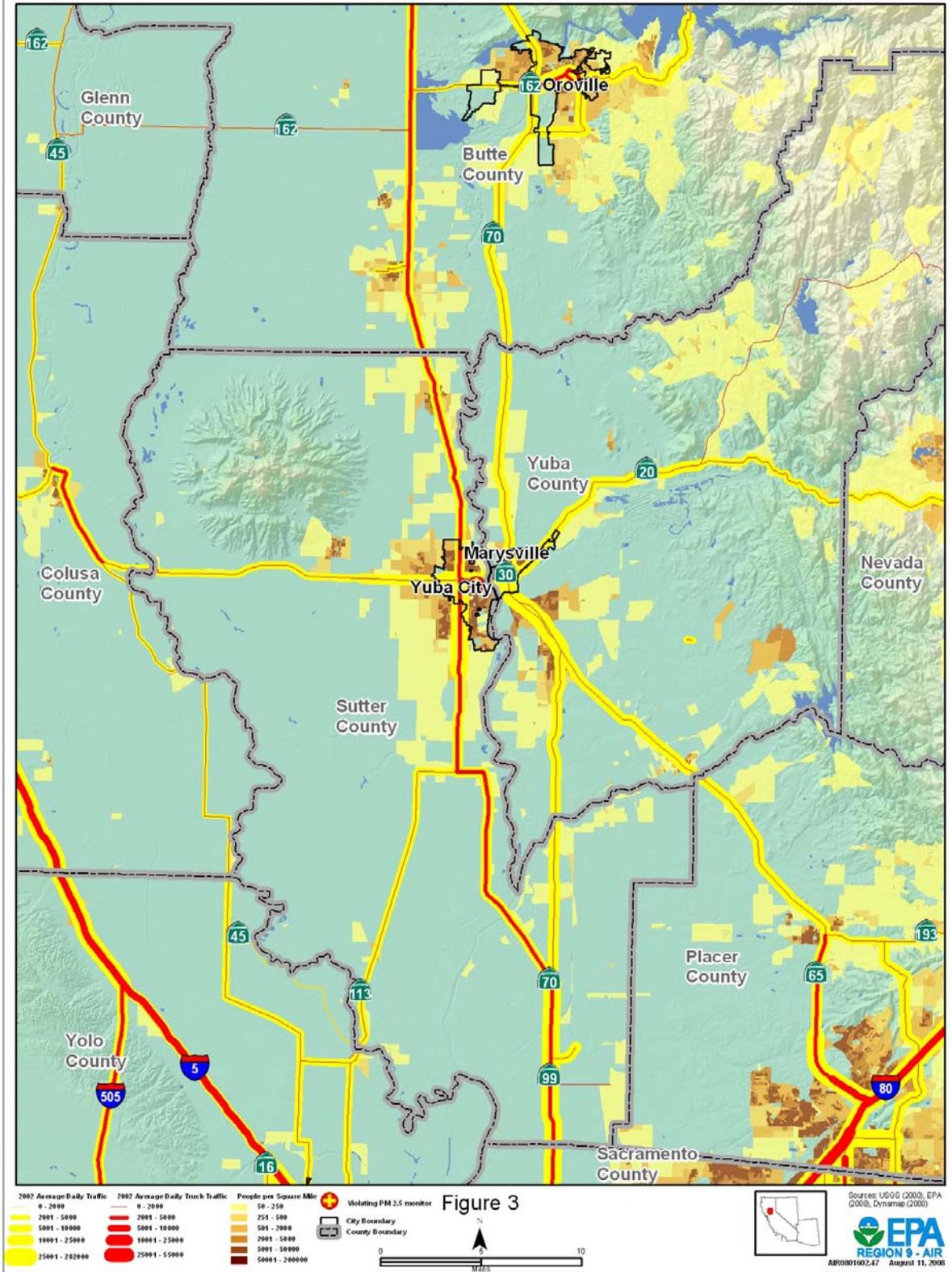
The CES shown in Table 1 describe the relative contribution of emissions from Sutter County to the high emission days in Yuba County based on a broad analysis of NOAA HYSPLIT trajectories linking county-wide emissions from Sutter County and Yuba County and speciated air monitoring data on high days. With respect to this factor, the CES does not show a significant link between the two counties even though the major cities within each county are part of the same metropolitan statistical area.

With respect to primary PM<sub>2.5</sub> emissions, area sources represent the dominant source category in both Yuba and Sutter Counties. Since speciation data was not available from the Yuba City monitor, speciation data from the Chico monitor was considered to be the most representative of these areas. Speciation data was considered in evaluating this factor as a way to link emission sources to high PM<sub>2.5</sub> levels. As shown in Figure 2, the chemical makeup of PM<sub>2.5</sub> in Chico is dominated by organic carbon. The highest concentrations occur during the winter months (i.e., November through February).

Based on Table 2, within the area source category, residential wood burning is the dominant source of  $PM_{2.5}$ . This corresponds with the speciation data summarized in Figure 2 which shows that as much as 75% of the  $PM_{2.5}$  makeup is carbon which can be attributed to residential wood burning during the winter months, assuming Chico is representative of Yuba City/Marysville.

