Technical Support

PM2.5 Designation Recommendations

The California Air Resources Board (ARB) continues to support our original recommendations transmitted to the United States Environmental Protection Agency (U.S. EPA) in December 2007. The U.S. EPA responded to the recommendation (U.S. EPA Response) on August 18, 2008. This document supplies additional support for ARB's recommendations.

In a memorandum dated June 8, 2007 from Robert Meyers, Acting Assistant Administrator, U.S. EPA identified the most important factors for States and Tribes to consider when making area designation recommendations. Specifically, demonstrations should show that,

1. violations are not occurring in the excluded portions of the recommended area, and
2. the excluded portions do not contain emission sources that contribute to the observed violations.

This addendum will address those two requirements in regard to the recommended nonattainment areas. In addition, prior to discussing each individual area, ARB is providing other issues that U.S. EPA should take into consideration when making the final nonattainment boundary decisions.

Size and Nature of Affected Areas

One of the primary issues that must be addressed when discussing the boundaries of a nonattainment area in California is the large size of California counties versus other states. The average area of a California county is 2,822 square miles, yet the average county size in the United States is 622 square miles. Alaska and Arizona are the only states with larger average county size (Table 1). The average California county is over 4 ½ times the average U.S. county; many as large, if not larger, than entire states. In many cases, California counties contain one or two urbanized regions and large stretches of sparsely populated areas.

Much of the nine-factor analysis utilized by U.S. EPA to determine PM2.5 nonattainment areas is based on a county level. This presents some unusual challenges for California. For instance, applying county-wide vehicle miles traveled (VMT) statistics to a large California county misrepresents differences that may exist in VMT urban and rural areas in that county, or between two widely separated urban areas in the same county. Throughout this submittal, we offer alternative approaches to analyzing the nine factors when county size presents a particular problem. This problem is most evident in Imperial County where the three main urban areas represent only one percent of the county (in square miles) recommended as a nonattainment area. The remaining 99 percent of the county is sparsely populated.

Table 1. Examples of County Area by State

State	**Mean County Area** (mi^2)
Alaska	39015
Arizona	7600
California	*2822*
Texas	1057
New York	880
Connecticut	693
Iowa	568
Ohio	509
Tennessee	444
Georgia	374
Rhode Island	243

Consistent Nonattainment Areas

Air quality planning in California is based primarily on air basin and air district boundaries if the pollution problem is of a regional nature. Although ARB generally uses a combination of air district and air basin lines to set the boundaries for areas violating California air quality standards, exceptions are made when a smaller area, such as a single city, exhibits an air quality issue distinct from the surrounding region. For example, due to the nature of the pollutant problem in Imperial County, only the City of Calexico is considered nonattainment for the State PM2.5 standard.

One of U.S. EPA's goals in designating nonattainment areas in California was to achieve a degree of consistency with existing ozone and PM10 nonattainment areas. Application of this goal in California led to differences between the State's recommended nonattainment areas and U.S. EPA's proposed designations. U.S. EPA expanded many of the State's recommended PM2.5 nonattainment areas boundaries to match 8-hour ozone nonattainment area boundaries. However, we do note areas throughout the country where U.S. EPA proposed PM2.5 nonattainment area designations are not consistent with existing 8-hour ozone nonattainment area boundaries. Examples are shown in Table 2.

Table 2. U.S. Examples of Excluded Areas Not Consistent With 8-Hour Ozone Nonattainment Boundaries

Excluded County, State	**Previous 8-hour Ozone Nonattainment Area**
Warren County NJ	New York-N. New Jersey-Long Island, NY-NJ-CT
Cecil County MD	Philadelphia-Wilmington-Atlantic City, PA-NJ-MD-DE
Salem County NJ	
Jefferson TN	Knoxville, TN
Sevier Counties TN	
Christian County KY	Clarksville-Hopkinsville, TN-KY
Geauga County OH	Cleveland-Akron-Lorain, OH
Clinton County OH	Cincinnati-Hamilton, OH-KY-IN
Knox and Madison Counties OH	Columbus, OH

Some of these areas were excluded based on the nature of the pollutant. PM2.5 is comprised of both primary and secondary components; the primary being more localized. ARB requests that U.S. EPA recognize the technical basis for different boundaries for regional ozone and localized PM2.5.

Additional Information – Area Specific

1. City of Calexico, Imperial County Air Pollution Control District

The only monitor in Imperial County violating the new federal PM2.5 standard is located in the City of Calexico. Data from air quality monitors in El Centro and Brawley, as shown in Figure 1-1, are well below the new standard and about 45% lower than Calexico (2007 Design Values are indicated in the colored circles). Calexico has 24% of the population of Imperial County within its boundaries (Table 1-1) with the second largest population and the highest population density. The largest population area, El Centro, only nine miles north of Calexico, is in attainment of the standard.

The majority of the county is largely unpopulated. Only 14% of the population resides outside of the urbanized areas, the majority of these still within the narrow area stretching from Mexico to the Salton Sea. Most of the population, however, lives in areas that attain the standard. Confining the nonattainment area to the City of Calexico would still ensure protection for the population exposed to unhealthy levels of PM2.5.

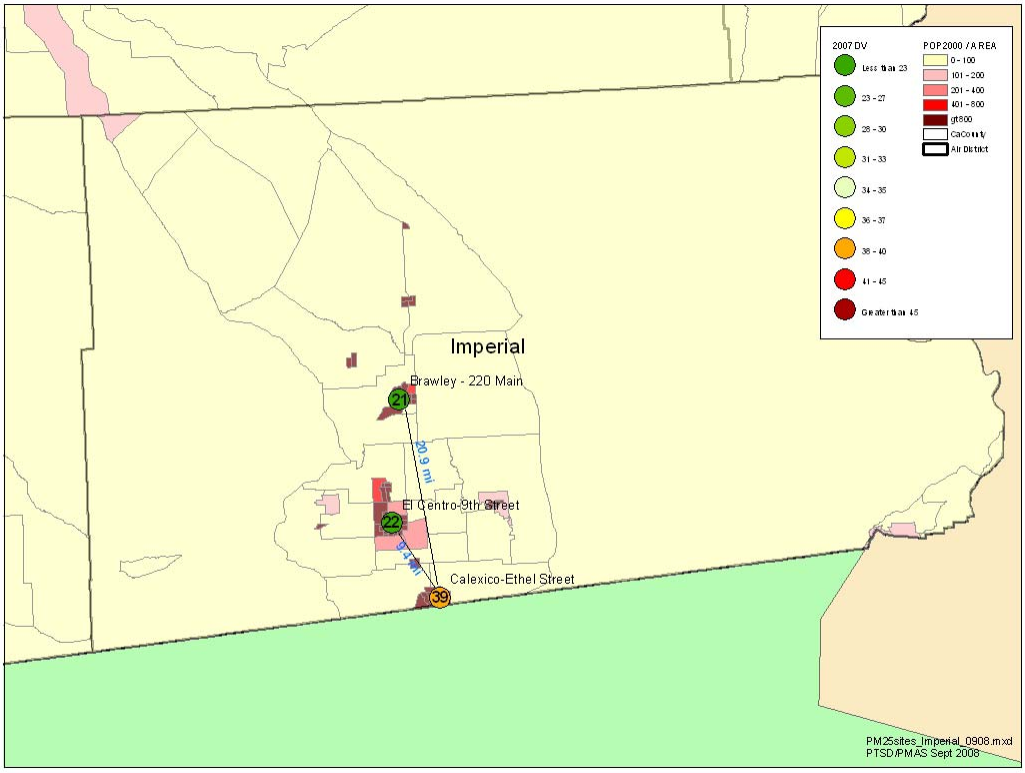

Figure 1-1: 2007 Design Values in Imperial County

The City of Calexico is located next to the Mexico international border. As seen in the satellite view in Figure 1-2, the urban area of Mexicali, Mexico is considerably larger than that of Calexico. Table 1-1 shows the disparity in both population and physical

size; Calexico accounts for only 5% of the population and 4% of the land area of the combined Calexico/Mexicali urban area, a metropolis separated by a nonphysical international border. The population density of Imperial County is less than a fifth of the Municipality of Mexicali, in an area of roughly the same size. A similar situation is faced at the border area of Nogales, AZ (population: 21,746). The Mexican city of Nogales (population: 203,719), with a much higher population and population density, is separated from Nogales, AZ only by a political boundary. This population disparity was noted by U.S. EPA in considering the Nogales area as a focused nonattainment area for PM2.5, retaining the rest of Santa Cruz County in attainment. ARB believes that air quality in the City of Calexico is similarly overwhelmed by the much larger City of Mexicali across the border and requests similar consideration.

Figure 1-2: Calexico and Mexicali Satellite Image
[Source: maps.google.com]

Table 1-1: Population of Calexico/Mexicali Border Region

Area	Population (2006 est.)	Area (mi^2)
Imperial County	160,301	4,598
El Centro	40,563	10
Calexico	37,243	9
Mexicali Municipality	873,937	5,200
Mexicali	653,046	200

[Data Source: U.S. Census [www.census.gov/; CONAPO [www.conapo.gob.mx]

The U.S. EPA states, “Imperial County shows violations of the 24-hour PM2.5 standard. Therefore, this county is a candidate for a 24-hour PM2.5 nonattainment designation (U.S. EPA Response, p.8).” Calexico, the only violating area of Imperial County, comprises only 1% of the county area. When Imperial County was designated as nonattainment for both PM10 and ozone, consideration was given for both the regional nature of the pollution sources and the presence of violating monitors throughout the county. This is not the case, however, for PM2.5. Both the presence of a single violating monitor, as well as the impact from Mexicali, argue for a focused nonattainment area, as originally recommended by ARB.

The Imperial Valley operates as a channel running northwest to southeast. Wind flow patterns tend to flow along this channel, from the northwest into Mexicali, and from the southeast into Calexico. Although the geography of the Imperial Valley is such that there are no topographical barriers that separate the City of Calexico from the rest of Imperial County, the significantly lower concentrations to the north (Figure 1-1 and Table 1-2) show that distance is enough of a barrier to keep the northern urban population from being exposed to levels above the standard.

Table 1-2: Exceedance Days at Calexico-Ethel

Date	Concentrations (ug/m3)		
	Calexico	El Centro	Brawley
12/12/05	67.6	57.9	19.9
12/18/05	41.1	34.1	**37.8**
1/8/06	44.8	12.7	20.3
1/14/06	49.6	23.2	n/a
1/17/06	37.1	16.4	n/a
12/22/06	46.0	16.5	11.7
12/25/06	68.8	9.6	8.5
12/5/06	52.7	20.9	19.5

Hysplit model results (U.S. EPA Response, Attachment 2) implied a contribution from emissions throughout Imperial County to elevated levels at the Calexico-Ethel site. As noted above, however, other sites in the county showed much lower concentrations during Calexico exceedance days, indicating that the high concentrations at Calexico were unlikely to be due to a northern influence. In fact, the two highest PM2.5 exceedance days coincide with PM10 exceedances being documented by the Imperial County Air Pollution Control District as due to transport from Mexicali.

The U.S. EPA noted two days with potential northern influence. ARB staff conducted further analysis using two-dimensional wind trajectory models (Figure 1-3). The first part of the figure (a) shows stagnant conditions present on January 8, 2006. The blue trajectory line indicates that the air parcel moved very little during the day. The second part of the figure (b), from January 17, 2006, shows a more northern flow, but concentrations at El Centro were half that of Calexico (no data available from Brawley on that day), indicating very limited influence from the northern portion of the county.

