M. San Joaquin Valley Air Basin (San Joaquin Valley APCD)

The San Joaquin Valley Air Basin is comprised of a single air district, the San Joaquin Valley APCD, and consists of the San Joaquin, Stanislaus, Merced, Madera, Fresno, Kings, and Tulare counties, and the western portion of Kern County. The entire air basin is designated as nonattainment for both the State 24-hour and the annual PM10 standards, as well as the State annual PM2.5 standard. The air basin is also designated as nonattainment for the national 24-hour and annual PM10 standards and the 24-hour and annual PM2.5 standards.

Figure M-1 the location of the PM10 (a) and PM2.5 (b) monitoring sites throughout the San Joaquin Valley APCD.

Figure M-1. PM10 and PM2.5 Monitoring Sites throughout the Air Basins.

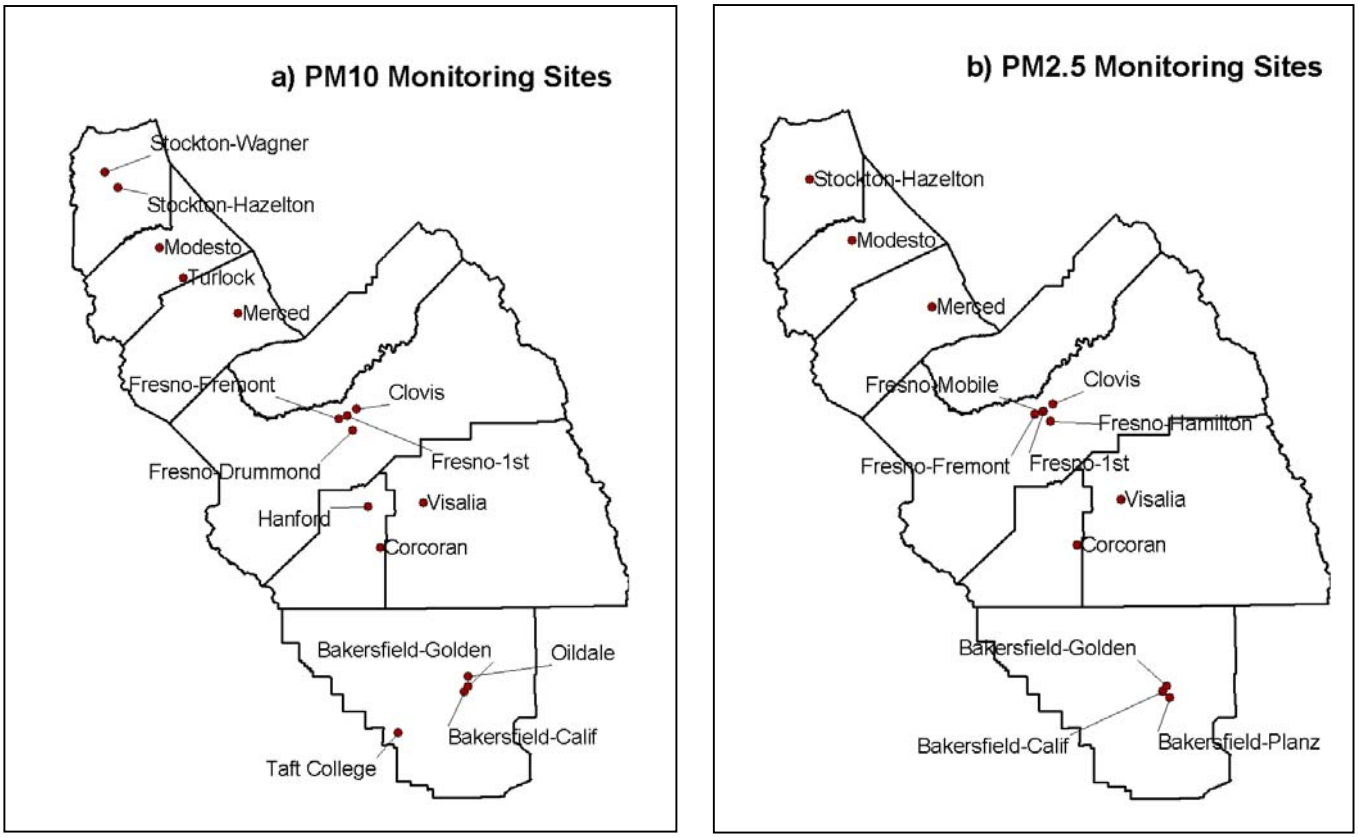


Table M-1 provides information on the yearly variations in the highest PM10 and PM2.5 concentrations recorded across the San Joaquin Valley APCD in 2001 through 2003. PM10 levels exceeded the State 24-hour standard of 50 $\mu g/m^3$ an estimated five hundred and ninety-one times, and consistently exceeded the State annual PM10 standard of 20 $\mu g/m^3$. PM10 levels also exceeded both national PM10 standards, the 24-hour standard of 150 $\mu g/m^3$ and the annual standard of 50 $\mu g/m^3$. Particulate levels in the air district exceeded the State annual PM2.5 standard of 12 $\mu g/m^3$, and both national PM2.5 standards, the 24-hour standard of 65 $\mu g/m^3$, and the annual standard of 15 $\mu g/m^3$.