Finally,  $NO_x$  emissions were considered. According to the speciation data in Figure 2, as much as 16% of the  $PM_{2.5}$  composition can be nitrates and thereby related to  $NO_x$  sources in the winter. Both Table 1 and 3 describe  $NO_x$  emissions data for Yuba and Sutter Counties and, as shown in Table 3, mobile sources are the dominant source of  $NO_x$  emissions. In light of the commuting patterns discussed under Factor 4 and illustrated in Figure 3, there appears to be a clear link between mobile source emissions and the  $PM_{2.5}$  exceedances measured in Yuba City.

# Yuba City/Marysville Population Density, Truck and Commuting Traffic



In summary, PM<sub>2.5</sub> exceedances most often occur in Yuba City during the winter months and speciation data suggest that residential wood burning and mobile source emissions are the most important sources. Area source data show that residential wood burning is the dominant source of PM<sub>2.5</sub> and there, could be linked to PM<sub>2.5</sub> exceedances measured in Yuba City. With respect to mobile sources, both Yuba and Sutter Counties have relatively significant mobile source emissions which, combined with the commuting patterns, suggest a link between exceedances in Yuba City and emissions from both counties.

**Factor 2: Air quality data**

This factor considers the 24-hour PM<sub>2.5</sub> design values in micrograms per cubic meter (µg/m<sup>3</sup>) for air-quality monitors based on data for the 2004-2006 and 2005-2007 period. A monitor’s design value indicates whether that monitor attains a specified air-quality standard. The 24-hour PM<sub>2.5</sub> standards are met when the 3-year average of a monitor’s 98<sup>th</sup> percentile values are 35 µg/m<sup>3</sup> or less. A design value is only valid if minimum data completeness criteria are met.

The violating monitor in the Yuba City/Marysville area is located in Yuba City in Sutter County, with a design value of 39µg/m<sup>3</sup> for 2005-2007. The 24-hour PM<sub>2.5</sub> design values for counties in the Yuba City/Marysville area are shown in Table 5.

<b>County/ City</b>	<b>State Recommended Nonattainment?</b>	<b>24-hr PM2.5 Design Values 2004-06 (µg/m<sup>3</sup>)</b>	<b>24-hr PM2.5 Design Values 2005-07 (µg/m<sup>3</sup>)</b>
Sutter County	Yes (P)	40	39
Yuba County,	Yes (P)	No data	No data

P = Partial County

Based on factor 2, Sutter County is a candidate for a PM<sub>2.5</sub> nonattainment designation. Although there is no monitor in Yuba County, it is important to note that the city of Marysville in Yuba County is part of a single urban area with Yuba City, and there are no topographic features that separates or distinguishes the two cities. Consequently both counties encompass the single urban area and need to be evaluated as PM<sub>2.5</sub> nonattainment areas.

In addition to considering design values, EPA also considered information supplied in the CARB recommendation letter regarding the area represented by PM<sub>2.5</sub> air monitoring data. Two studies cited by CARB support nonattainment area boundaries larger than the areas they recommended. The studies were both based on data collected during the 2000 California Regional PM<sub>10</sub>/PM<sub>2.5</sub> Air Quality Study (CRPAQS). These studies focused on the San Joaquin Valley which, together with the Sacramento Valley to the north, comprises California's Central Valley situated between the Sierra Nevada and the coastal mountain ranges. CARB cited the studies as showing that the organic carbon portion of PM<sub>2.5</sub> is largely urban rather than rural, because of the limited range of influence of PM<sub>2.5</sub> monitors (which are in urban areas). While it is likely true that organic carbon concentrations are higher in urban than in rural areas, this does not in itself support nonattainment areas limited to city boundaries.

Range of influence (or zone or radius of representation) can be defined in various ways. In the 2006 Chow study cited by CARB, zone of representation is defined as the area over which the average concentration differs less than 10% from the monitored value and this area was estimated based on concentration differences between monitors. A rapid concentration drop from one monitor to another nearby monitor would show a small zone of representation while a slow concentration drop between distant monitors would show a large zone. The study found the radius of representation to range from 3 km to 21 km (2 mi to 13 mi) and averaging 13 km (8 mi). This study included monitoring locations in the Sacramento Valley location which were intended to describe the spatial distribution of concentrations and not to set boundaries for planning purposes. However, they do suggest the size of the area that is represented by a PM<sub>2.5</sub> air monitor.

In a second study using CRPAQS data, MacDonald et al. defined "zone of influence" as the distance at which CALPUFF-modeled concentrations fell to 1/10 of the urban maximum. This analysis showed larger regions of influence in the Sacramento area, 15-100 km (9-60 mi), than in the San Joaquin Valley, 15-50 km (9-30 mi).

Considering the results from these studies, EPA used buffer zones of 5 and 10 miles around city boundaries to approximate the area which could be influenced by PM<sub>2.5</sub> measurements in Yuba City. These boundaries are shown in Figure 4.