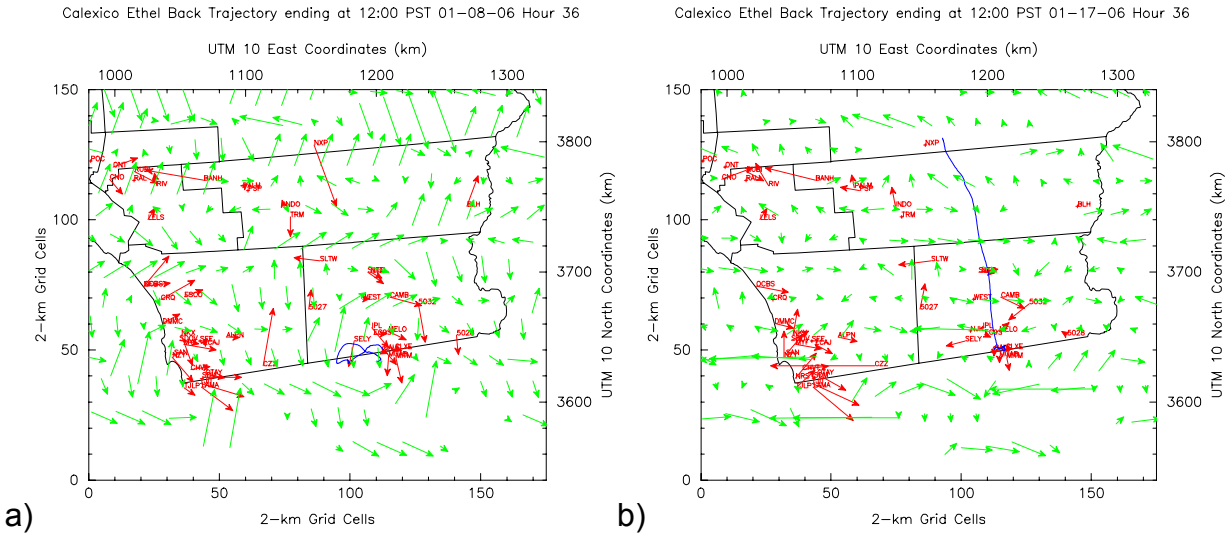

Figure 1-3: 2-D Wind Trajectory Model Results, Calexico-Ethel, Imperial County

Additionally, BAM concentrations on these two exceedance days show a strong correlation with wind from the south (Figure 1-4). The red boxes outline the flow from the south (90-270 degrees); the blue boxes indicate the increased PM2.5 concentrations associated with these winds.

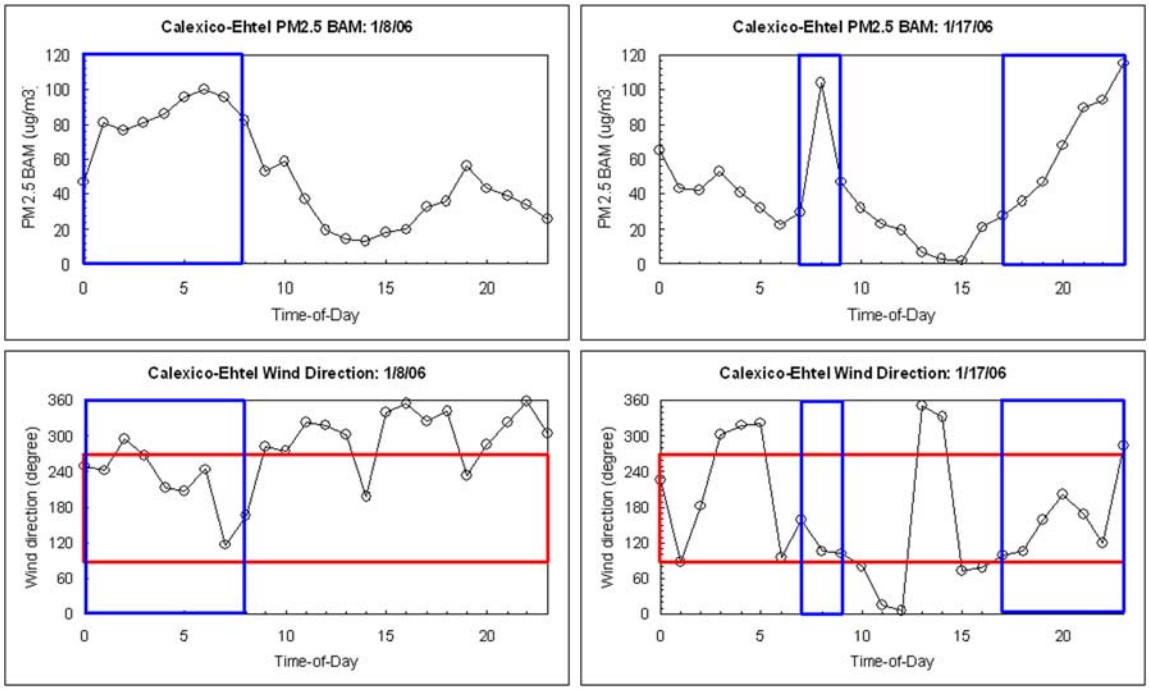

Figure 1-4: Correlation between PM2.5 BAM Concentrations and Wind Direction

Research into PM10 concentration differences between Mexicali and Calexico (Chow, et.al., 2000) showed that average cross-border transport of PM10 from Mexico was

three times higher than from the U.S. The study showed that Mexicali's PM10 concentrations were almost double those at Calexico. Although the relative source contributions between the two sites were found to be similar, the absolute source contributions at the Mexicali site were three to seven times that at the Calexico site. The researchers suggested that increased charbroiling in Mexicali during the major holiday season (mid December to early January) accounted for the difference; the same period of time as the PM2.5 exceedances at Calexico-Ethel.

As noted in the U.S. EPA Response (Table 1, p.5) , the emissions inventory for Imperial County shows a 24% contribution from carbon. Chemical composition data for Calexico specifically from exceedance days at Calexico shows an organic carbon contribution of over 50% (Figure 1-5). The seasonal pattern (Figure 1-6) shows the strong wintertime increase in organic carbon. We believe the majority of these carbon emissions are the result of transport from the City and Municipality of Mexicali, Mexico, where residential trash and wood burning are largely unregulated. In addition, the majority of the exceedance days noted in Table 1-2 occurred during the December/January time period when there are increased volumes of smoke across the border, as evidenced in Figures 1-10 and 1-11. These emissions, while large, tend to remain in the local area, as shown by a comparison to PM2.5 concentrations at Brawley, a site further removed from the border influence (Figure 1-7). Very little variation in PM2.5 concentrations is seen throughout the year. Calexico, however, as indicated by the trend line shown in red, shows a distinct increase in winter.

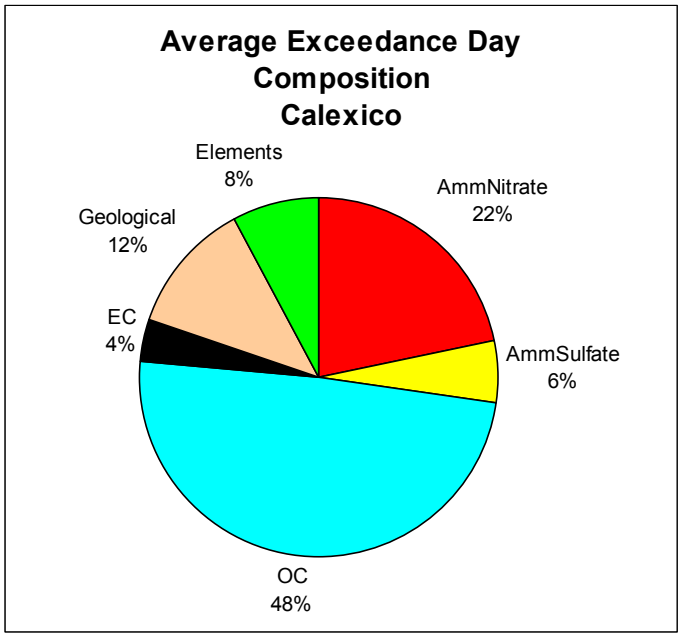

Figure 1-5: PM2.5 Composition, Calexico, Imperial County

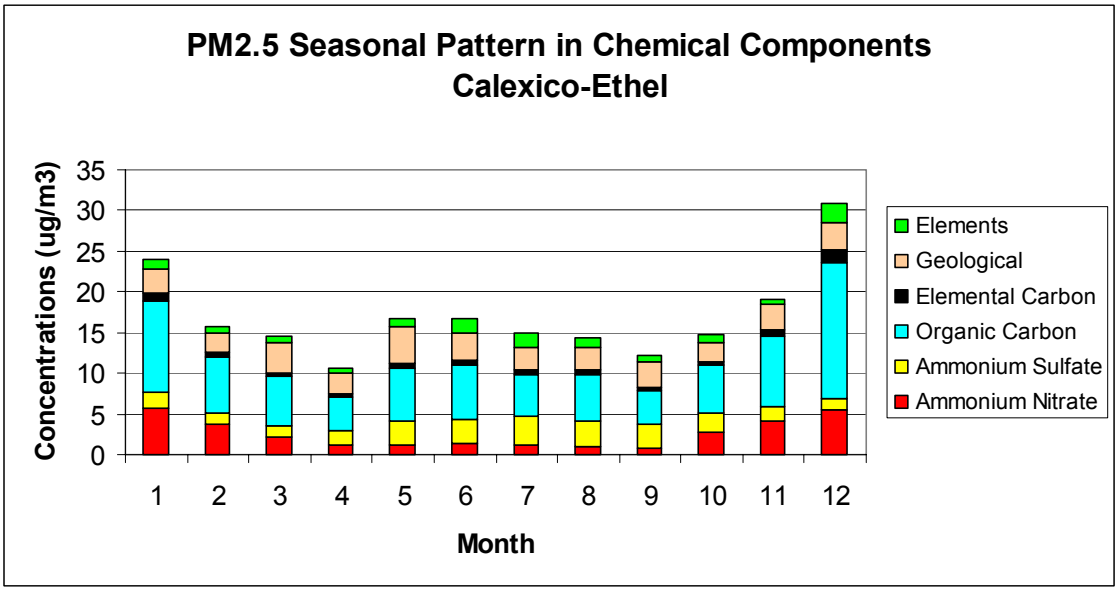

Figure 1-6: Seasonal Pattern of PM2.5 Composition, Calexico, Imperial County

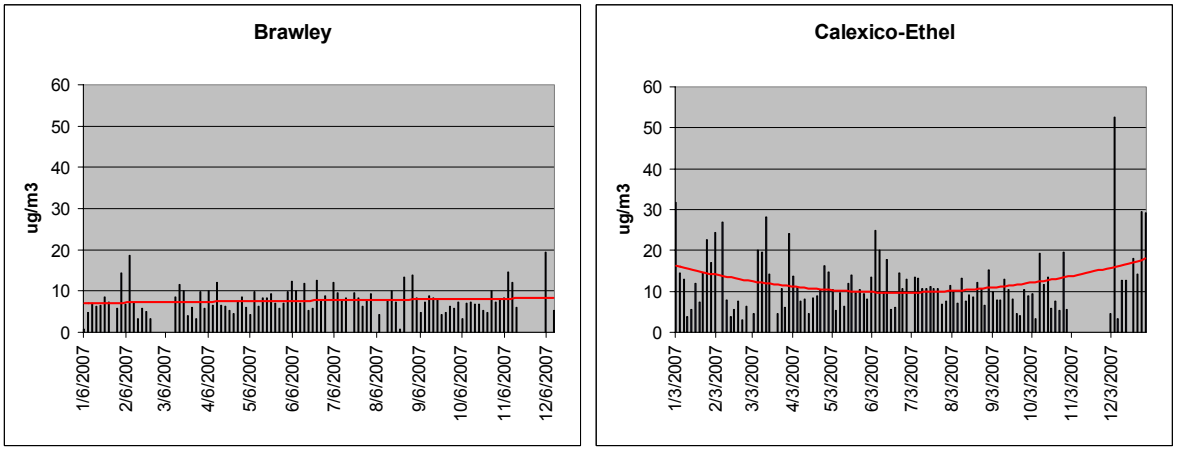

Figure 1-7: Seasonal variation in PM2.5 at two sites in Imperial County

Per a request in U.S. EPA Response, Table 1-3 includes 2005 Imperial County and Mexicali emissions. Imperial County PM2.5 emissions are higher than Mexicali mostly due to area sources, 65% due to windblown fugitive dust. In the absence of a more detailed inventory, it can be reasonably assumed that Calexico, with only 24% of the population of Imperial County, would account for less than half of the emissions of Imperial County as a whole. In addition, wind-blown dust emissions are not a factor during winter-time stagnation episodes. Table 1-3 illustrates the great disparity between Imperial County and Mexicali emissions. Mexicali total NOx emissions are twice those of Imperial, with SOx emissions are thirteen times those north of the border. A significant portion of the Mexicali emissions are from stationary sources. Figure 1-8 shows the large number of stationary sources located near the international border with several right on the border. In comparison, Figure 1-9 shows that there are only a few

stationary sources (triangles) in Imperial County and none in the City of Calexico (blue squares are monitoring sites).

Table 1-3: 2005 Emissions Imperial County and Mexicali (tons/day)

Imperial County	**NOx**	**SOx**	**PM2.5**
Stationary Sources	7.1	0.2	1.3
Area Sources	0.9	0.1	37.5
Mobile Sources	30.2	0.6	1.7
Total	**38.3**	**0.9**	**40.4**
Mexicali			
Stationary Sources	39.4	12.7	0.4
Area Sources	3.7	0.5	18.5
Mobile Sources	35.8	0.6	3.3
Total	**78.9**	**13.8**	**22.2**

[Source: Imperial County Emissions- ARB Almanac; Mexicali Emissions-ERG 2005 Mexicali Emissions Inventory Draft Final, 10/3/08]

Figure 1-8: Location of Federal and State Jurisdiction Point Sources in the Urban Portion of Mexicali

[Source: Mexicali Emissions-ERG 2005 Mexicali Emissions Inventory Draft Final, 10/3/08]

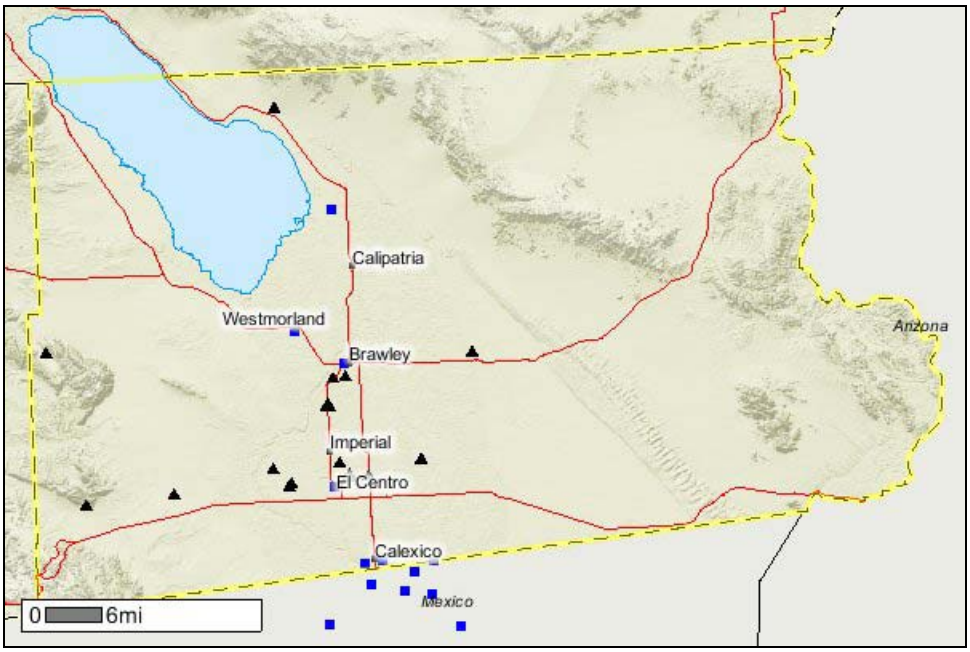

Figure 1-9: Stationary NOx Sources in Imperial County
[Source: CARB Almanac, Imperial County Emissions]

The possible source directions of the major PM2.5 components were investigated using Conditional Probability Function (CPF) Analysis (Kim and Hopke, 2004). CPF estimates the possible local source directions utilizing wind directions coupled with PM2.5 concentration and speciation data. The sources are likely to be located in the directions with high CPF values.

The Calexico-Ethel monitoring site experienced source impacts from primarily southern directions on exceedance days in the winter (Figure 1-10). These southern contributions indicate smoke and particulates from Mexicali.

The impact of smoke from Mexicali is further illustrated with the CPF analysis of potassium (K+) source contributions as illustrated in Figure 1-11. These figures also visually illustrate the transport of smoke from Mexicali into the City of Calexico.

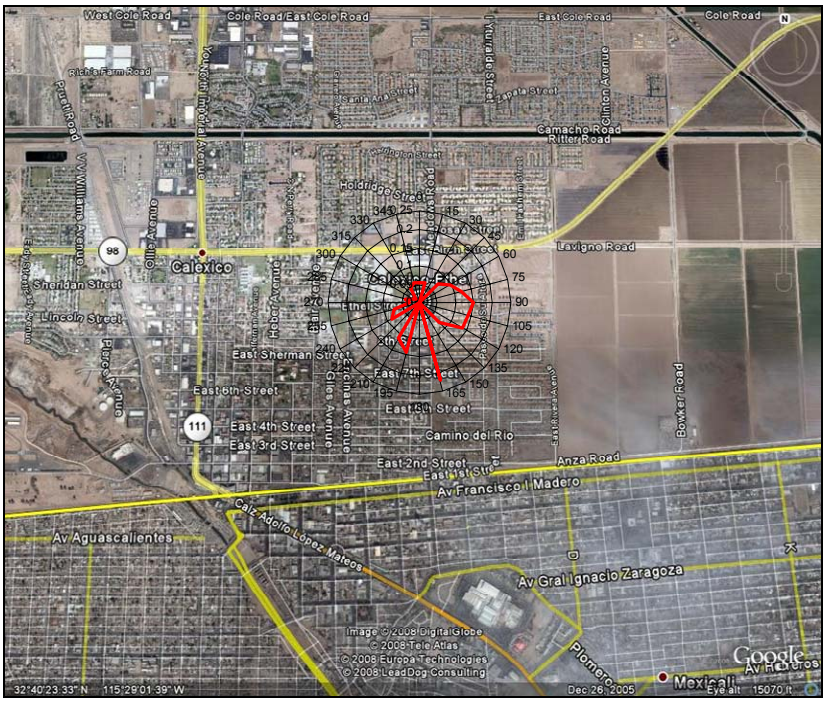

Figure 1-10: CPF Analysis of PM2.5 Concentration Source Contributions.

[Map Source: maps.google.com; 12/26/2005]

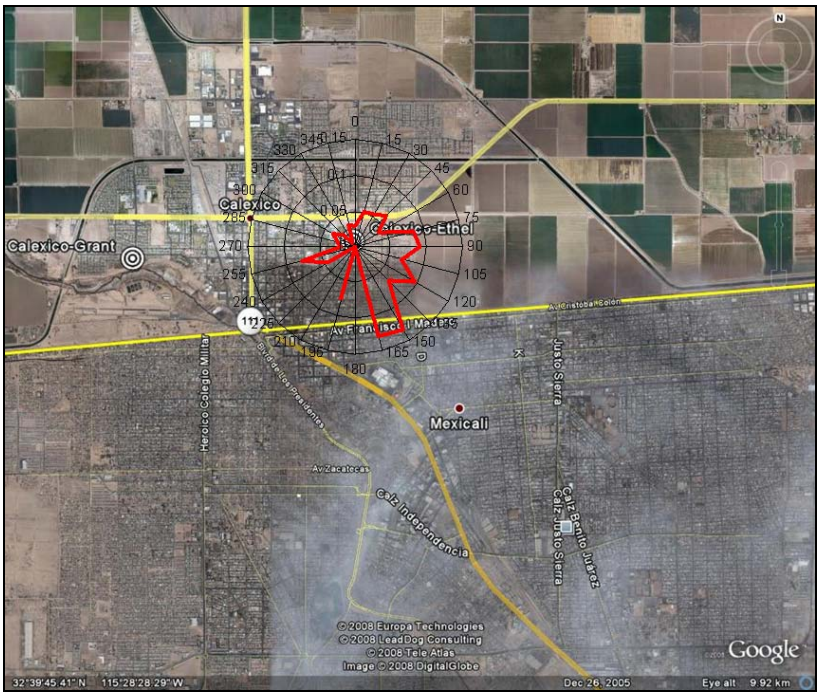

Figure 1-11: CPF Analysis of PM2.5 Potassium (K+) Concentration Source Contributions. *[Map Source: maps.google.com; 12/26/2005]*

Summary

In response to the two primary concerns of the U.S. EPA, ARB believes that the City of Calexico encompasses the population exposed to the high PM2.5 concentrations represented by the Calexico-Ethel site, and that the remainder of the county does not significantly contribute to PM2.5 exceedances at Calexico. ARB analysis continues to support that violations at Calexico are due to international transport from Mexico.

While U.S. EPA has used the argument that increased VMT across the county is a factor in a county-wide nonattainment area, we disagree. As noted above, the primary problem in Imperial County is international transport, which affects only the local Calexico area.

Finally, the regional background of ammonium nitrate is not sufficient to cause violations of the standard. Regional contributions of ammonium nitrate will be decreasing due to already adopted State-wide controls. Over the next ten years, these controls will reduce State-wide NOx emissions by 28%.

An updated map, encompassing the complete population of the City of Calexico, and incorporating potential growth is shown in Figure 1-13.