# Yuba City/Marysville - City Boundaries and Buffer Zones

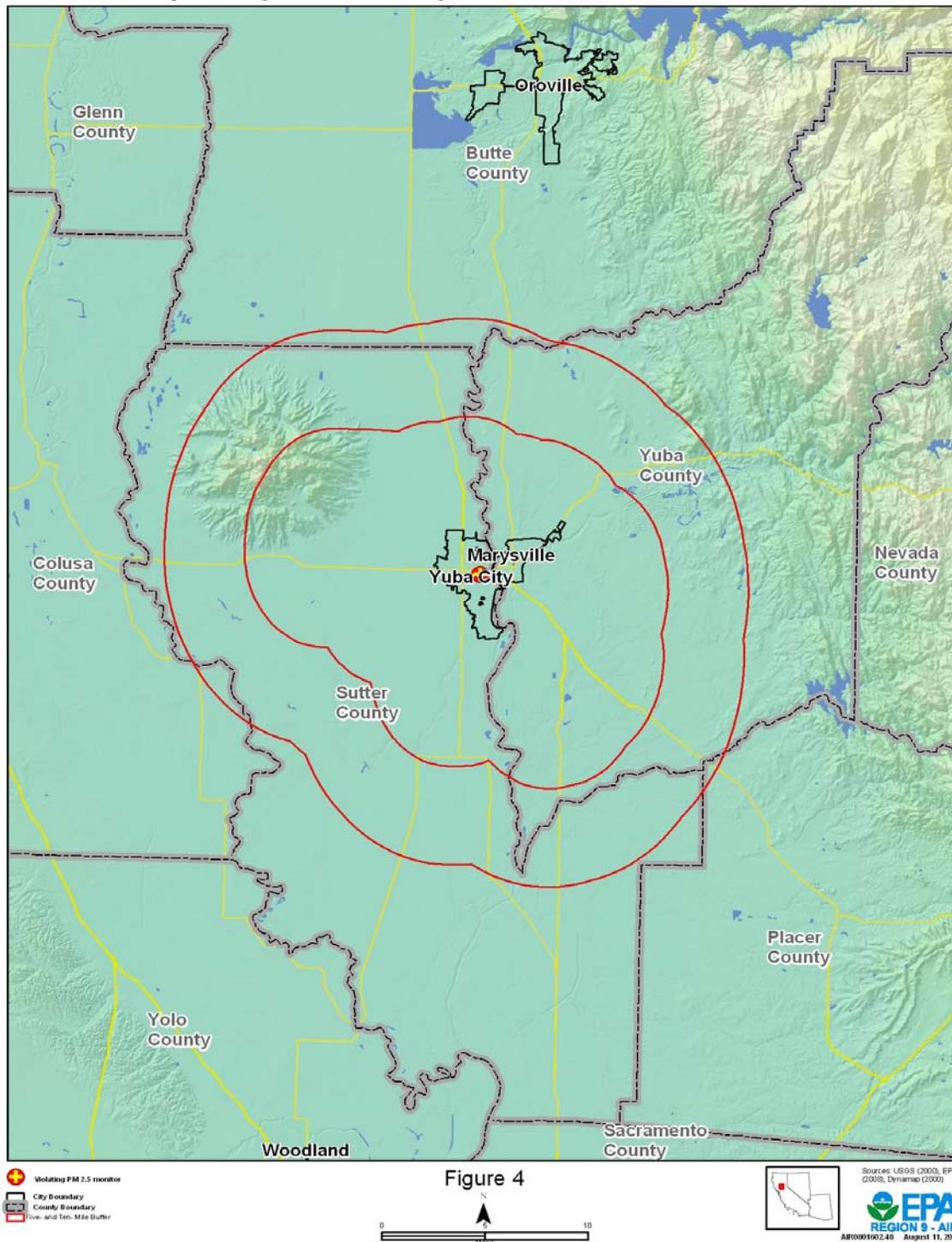


Figure 4

Eligible monitors for providing design value data generally include State and Local Air Monitoring Stations (SLAMS) at population-oriented locations with a FRM or FEM monitor. All data from Special Purpose Monitors (SPM) using an FRM, FEM, or Alternative Reference Method (ARM) which has operated for more than 24 months is eligible for comparison to the relevant NAAQS, subject to the requirements given in the October 17, 2006 Revision to Ambient Air Monitoring Regulations (71 FR 61236). All monitors used to provide data must meet the monitor siting and eligibility requirements given in 71 FR 61236 to 61328 in order to be acceptable for comparison to the 24-hr PM<sub>2.5</sub> NAAQS for designation purposes.

**Factor 3: Population density and degree of urbanization (including commercial development)**

Population data are relevant in defining the boundaries of the PM<sub>2.5</sub> nonattainment area given the correlation between population and the emission sources contributing to PM<sub>2.5</sub> exceedances (i.e., residential wood burning and mobile sources), as well as the population exposed to high PM<sub>2.5</sub> levels. Table 6 summarizes 2005 population and population density data (population per square mile) for each county in the area being evaluated and Figure 3 shows the distribution of populations in Sutter and Yuba County.

<b>Table 6. Population</b>			
<b>County</b>	<b>State Recommended Nonattainment?</b>	<b>2005 Population</b>	<b>2005 Population Density (pop/sq mi)</b>
Sutter	Yes (P)	89,005	146
Yuba	Yes (P)	67,144	104

P = partial

Both Sutter and Yuba Counties have moderate population numbers and a relatively higher population density. In addition to the recommended area of Yuba City/Marysville, Figure 3 indicates there is significant population in areas outside the boundaries of these two cities, radiating out from the center, but entirely within Yuba and Sutter counties. This factor supports expanding the nonattainment boundary to capture these surrounding populations.

**Factor 4: Traffic and commuting patterns**

This factor considers the number of commuters in each county who drive to a violating area, the percent commuting to a violating area, the number of vehicles commuting into a statistical area, as well as the total Vehicle Miles Traveled (VMT) for each county in thousands of miles. This data is summarized in Table 7 and shown in Figure 3. A county with numerous commuters is generally an integral part of an urban area and could be an appropriate county for implementing mobile-source emission control strategies, thus warranting inclusion in the nonattainment area.

<b>County</b>	<b>State Recommended Nonattainment?</b>	<b>2005 VMT (1000s mi) 2005</b>	<b>Number Commuting to any violating county</b>	<b>Percent Commuting to any violating county</b>
Sutter	Yes (P)	757	20,410	67%
Yuma	Yes (P)	497	6,420	29%

Although Yuba County’s contribution to traffic levels in Sutter County is small (29%), these data may not adequately take into account heavy-duty diesel truck traffic. Highway 99 traverses both Yuba and Sutter Counties with daily average truck traffic in the range of 5,001 to 10,000 trucks. In addition, Highway 65 crosses Yuba County with daily average traffic ranging from 10,001 to 25,000 cars. Therefore, both counties have a high level of traffic not associated with commuting, which could also contribute to PM<sub>2.5</sub> emissions in this area.

The 2005 VMT data used for Tables 5 and 6 of the 9-factor analysis has been derived using methodology similar to that described in “Documentation for the final 2002 Mobile National Emissions Inventory, Version 3, September 2007, prepared for the Emission Inventory Group, U.S. EPA. This document may be found at:

[atftp://ftp.epa.gov/EmisInventory/2002finalnei/documentation/mobile/2002\\_mobile\\_nei\\_version\\_3\\_report\\_092807.pdf](http://ftp.epa.gov/EmisInventory/2002finalnei/documentation/mobile/2002_mobile_nei_version_3_report_092807.pdf). The 2005 VMT data were taken from documentation which is still draft, but which should be released in 2008.

#### **Factor 5: Growth rates and patterns**

This factor looks at expected population for 2000-2005 and growth in vehicle miles traveled (VMT) for 1996-2005 for Yuba and Sutter Counties. Table 8 lists counties in descending order based on VMT growth between 1996 and 2005.

<b>County</b>	<b>Population (2005)</b>	<b>2005 Population Density</b>	<b>Population % change (2000 - 2005)</b>	<b>2005 VMT (millions mi)</b>	<b>VMT % change from 1996-2005</b>
Sutter	89,005	146	12%	757	23
Yuba	67,144	104	11%	497	(6)

While both Sutter and Yuba Counties experienced population growth from 2000 to 2005, only Sutter County had a growth in VMT (23%) for the years 1996 to 2005 while Yuba County experienced a decrease of 6% during the years 1996 to 2002.

Based on the amount of population growth from 2000 to 2005, and despite the decrease in VMT from 1996 to 2005, Yuba County can still be considered a candidate for PM<sub>2.5</sub> nonattainment status. Sutter County should be considered due to increases in population growth and VMT.

## **Factor 6: Meteorology (weather/transport patterns)**

For this factor, EPA considered data from National Weather Service instruments in the area. Wind direction and wind speed data for 2004-2006 were analyzed, with an emphasis on “high PM<sub>2.5</sub> days” for each of two seasons (an October-April “cold” season and a May-September “warm” season). These high days are defined as days where any FRM or FEM air quality monitors had 24-hour PM<sub>2.5</sub> concentrations above 95% on a frequency distribution curve of PM<sub>2.5</sub> 24-hour values, or where 24-hour values exceeded 35 µg/m<sup>3</sup>.

For each air quality monitoring site, EPA developed a “pollution rose” to understand the prevailing wind direction and wind speed on the days with highest fine particle concentrations. The figure identifies 24-hour PM<sub>2.5</sub> values by color; days exceeding 35 µg/m<sup>3</sup> are denoted with a red or black icon. A dot indicates the day occurred in the warm season; a triangle indicates the day occurred in the cool season. The center of the figure indicates the location of the air quality monitoring site, and the location of the icon in relation to the center indicates the direction from which the wind was blowing on that day. An icon that is close to the center indicates a low average wind speed on that day. Higher wind speeds are indicated when the icon is further away from the center.

The pollution rose for Sutter County below (Figure 5) indicates that the elevated levels of the PM<sub>2.5</sub> 24-hour values for the Yuba City monitoring site occur primarily when the wind is from the south, and occasionally when the wind is from the north. The pollutant rose for Sutter County also indicates that elevated PM<sub>2.5</sub> 24-hour values occur during the cool season, during time periods of low wind speeds.