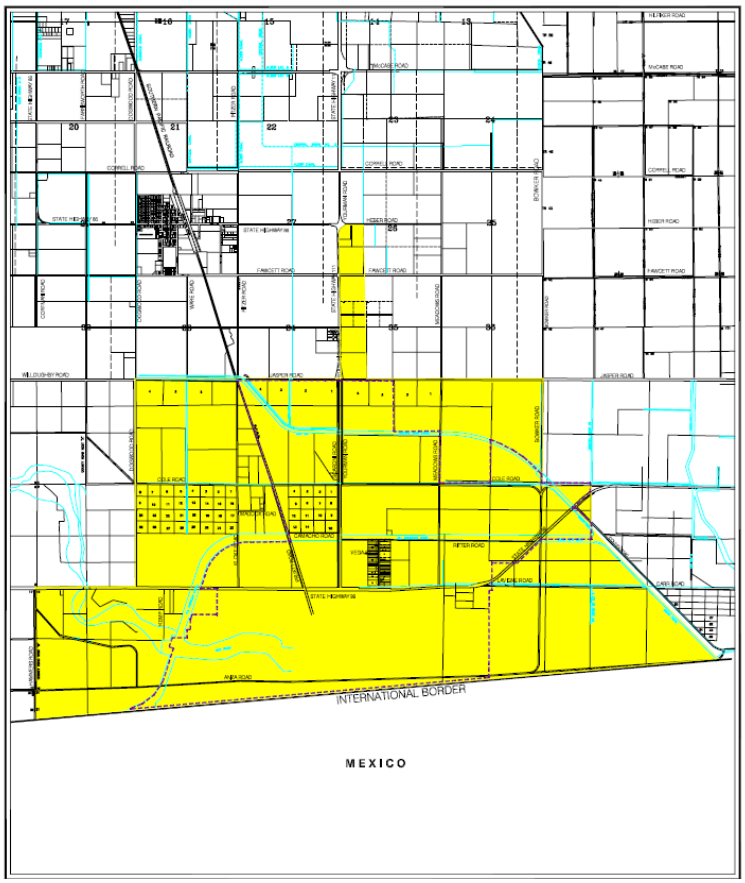

Figure 1-13: City of Calexico Sphere of Influence
[Source: Imperial County, CA]

2. Sacramento Air Quality Management District

The only violating monitors in the Sacramento area are located in the City of Sacramento; specifically, Sacramento-Del Paso, Sacramento-T Street, and Sacramento-Health Dept. Data from air quality monitors in surrounding counties, as shown in Figure 2-1, are well below the new standard (2007 Design Values are indicated in the colored circles) and far outside the zone of influence established by the Sacramento-Del Paso monitoring site. According to the CRPAQS study by Chow (Chow, et.al, 2006), a zone of influence is defined in which a concentration varies by 20%. Only the monitoring sites at Sacramento-T Street and Sacramento-Health Dept fall within this zone. The steep PM2.5 concentration gradients are illustrated in the figure below.

The U.S. EPA Response indicated that Placer County was in violation of the PM2.5 standard in 2006. The 2006 Design Value for the monitoring site in Placer County was, however, well below the standard at 31 ug/m3 (CARB iADAM website, 2008).

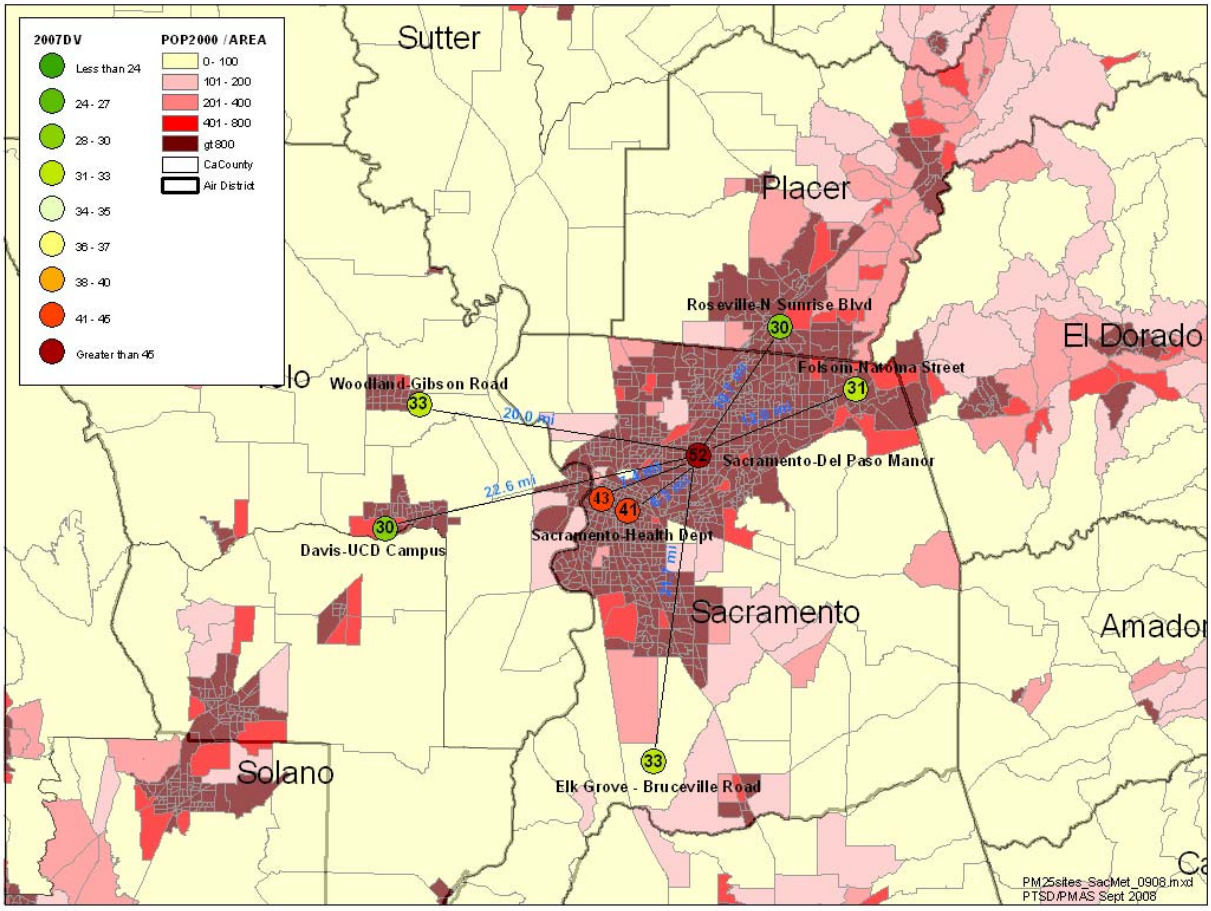

Figure 2-1: 2007 Design Values in Sacramento County Area

Air Quality and Emissions

As noted in the U.S. EPA Response and in Figure 2-2 below, during exceedance days in Sacramento, over 50% of the PM2.5 mass is organic carbon, primarily from residential wood burning. The seasonal pattern (Figure 2-3) shows the strong wintertime increases in organic carbon.

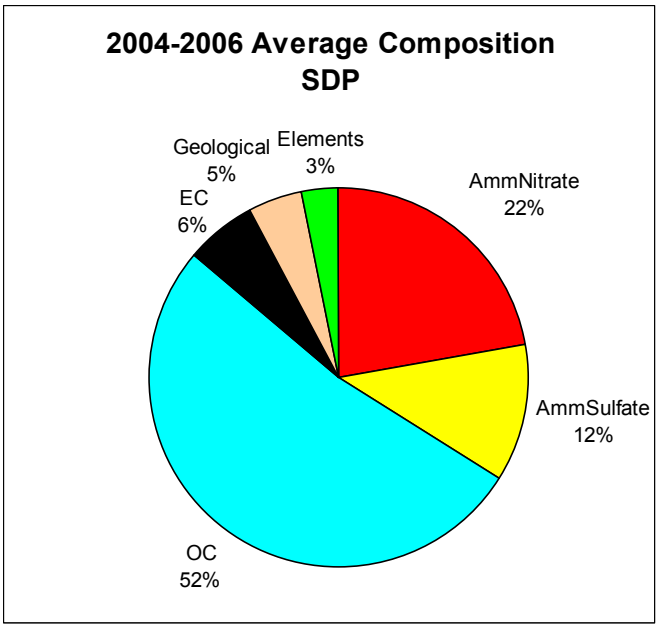

Figure 2-2: PM2.5 Composition, Sacramento-Del Paso, Sacramento County

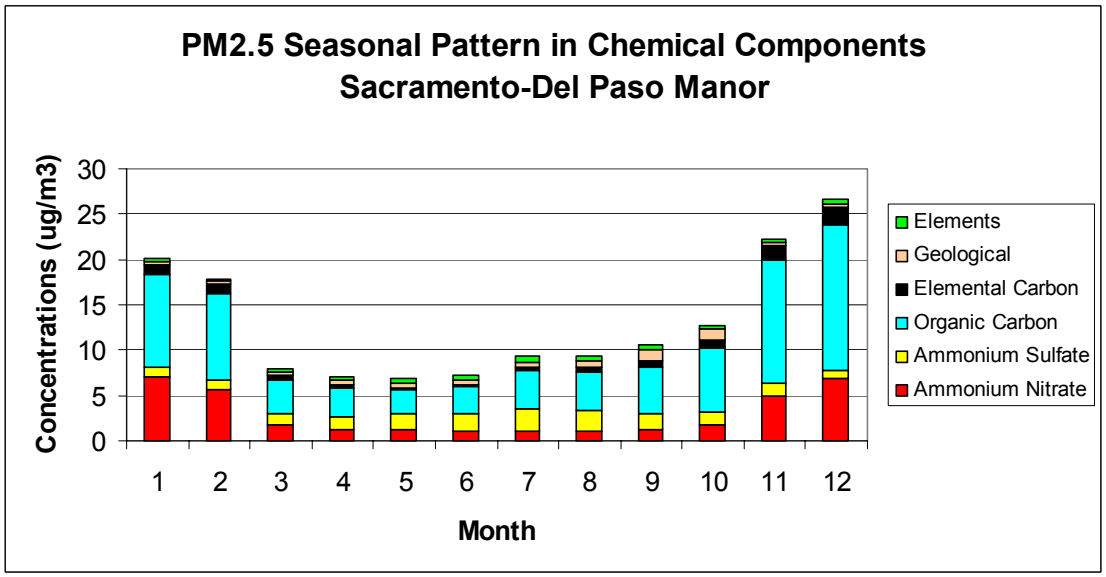

Figure 2-3: Seasonal Pattern of PM2.5 Composition, Sacramento-Del Paso

Chemical composition data is unavailable for other sites in the Sacramento region, but daily PM2.5 concentrations show the strong impact of winter PM2.5 emissions on the sites in the Sacramento urban area and the lesser impact at the more removed areas of Roseville and Woodland (Figure 2-4). These wintertime increases are due primarily to increased residential wood burning, as already noted in the area source emissions inventory in the U.S. EPA Response (Table 2, p.6). The Sacramento Metropolitan Air Quality Management District has already begun to address this issue. Mandatory wood burning controls were established in 2007. Their impact will be seen as early as 2008.

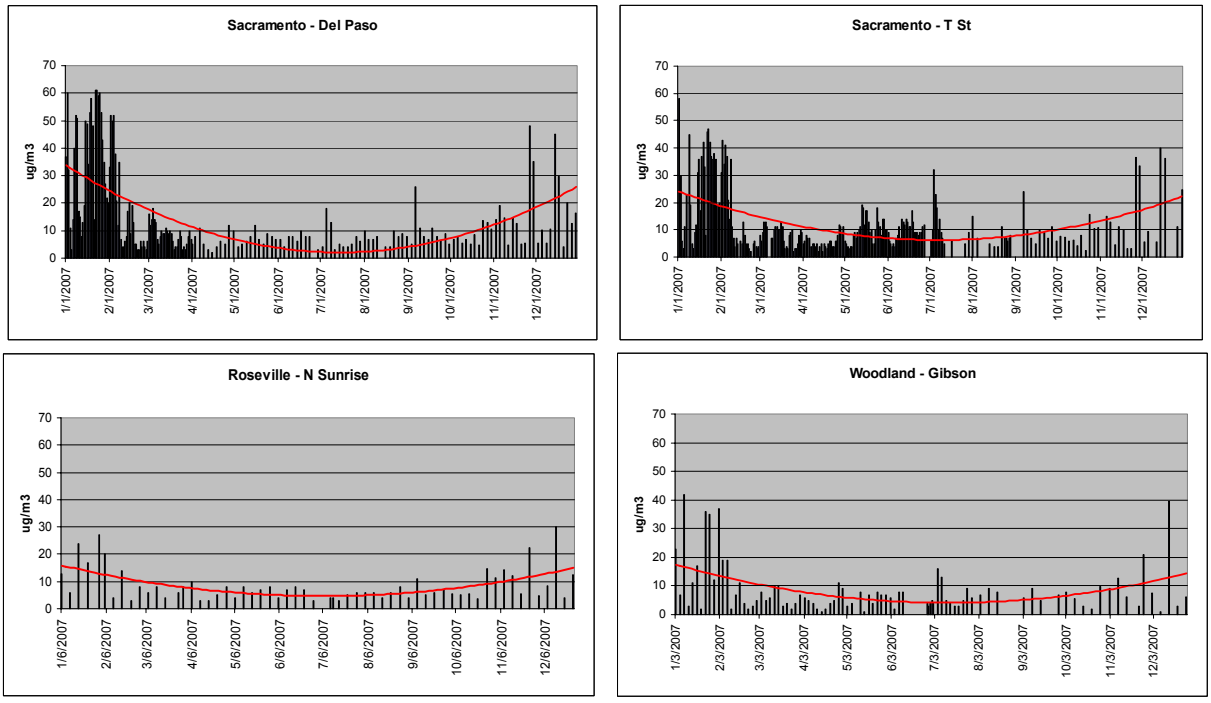

Figure 2-4: Seasonal Variation in PM2.5 at Four Sites in Sacramento Region

The use of county-wide emissions for areas such as Placer and El Dorado Counties, mountainous regions with large rural populations does not adequately reflect the reality of emissions within these areas. Although the majority of the population of El Dorado County resides in the western portion of the county, the population of the eastern portion, South Lake Tahoe and the surrounding mountainous areas, is over 25,000. The majority of the urban population of Placer County resides in the western part of the county, but almost a third reside in unincorporated areas.

Complete county emissions data was also used for Solano County, even though U.S. EPA split the county, overstating the contribution each adjacent portion may have on Sacramento County and the San Francisco Bay Area. Air quality monitoring data was split between the western and eastern parts of Solano County, the same care should be taken with the other factors contributing to the CES.

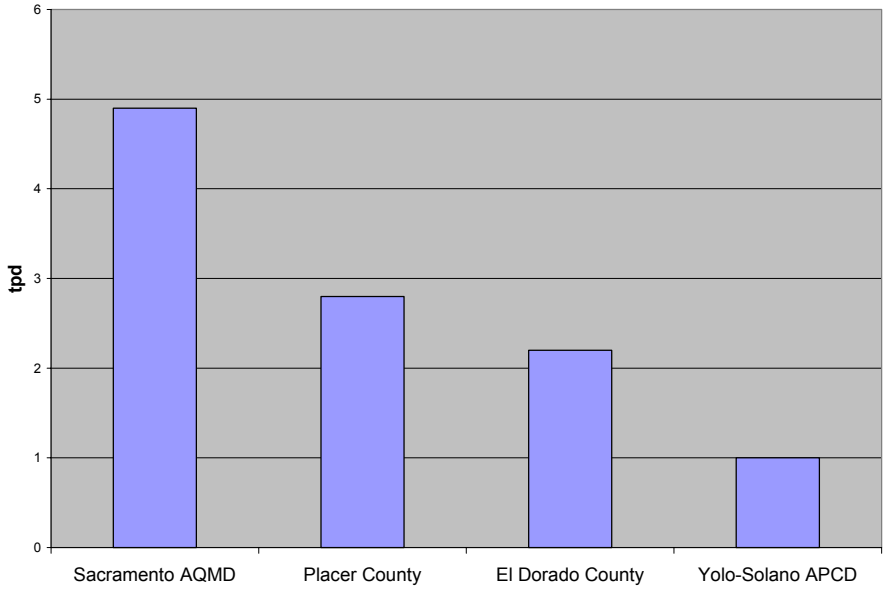

Figure 2-5: Wood smoke PM2.5 Emissions in the Sacramento Region

Recently, El Dorado County notified ARB that the residential wood combustion emissions in Table 2 of U.S. EPA's Response (p. 6) were incorrect and inaccurately indicated high residential burning emissions in El Dorado County. ARB staff worked to update these numbers, however, we were unable to separate the contribution from the Lake Tahoe Air Basin portion. Even including that portion, El Dorado County PM2.5 emissions for this category decreased significantly, from 5.3 to 2.2 tons/day. The chart above reflects the emissions and shows that PM2.5 emissions from Sacramento residential fuel combustion are significantly larger than any of the surrounding counties.

Meteorology and Transport

U.S. EPA notes that prevailing winds at Sacramento during exceedance days are from the northwest and southeast and during time periods with wind speeds of 4 miles per hour or less, concurring that high PM2.5 concentrations were dependent on calm-to-light winds. In other words, stagnant conditions were evident during the exceedance periods, an indication of local not transported pollutants.

ARB believes that exceedances were of a localized nature. Additional analysis (two exceedance days shown in Figure 2-6) shows little or no contribution from outlying areas. The trajectories (circled) indicate that air parcel movement was confined to the local area.

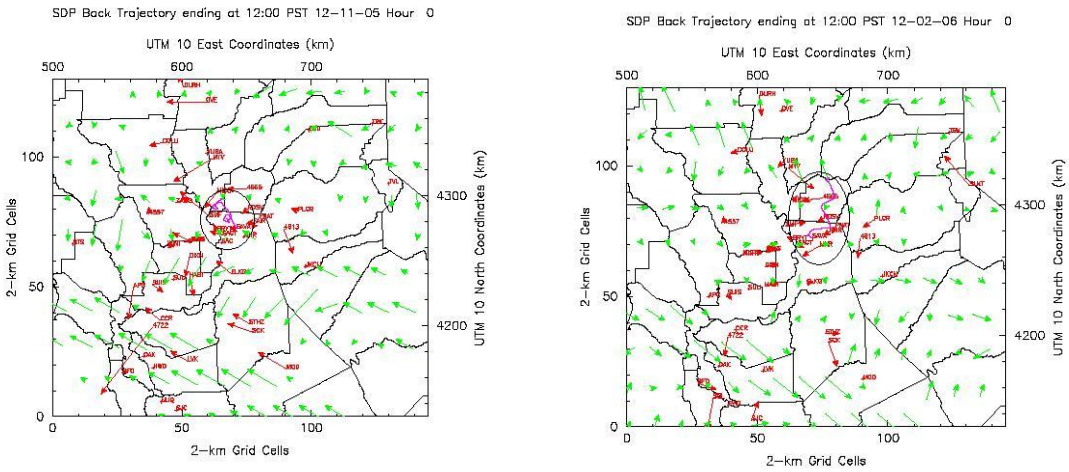

Figure 2-6: 2-D Wind Trajectories for Two Exceedance Days (12/11/05 and 12/2/06) at Sacramento-Del Paso

An examination of BAM data from Roseville and Sacramento-Del Paso are also indicative of the higher concentrations at Sacramento-Del Paso being due to local influence and not transport from Placer County (Figure 2-7).

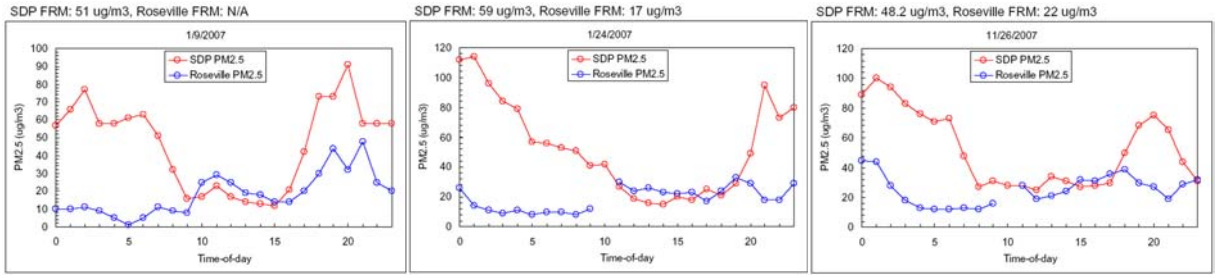

Figure 2-7: Diurnal PM2.5 Patterns at Sacramento-Del Paso and Roseville

The Roseville site remains fairly stable throughout each exceedance day. Some nighttime increases are noted on January 9, 2007, but are more likely the result of increased PM2.5 from local wood burning during stagnant conditions, which also resulted in local wood burning impacts at Sacramento-Del Paso. Local stagnant conditions for that day are further indicated by a HYSPLIT backward trajectory analysis (Figure 2-8).

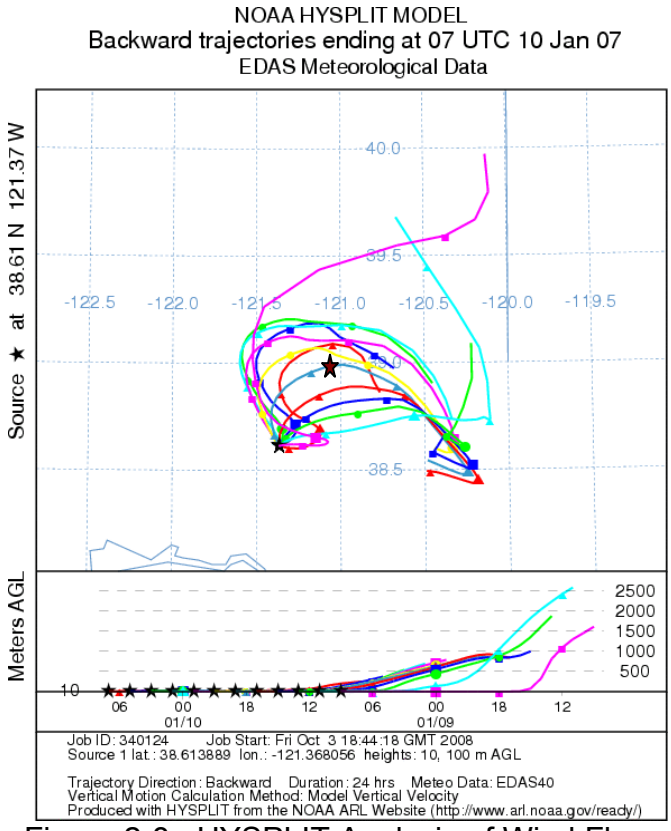

Figure 2-8: HYSPLIT Analysis of Wind Flow during Exceedance Day at Sacramento-Del Paso

Contributing Emission Scores (CES)

One of U.S. EPA's goals in designating nonattainment areas in California was to achieve a degree of consistency with existing ozone and PM10 nonattainment areas. Application of this goal in California led to differences between the State's recommended nonattainment areas and U.S. EPA's proposed designations. When U.S. EPA originally designated the 8-hour ozone area for the Sacramento area consideration was given to the regional nature of the pollutant and emission sources as well as the presence of violating monitors throughout the region. The Sacramento Metropolitan ozone nonattainment area therefore includes all of Sacramento and Yolo Counties, and portions of Solano, Sutter, Placer, and El Dorado Counties. This was not the case for PM10. In that case, violating monitors occurred only within Sacramento County, which was, in and of itself, declared an appropriate boundary area. For PM2.5, the localized nature of organic carbon, which is the key contributor to wintertime violations, as well as the lack of violating monitors outside of the City of Sacramento, argue for a more focused nonattainment boundary similar to that of PM10.