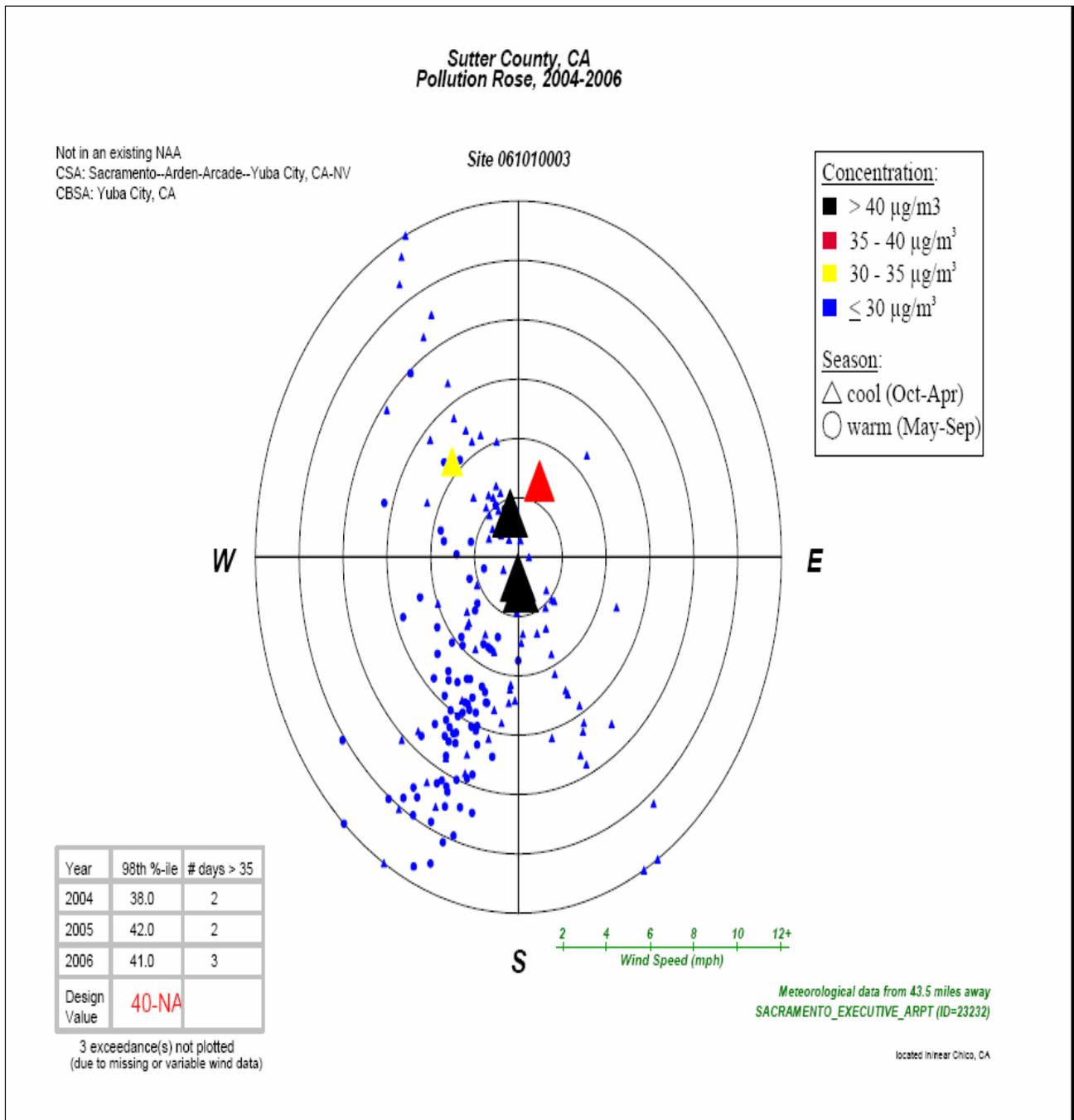


Figure 5

The analysis provided by California stated that for Yuba City/Marysville:

“ . . . cool temperatures, low windspeeds, low inversion layers, and high humidity during the late fall and winter favor the formation of ammonium nitrate, while sunny warmer conditions during the spring and summer favor the formation of ammonium sulfate, as well as the formation of secondary organic aerosols.”

The pollutant rose data are consistent with the analysis provided by California, and may also support the CARB position that the organic carbon portion of the particulate matter problem is localized. However, as discussed in Factor 2: Air Quality, above, and shown in Figure 3, the buffer zones of 5 and 10 miles around city boundaries approximate the area which could be influenced by PM<sub>2.5</sub> measurements in Yuba City/Marysville. Therefore, the presumptive boundary of the city limits appears to be inappropriately small for taking into account the area influenced by the PM<sub>2.5</sub> measurements in Yuba City.

This factor, together with Factors 1 and 2, supports the EPA proposal that all of Yuba and Sutter Counties be considered for designation as a nonattainment area for the 24-hour PM<sub>2.5</sub> standard.