U.S. EPA based part of its decision to include more counties in the Sacramento nonattainment area on the comparable population densities of surrounding counties to Sacramento County. The analysis for CES Factor 3 states that the populations

associated with Sacramento clearly extend into Placer, El Dorado, Solano, and Yolo Counties. The surrounding counties' populations range from 4% to 34% of Sacramento County (Table 2-1). Surrounding counties' population densities range from 7% (El Dorado) to 35% (Solano) of Sacramento County.

Table 2-1: Population and Population Density in Sacramento and Surrounding Counties

County/City	2005 Population	% of Own County	% of Sacramento County	% of Five County Region	Pop Density
Sacramento	1,363,423	100%	100%	55.6%	1343
Elk Grove	136,318	10.0%	10.0%	5.6%	
Folsom	70,835	5.2%	5.2%	2.9%	
Sacramento	467,343	34.3%	34.3%	19.1%	
El Dorado	176,319	100%	12.9%	7.2%	98
Placer	316,868	100%	23.2%	12.9%	210
Roseville	106,266	33.5%	7.8%	4.3%	
Solano	410,786	100%	30.1%	16.8%	471
Yolo	185,091	100%	13.6%	7.6%	179
Davis	64,938	35.1%	4.8%	2.7%	
Woodland	54,060	29.2%	4.0%	2.2%	

[Source: www.csac.counties.org; www.cacities.org; www.census.gov]

Population growth, another factor (Factor 5) in determining CES, indicated substantial growth in the Sacramento area. As noted in Table 2-2, however, the majority of this growth, over half, is occurring in Sacramento County. Although growth rates in surrounding counties range from 4% to 28%, these rates are based on county populations significantly less than Sacramento (Figure 2-9).

Table 2-2: Population Growth in the Sacramento and Surrounding Counties

County	2000 Population	2006 est. Population	County Growth	% Change of County	% of Regional Growth
Sacramento	1,223,499	1,374,724	139,924	11.4%	53.6%
El Dorado	156,299	178,066	20,020	12.8%	7.7%
Placer	248,399	326,242	68,489	27.6%	26.2%
Solano	394,542	411,680	16,244	4.1%	6.2%
Yolo	168,660	188,085	16,431	9.7%	6.3%
COMBINED	*2,191,399*	*2,478,797*	*261,088*	*11.9%*	*100.0%*

[Source: www.census.gov]

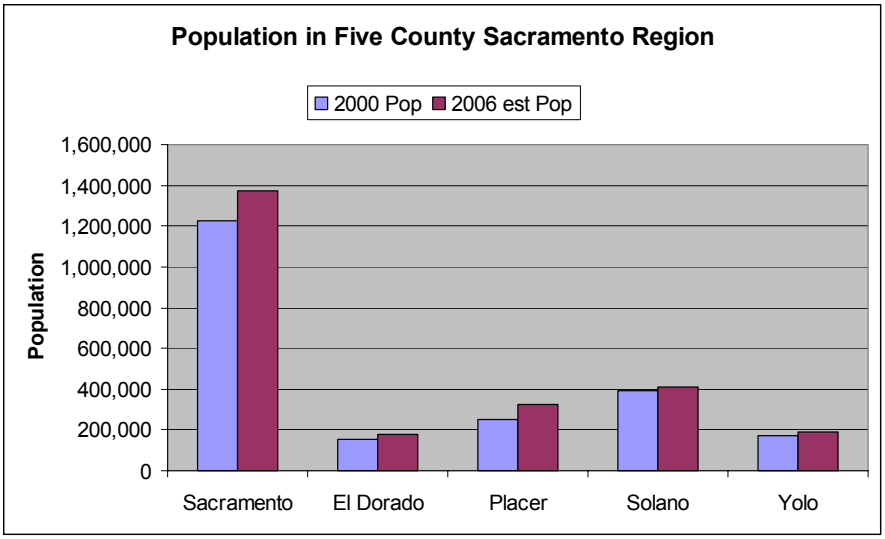

Figure 2-9: Population of the Sacramento Region
[Source: www.census.gov]

Although the CES is only one element in determining the nonattainment boundary areas, a high CES implies that a county has a high impact on the adjacent violating county. However, CES numbers are based on data for entire counties. The CES should be adjusted to reflect only those portions of a county to be included with an adjoining nonattainment area, such as Solano, El Dorado, and Placer Counties within the Sacramento nonattainment area.

The higher score of Solano was discounted, based on its contribution to the San Francisco Bay Area nonattainment area and the higher population in the western portion of the county. The high scores for Placer and El Dorado were based, partially, on analysis done for the entire counties. As noted in U.S. EPA Technical Document (Rizzo and Hunt, 2008), the CES methodology uses county-based emissions inventories which may be inaccurate in counties with large rural populations or with mountainous terrain, both of which occur in El Dorado and Placer. Although U.S. EPA took some of this into account in recommending only a part of each county for inclusion in the nonattainment area, it did not take into account the fact that the majority of PM2.5 emission are from residential wood burning. These emissions were recently found to be inaccurate (pages 17 and 18 of this report) and a significant portion may be occurring in the Lake Tahoe Air Basin segment of these counties.

Use of population and population growth as factor in U.S. EPA's decision-making was not consistent throughout the country. Warren County, New Jersey, is an example of a county not included with an adjacent violating area. According to U.S. EPA, "Warren County [New Jersey] ranks low in terms of population and in population density in comparison to counties located near the violating monitor in Northampton County, Pennsylvania. In comparison to the two counties that have been recommend as nonattainment for the Allentown, PA-NJ area, *Warren County's population and population density is below 50% that of Lehigh and Northampton*. (U.S. EPA Response to New Jersey, 2008)" Warren County's population density is, in fact, 32% of Lehigh

County and 40% of Northampton County. Although, the Sacramento County population is larger than the populations for counties around Warren County, NJ; Sacramento's population density is very similar. Both total populations and population densities for all surrounding counties are below those of Sacramento County and far below the U.S. EPA stated limit above of 50%.

In an additional example, Hamblen County, part of the Knoxville-Sevierville-LaFollette, TN CBSA, has a population density 44% of neighboring (and violating) Knox County. Hamblen County was designated in attainment (U.S. EPA Response to Tennessee, 2008). There are many other examples of counties with higher population densities than those adjoining Sacramento, within a MSA, but not designated nonattainment.

EPA has placed a high importance on the Contributing Emissions Scores (CES) in designating nonattainment areas. While several counties in California have a relatively low CES and no violating monitor, U.S. EPA has still proposed a nonattainment designation in tandem with neighboring violating counties. In several other areas throughout the country, however, counties with similar, or higher, CES are not wed to their adjacent nonattainment counties (Table 2-3). California requests similar flexibility as provided to other areas of the country.

Table 2-3: Sample of Counties with CES scores at or above 16 with Adjacent PM2.5 Nonattainment Areas

Attaining County, State	**CES score**	**Adjacent Violating Area**
Clinton County IA	52	Davenport-Moline-Rock Island, IA-IL 2006 CBSA
Cedar County IA	17	
Louisa County IA	36	Muscatine, IA 2006 CBSA
Johnson County IA	24	
Greenup County KY	24	Huntington-Ashland Area 2006 CBSA
Dickson County TN	19	Clarksville-Hopkinsville, KY-TN 2006 CBSA
Robertson County TN	17	
Posey County IN	19	Evansville Metropolitan Statistical Area
Pickaway County OH	19	Columbus Metropolitan Statistical Area
Ross County OH	18	
Adams County OH	18	
Jefferson County TN	17	Knoxville-Sevierville-LaFollette, NA area, 8-hour ozone

Summary

In response to the two primary concerns of the U.S. EPA, ARB believes that Sacramento County encompasses the population exposed to the high PM2.5 concentrations represented by the Sacramento-Del Paso, Sacramento-Health Dept., and Sacramento-T St. sites, and that the remainder of the region does not significantly contribute to PM2.5 exceedances in Sacramento County.

Sacramento County, which encompasses the majority of the population in the region, is the only area that violates the new PM2.5 standard. ARB analysis continues to support that violations in Sacramento are due to localized wood smoke emissions. Filter

analysis shows that regional background ammonium nitrate is not sufficient to cause violations of the standard. Regional contributions of ammonium nitrate will be decreasing due to already adopted State-wide controls. Over the next ten years, these controls will reduce State-wide NOx emissions by 28%.

In other areas throughout the country, counties with CES scores comparable to those counties surrounding Sacramento, were not included as part of adjacent nonattainment areas. Following the same rationale, the non-violating Counties of Yolo, Solano, El Dorado, and Placer should not be part of the Sacramento PM2.5 nonattainment area.

Therefore, ARB continues to supports our original recommendation of a focused nonattainment area for the County of Sacramento.

3. City of Chico, Butte County Air Quality Management District

The only violating monitor in Butte County is located in the City of Chico, which has a 2007 Design Value (DV) of 55 ug/m3. A continuous beta attenuation monitor (BAM) located in the City of Gridley, a community to the south of Chico, shows a 2007 DV of 33 ug/m3 (Figure 3-1). Chico, the largest urban area in Butte County, has a population three-to-five times other areas in the county (Table 3-1). Based on the localized nature of the primary emission contribution to winter PM2.5 (Figures 3-2 through 3-4), ARB considers the urban area of Chico an appropriate nonattainment boundary for PM2.5.

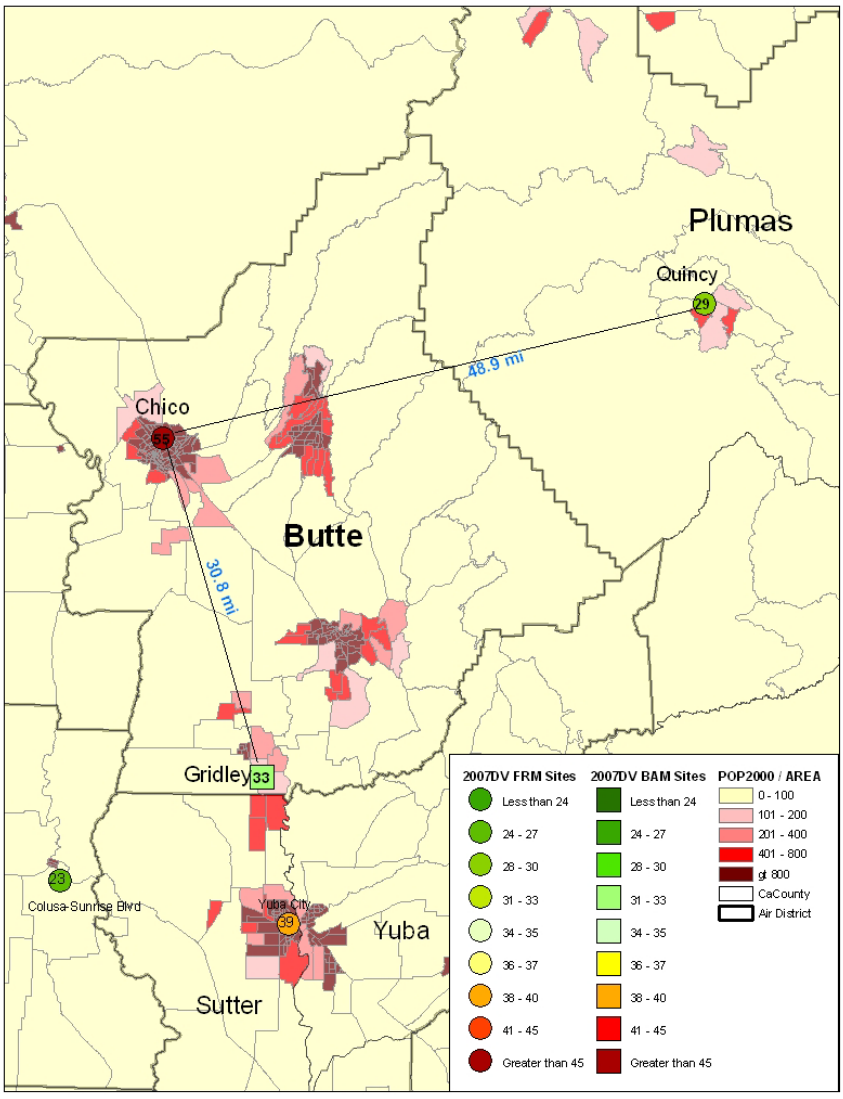

Figure 3-1: 2007 Design Values in Butte County

Table 3-1: Demographic Information, Butte County

County/City	Population	Population Density (pop./mi^2)
Butte County	219,101	132
Biggs	1,809	3471
Chico	84,396	2547
Gridley	6,167	3769
Oroville	14,443	1103
Paradise	26,725	1446

[Source: U.S. Census, www.census.gov; California State Association of Counties, www.csac.counties.org; League of California Cities,www.cacities.org]

As shown in Figure 3-2, 75% of PM2.5 on exceedance days in Chico is composed of organic carbon, primarily from residential wood combustion. The seasonal variation of PM2.5 chemical composition is seen in Figure 3-3. Although ammonium nitrate also shows a winter increase, by itself it would not be enough to cause Chico to exceed the new federal standard. Exceedances are due primarily to increased winter-time residential wood burning, a more localized pollutant. The low wind speeds exhibited during times of PM2.5 exceedances, as noted in the pollution wind rose on page 16 of the U.S. EPA Response, only reinforces that exceedances result from a localized source such as wood burning. Residential wood combustion, particularly during times of low winds or stagnant conditions, is the primary cause of Chico's PM2.5 exceedances.

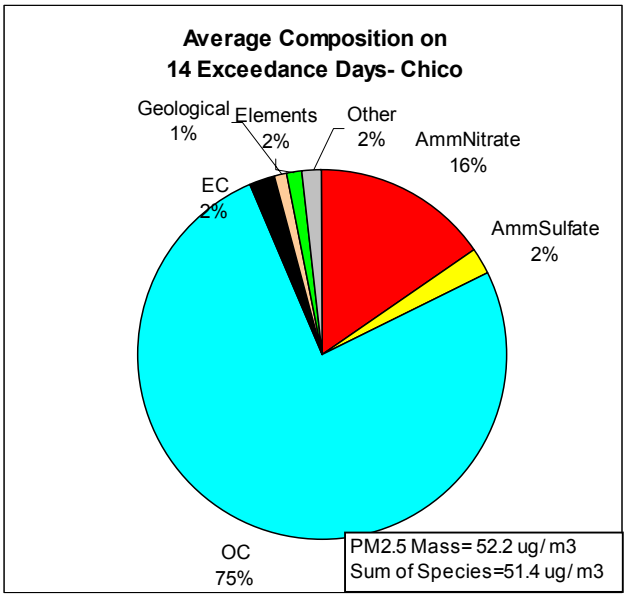

Figure 3-2: PM2.5 Composition, City of Chico, Butte County

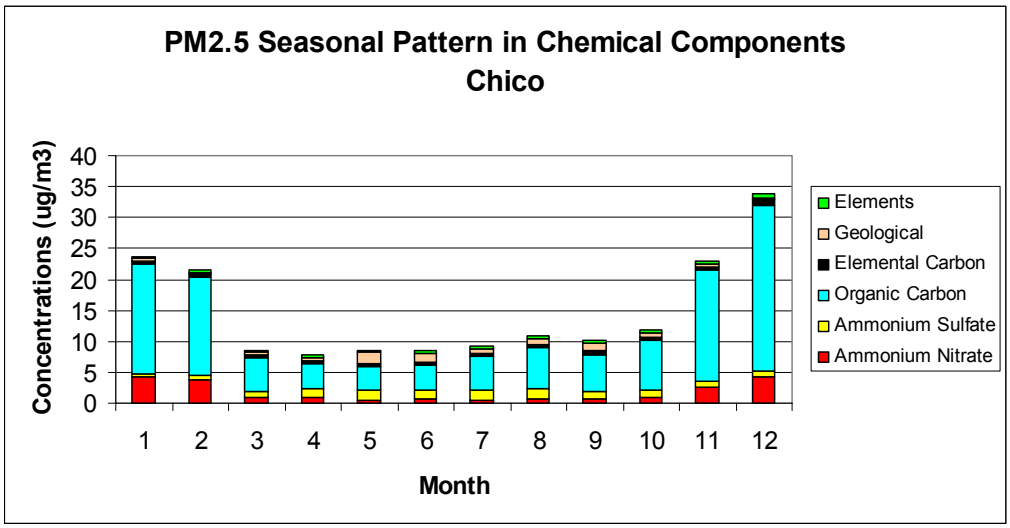

Figure 3-3: Seasonal Pattern of PM2.5 Composition, City of Chico, Butte County

A diurnal analysis of concentrations at Chico and Gridley, during Chico exceedance days, highlights the localized nature of the PM2.5 pollution episodes (Figure 3-4). The nighttime increases at Chico, the result of residential wood burning, are not reflected at the monitoring site at Gridley. As previously noted, the majority of exceedance days occur during periods of stagnant or low wind, keeping pollutants close to the emission source.

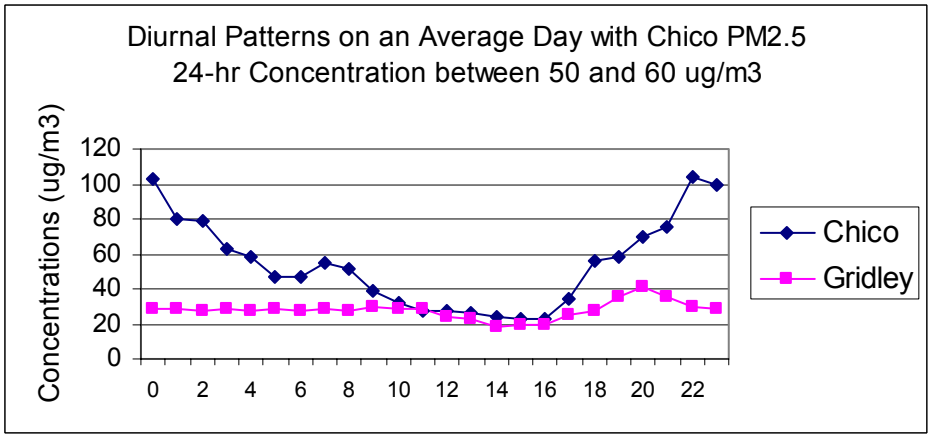

Figure 3-4: Diurnal PM2.5 Patterns at Chico and Gridley

Summary

In response to the two primary concerns of the U.S. EPA, ARB believes that the City of Chico encompasses the population exposed to the high PM2.5 concentrations represented by the Chico-Manzanita site, and that the remainder of the county does not significantly contribute to PM2.5 exceedances in the City of Chico.

The City of Chico, which encompasses the majority of the urban population in the county, is the only site that violates the new PM2.5 standard. ARB analysis continues

to support that violations in Chico are due to localized wood smoke emissions. Filter analysis shows that regional background ammonium nitrate is not sufficient to cause violations of the standard. Regional contributions of ammonium nitrate will be decreasing due to already adopted State-wide controls. Over the next ten years, these controls will reduce State-wide NOx emissions by 28%.

While U.S. EPA has used the argument that increased VMT across the county is a factor in a county-wide nonattainment area, we disagree. As noted above, the primary problem is wood smoke, which affects the localized Chico urban core.

Therefore, ARB continues to supports our original recommendation of a focused nonattainment area for the City of Chico. Similar to our recommendation for the City of Calexico, we believe that the City of Chico's sphere of influence may be an appropriate boundary. The General Plan Diagram of the City of Chico, outlining the sphere of influence (gold boundary), is shown in Figure 3-5.

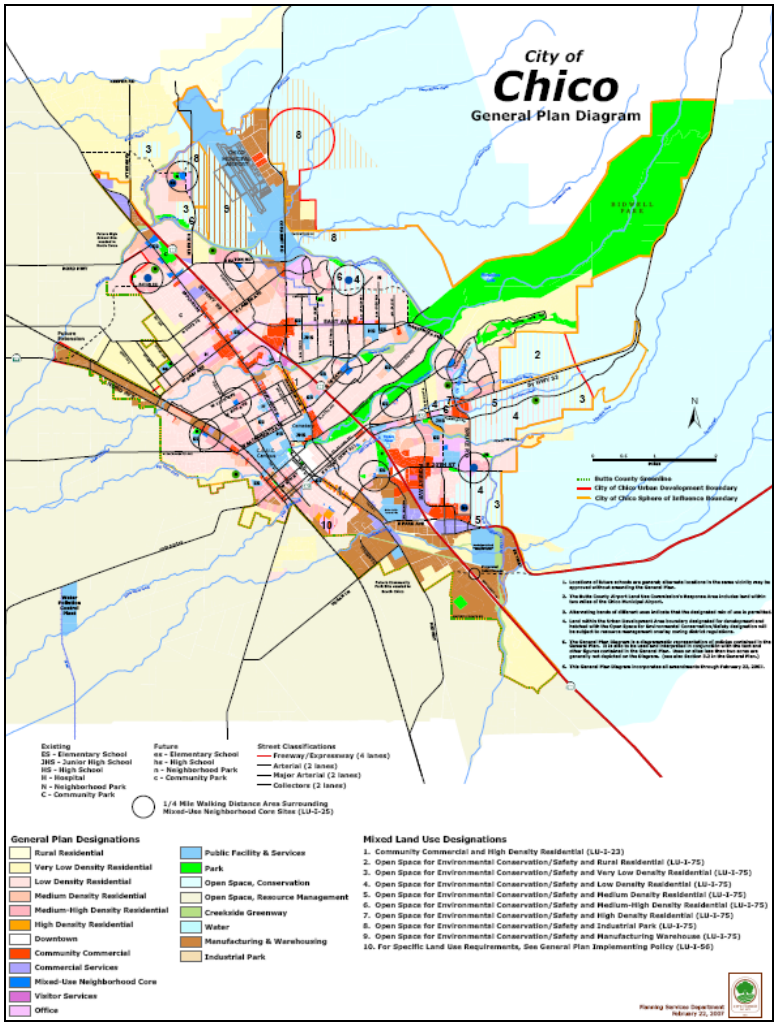

Figure 3-5. City of Chico, Sphere of Influence

[Source: City of Chico, www.chico.ca.us]

4. Combined Cities of Yuba City/Marysville, Feather River Air Quality Management District

The only violating monitor in the Feather River Air Quality Management District (Feather River) is located in Yuba City, which has a 2007 Design Value of 39 ug/m3 (Figure 4-1). Yuba City, the largest urban area in Sutter County, is home to over 65% of the County's population; 18% of Yuba County's residents live in Marysville, located in Yuba County but sharing a border with Yuba City. Combined, the two cities account for 44% of the population of the two counties. Based on the localized nature of the primary emission contribution to winter PM2.5 (Figures 4-2 through 4-4), ARB considers the combined urban areas of Yuba City/Marysville an appropriate nonattainment boundary for PM2.5.