The meteorology factor is also considered in each county's Contributing Emissions Score because the method for deriving this metric included an analysis of trajectories of air masses for high PM<sub>2.5</sub> days.

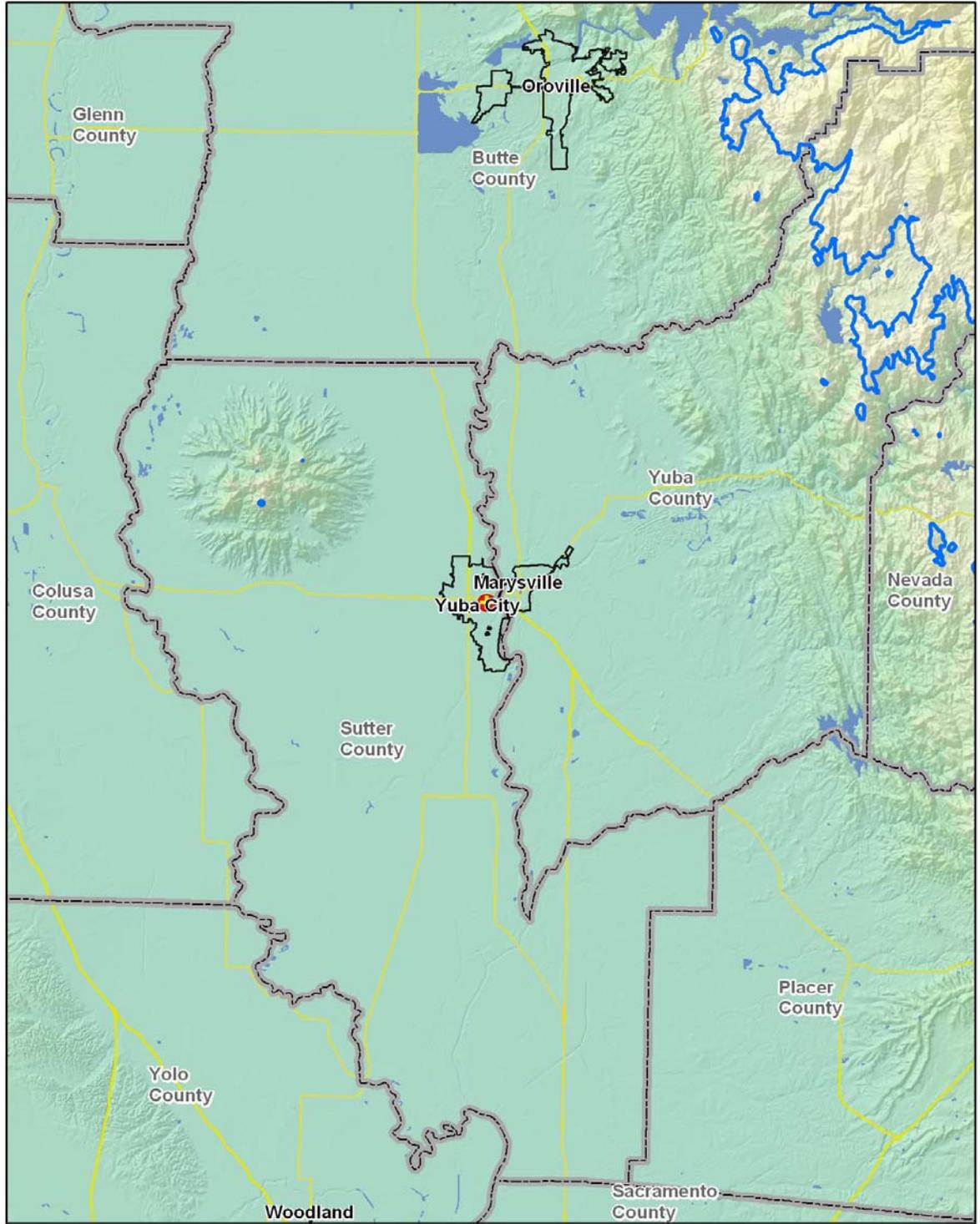
#### **Factor 7: Geography/topography (mountain ranges or other air basin boundaries)**

The geography/topography analysis looks at physical features of the land that might have an effect on the air shed and, therefore, on the distribution of PM<sub>2.5</sub> over the Yuba City/Marysville area.

As shown in Figure 6, Yuba City (with the violating monitor) is in Sutter County, while Marysville is directly across the Feather River in Yuba County. Together, the two counties encompass 1,234 square miles. The Feather River AQMD, which is the local jurisdiction for both cities, is part of the larger Northern Sacramento Valley Air Basin (NSVAB). The NSVAB is bounded on the north and west by the Coastal Mountain Range and on the east by the southern portion of the Cascade Mountain Range and the northern portion of the Sierra Nevada Mountains. Although a significant area of the NSVAB is above 100 feet sea level, the majority of the Feather River AQMD is located in the relatively flat, valley floor and foothill regions. The valley is often subjected to inversion layers that, coupled with geographic barriers and high summer temperatures, create a high potential for air pollution problems.

The eastern portion of Yuba County extends into the foothills of the Sierra Nevada Mountains. The height of an inversion layer in this area is at approximately 1,500 feet above sea level. The part of Yuba County that is above this height includes the far eastern 1/3 of the county. Because the Yuba area has topographical features higher than the typical daytime height of the inversion layer, EPA considered the inversion height to estimate the size of the area likely to have similar pollution conditions, and to determine an appropriate eastern boundary. To get a sense of the eastern edge of area in which pollution could be confined, EPA examined the Sierra foothills elevation contour that is 1,500 feet. This contour is represented in Figure 6, below.

# Yuba City/Marysville - Inversion Layer Boundary



- ⊕ Violating PM 2.5 monitor
- ▭ City Boundary
- ▭ County Boundary
- 1,500-foot Inversion Layer

Figure 6



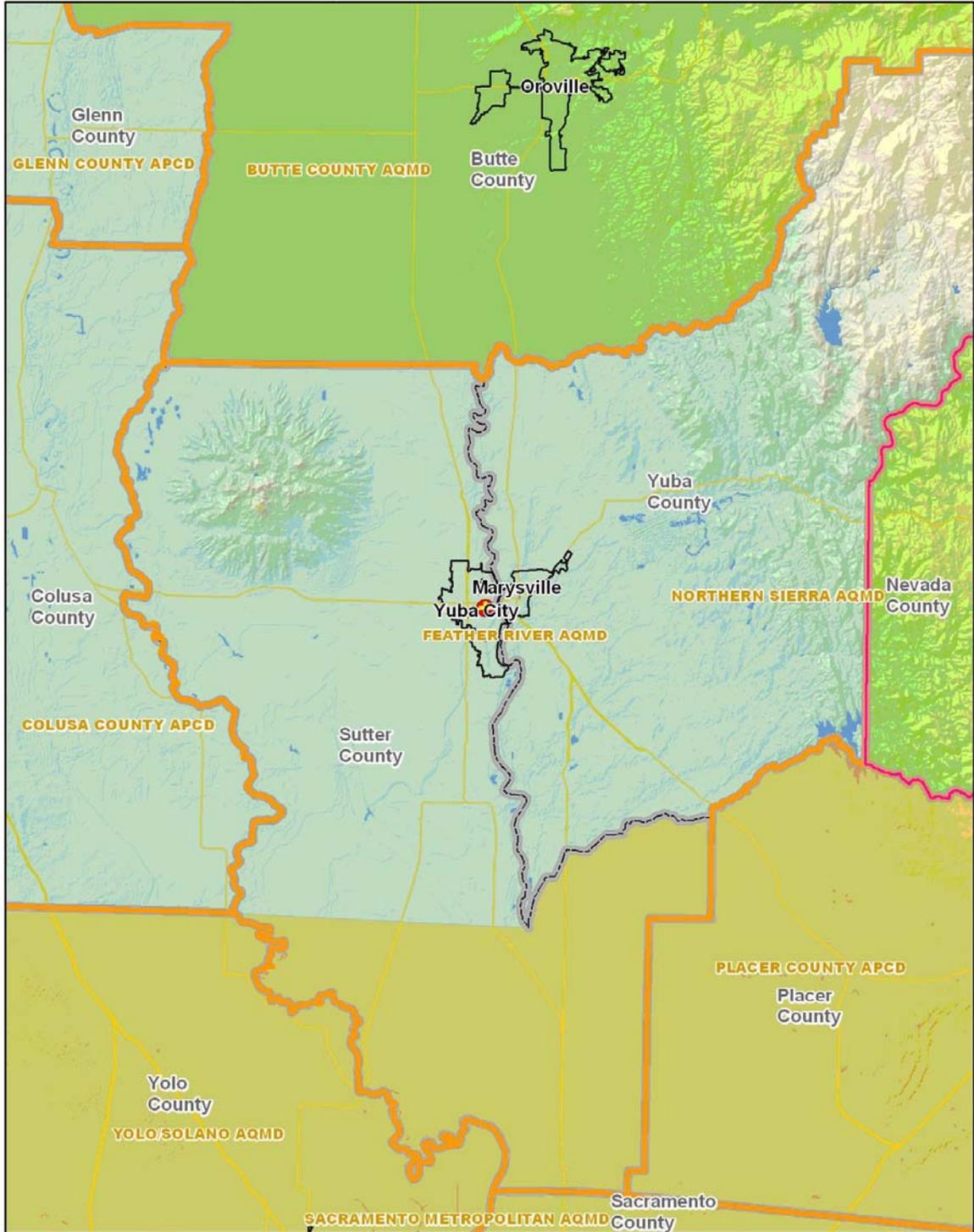
Sources: USGS (2000), EPA (2000), Dynamap (2000)  
**EPA**  
REGION 9 - AIR  
AR0001602-09 August 11, 2006

For the areas under consideration, high PM<sub>2.5</sub> concentrations mostly occur during stagnant conditions during winter, with radiation inversions. The cooling of the ground, as heat is radiated away, creates an inversion, since air near the ground is cooler than that above. This inhibits mixing and confines pollutants to a relatively shallow layer near the ground. Ferreria and Shipp examined the meteorology of San Joaquin Valley PM<sub>2.5</sub> and PM<sub>10</sub> episodes, including inversion heights, typically based on aircraft temperature soundings. (During CRPAQS, radio acoustic sounding system (RASS) data were also available.) A typical value for maximum mixing height during high PM<sub>2.5</sub> conditions is 500 m. (Minimum mixing height can be 100 m or less.)