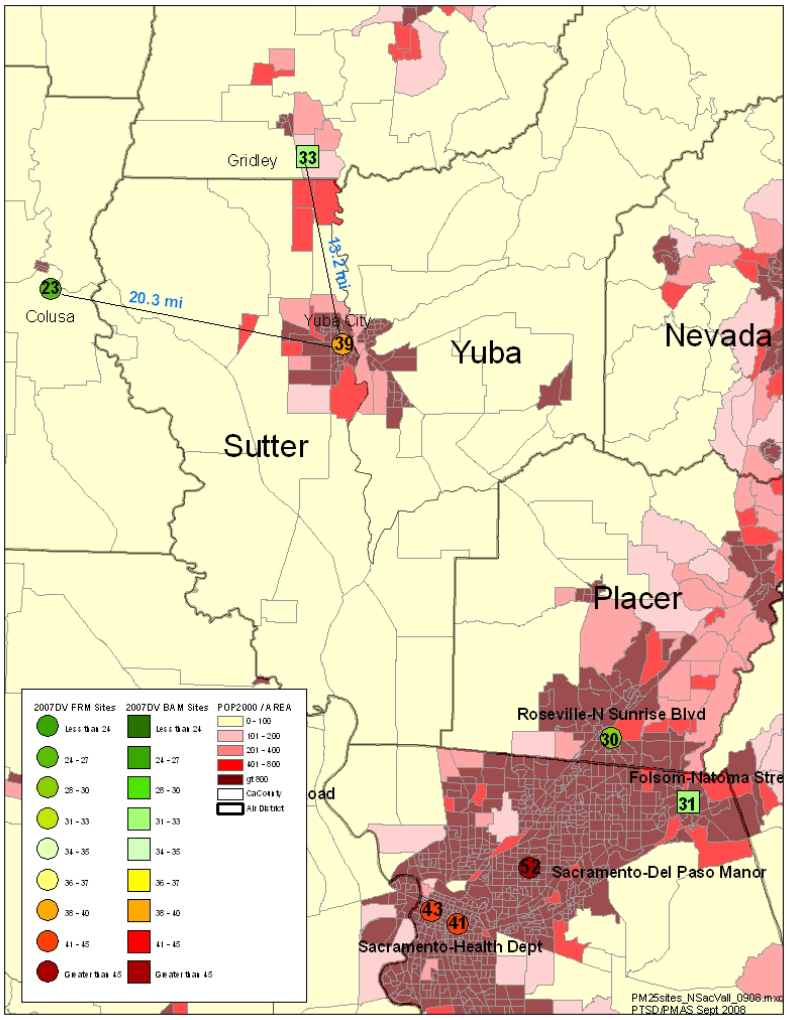

Figure 4-1: 2007 Design Values in Sutter and Yuba Counties

As shown in Figure 4-2, almost 55% of PM2.5 on exceedance days in Yuba City is composed of total carbon (tcm), primarily from residential wood combustion. A seasonal variation of PM2.5 chemical composition is not available for this site, but a look at the mass concentrations throughout the 2007 clearly show the higher

concentrations experienced during the winter (Figure 4-3). Exceedances are due primarily to increased winter-time residential wood burning and ammonium nitrate. The low wind speeds exhibited during times of PM2.5 exceedances, as noted in the pollution wind rose on page 16 of the U.S. EPA Response, only reinforces the exceedances as resulting from a localized source such as residential wood burning.

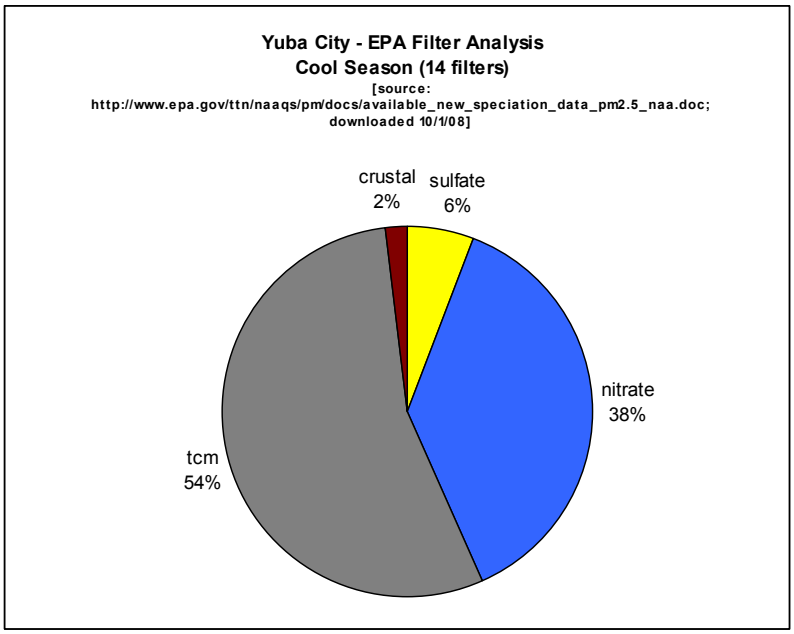

Figure 4-2: PM2.5 Composition, Yuba City, Sutter County

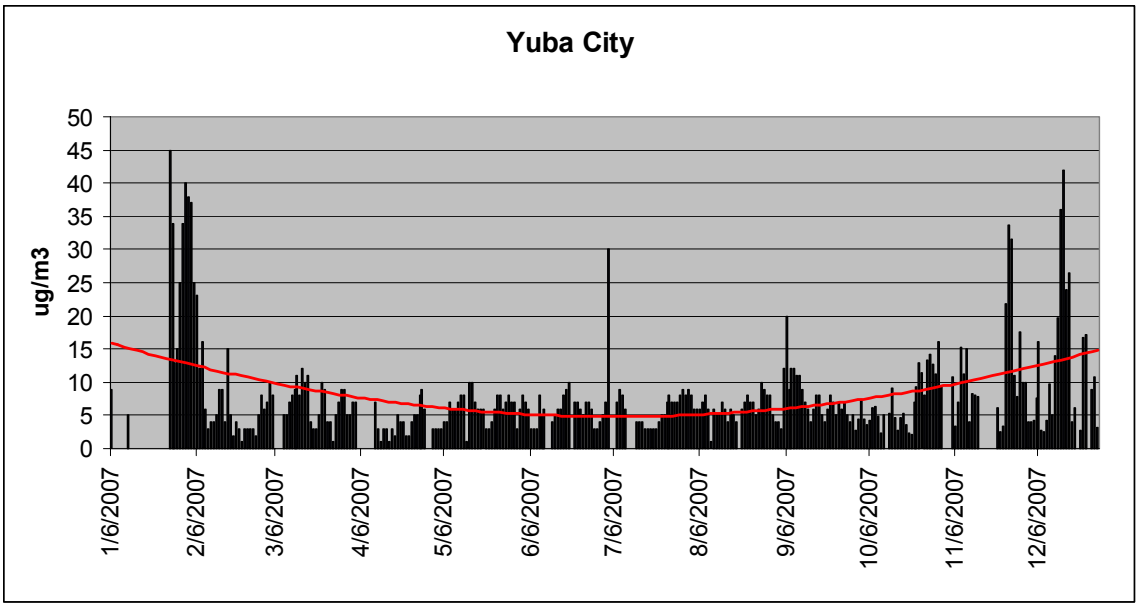

Figure 4-3: Seasonal Pattern of PM2.5, Yuba City, Sutter County

The localized nature of the PM2.5 pollution problem in Yuba City can also seen in this diurnal analysis (Figure 4-4) of concentrations at Yuba City for days that the standard was exceeded at Yuba City. The high nighttime concentrations at Yuba City reflect the diurnal pattern of residential wood burning, separate from the patterns exhibited by commuter traffic, which would show a decrease after peak commuter hours. As previously noted, the majority of exceedance days occur during periods of stagnant or low wind, keeping pollutants close to the emission source, in this case, Yuba City and Marysville.

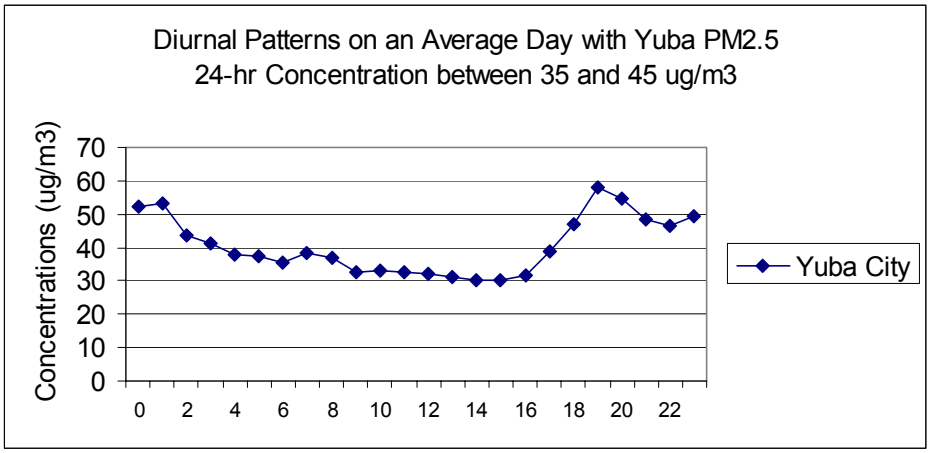

Figure 4-4: Diurnal PM2.5 Patterns at Yuba City

Summary

In response to the two primary concerns of the U.S. EPA, ARB believes that the urban area of Yuba City/Marysville encompasses the population exposed to the high PM2.5 concentrations represented by the Yuba City site, and that the remainder of the Sutter and Yuba Counties do not contribute significantly to PM2.5 exceedances in the combined Yuba City/Marysville urban area.

The combined Cities of Yuba City/Marysville, which encompass the majority of the urban population in the Counties of Sutter and Yuba, is the only site that violates the new PM2.5 standard. ARB analysis continues to support that violations in Yuba City/Marysville are due to localized wood smoke emissions. Filter analysis shows that regional background ammonium nitrate is not sufficient to cause violations of the standard. Regional contributions of ammonium nitrate will be decreasing due to already adopted State-wide controls. Over the next ten years, these controls will reduce State-wide NOx emissions by 28%.

While U.S. EPA has used the argument that increased VMT across the county is a factor in a county-wide nonattainment area, we disagree. As noted above, the primary problem is wood smoke, which affects the localized Yuba City/Marysville urban core.

Therefore, ARB continues to supports our original recommendation of a focused nonattainment area for Yuba City/Marysville. Similar to our recommendation for the City of Calexico, we believe that the combined Yuba City/Marysville sphere of influence may be an appropriate boundary. We are working with local agencies to obtain maps to document this area.

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