EPA recognizes that an inversion height is not a rigid boundary extending through a fixed elevation. In reality, the inversion would be partly terrain-following, and the degree of stagnation would be subject to additional influences at the foothill edges, such as strong diurnal slope flows. In any case, the mixing heights vary substantially by site and date, so any single height can provide only a scale for comparison, not a definitive value. Nevertheless, this contour gives a rough sense of the area over which inversions may be enhancing pollution concentrations. The contour extends 10 or more miles beyond the 10-mile buffer zones described above, providing additional support for nonattainment areas larger than city boundaries.

EPA considered the buffer zones and the inversion layer when looking at the boundary for the Yuba and Sutter County nonattainment area. That information, plus the information in Factors 3 and 4 argued for a nonattainment boundary that extended beyond the city limits of Marysville and Yuba City. EPA does not have adequate information to exclude any part of Yuba and Sutter Counties at this time.

# Yuba City/Marysville - Air Districts, Air Basins



**2008 8-Hour Ozone Designations**

- Subpart 2/Extreme\*
- Subpart 2/Severe-17\*
- Subpart 2/Severe-15\*
- Subpart 2/Seious\*
- Subpart 2/Moderate
- Subpart 2/Marginal
- Subpart 1
- Unclassifiable/Attainment

Figure 7



Source: USGS (2000), EPA (2008, Dynamics (2008))  
**EPA**  
 REGION 9 - AIR  
 ABR0001002.19 August 11, 2008

**Factor 8: Jurisdictional boundaries (e.g., existing PM and ozone areas)**

The analysis of jurisdictional boundaries considered the planning and organizational structure of the Yuba City/Marysville area to determine if the implementation of controls in a potential nonattainment area can be carried out in a cohesive manner.

The State's recommendation for the combined city limits of Marysville and Yuba City does not include the existing urban population, and therefore, is not a reasonable boundary for a new nonattainment area. Both Yuba and Sutter counties are located in the Northern Sacramento Valley Air Basin and share the same meteorology and topography. As shown in Figure 7, the Feather River Air Quality Management District includes Sutter and Yuba Counties in their entirety. Despite the fact that only Sutter County has a violating monitor, and that only part of Sutter County was designated as nonattainment for the 8-hour ozone standard (Sutter Buttes), both Counties are candidates for the PM<sub>2.5</sub> nonattainment status based on the shared meteorology and geography, and they both are under the jurisdiction of the Feather River Air Quality Management District. This argues for including both Yuba and Sutter Counties in the Feather River PM<sub>2.5</sub> nonattainment area.

**Factor 9: Level of control of emission sources**

This factor considers emission controls currently implemented for major sources in Yuba and Sutter Counties.

The emission estimates on Table 1 (under Factor 1) include any control strategies implemented by Yuba and Sutter Counties before 2005 that may influence emissions of any component of PM<sub>2.5</sub> emissions (i.e., total carbon, SO<sub>2</sub>, NO<sub>x</sub>, and crustal PM<sub>2.5</sub>).

## Attachment 2

### Description of the Contributing Emissions Score

The CES is a metric that takes into consideration emissions data, meteorological data, and air quality monitoring information to provide a relative ranking of counties in and near an area. Using this methodology, scores were developed for each county in and around the relevant metro area. The county with the highest contribution potential was assigned a score of 100, and other county scores were adjusted in relation to the highest county. The CES represents the relative maximum influence that emissions in that county have on a violating county. The CES, which reflects consideration of multiple factors, should be considered in evaluating the weight of evidence supporting designation decisions for each area.

The CES for each county was derived by incorporating the following significant information and variables that impact PM<sub>2.5</sub> transport:

- Major PM<sub>2.5</sub> components: total carbon (organic carbon (OC) and elemental carbon (EC)), SO<sub>2</sub>, NO<sub>x</sub>, and inorganic particles (crustal).
- PM<sub>2.5</sub> emissions for the highest (generally top 5%) PM<sub>2.5</sub> emission days (herein called “high days”) for each of two seasons, cold (Oct-Apr) and warm (May-Sept)
- Meteorology on high days using the NOAA HYSPLIT model for determining trajectories of air masses for specified days
- The “urban increment” of a violating monitor, which is the urban PM<sub>2.5</sub> concentration that is in addition to a regional background PM<sub>2.5</sub> concentration, determined for each PM<sub>2.5</sub> component
- Distance from each potentially contributing county to a violating county or counties

A more detailed description of the CES can be found at [http://www.epa.gov/ttn/naaqs/pm/pm25\\_2006\\_techinfo.html#C](http://www.epa.gov/ttn/naaqs/pm/pm25_2006_techinfo.html#C).