Table M-1. PM10 and PM2.5 Air Quality in the San Joaquin Valley APCD.

Year	PM10 (ug/m^3)			PM2.5 (ug/m^3)	
	Calculated Days over State Std.	Max 24-hour (Std.=50)	Max Annual Average (Std.=20)	Max 24-hour*	Max Annual Average (Std.=12)
2001	168	221**	52	155	21
2002	256	194	60	104	24
2003	167	134	52	85	25

* The maximum 24-hour PM2.5 values are provided for information only.
** This value was excluded for determining attainment status. See text.

Table M-2 provides the 24-hour and annual designation values for the State standards for the 2001-2003 period. Designation values represent the highest 24-hour PM10 concentration measured during the three year period, after concentrations measured during highly irregular and infrequent events have been excluded, and the highest estimated PM10 and PM2.5 annual average in the same period. For example, the high 24-hour PM10 concentration in 2001 shown in Table M-1 was identified as an extreme concentration event and was excluded in determining the designation values shown in Table M-2. The designation values are determined for each site, and the highest site is used for determining an area's designation. Based on these data, the San Joaquin Valley APCD currently is nonattainment for both the State 24-hour and annual average PM10 standards, as well as the State annual average PM2.5 standard.

Table M-2. Air District Level Designation Values* for the State PM10 and PM2.5 Standards (2001-2003 Period).

	PM10 (ug/m^3)		PM2.5 (ug/m^3)
	24-Hour (Std.=50)	Annual Average (Std.=20)	Annual Average (Std.=12)
Designation Value	198	60	25

* Designation value is the value used for determining attainment status. It is the highest measured value over three years after excluding highly irregular or infrequent events.

Table M-3 provides designation values for each monitoring site in the air district to provide further information on the geographic distribution of concentrations. Particulate levels exceeded the State 24-hour and annual average PM10 standards, as well as the State PM2.5 standard at all monitored areas in the air district. Concentrations of both PM10 and PM2.5 tend to be highest in the central and southern Valley, with highest concentrations in Fresno and Bakersfield area monitoring sites.

Table M-3. Monitoring Site Level Designation Values* for the State PM10 and PM2.5 Standards (2001-2003 Period).

Site	PM10 (ug/m^3)		PM2.5 (ug/m^3)
	24-Hour (Std.=50)	Annual Average (Std.=20)	Annual Average (Std.=12)
Clovis	117	43	16
Fresno-1st St.	147	43	18
Fresno-Drummond	198	Incomplete Data	No Monitor
Fresno-Fremont School	Incomplete Data	Incomplete Data	Incomplete Data
Fresno Mobile	No Monitor	No Monitor	Incomplete Data
Fresno-Hamilton	No Monitor	No Monitor	21
Bakersfield-California	164	51	25
Bakersfield-Golden	194	60	24
Bakersfield-Planz	No Monitor	No Monitor	24
Oildale	143	48	No Monitor
Taft College	133	Incomplete Data	No Monitor
Corcoran	172	55	16
Hanford	168	55	No Monitor
Merced	117	40	19
Stockton-Hazelton	100	37	17
Stockton-Wagner-Holt School	89	31	No Monitor
Modesto	119	37	19
Turlock	127	41	No Monitor
Visalia	127	52	23

* Designation value is the value used for determining attainment status. It is the highest measured value over three years after excluding highly irregular or infrequent events.

Figure M-2 illustrates the variation in PM10 and PM2.5 levels throughout 2002 at Stockton (a); Modesto (b); Merced (c); Clovis (d); Fresno-1st Street (e); Visalia (f); and Bakersfield-California (g). The total height of the bars represents PM10 concentrations, while the height of the black portion of the bars represents the PM2.5 fraction. In general, the highest PM10 and PM2.5 concentrations occurred during the late fall and winter. The colder, more stagnant conditions during this time of the year are conducive to the buildup of PM2.5, including the formation of secondary ammonium nitrate. In addition, increased activity from residential wood combustion may also occur.

Overall, the coarse fraction (particles between PM2.5 and PM10 in size) was highest during the spring through the early fall. However, at Clovis the coarse fraction was highest during the winter. The coarse fraction is primarily due to activities that resuspend dust, such as emissions from paved and unpaved roads and construction. Based on 2000-2003 monitoring data, we estimate that throughout the air district, PM2.5 contributes approximately 70 percent of PM10 during the winter (November-February) and 50 percent during January and February at Clovis. PM2.5 contributes approximately 30 percent to ambient PM10 during the rest of the year. On an annual average basis, PM2.5 contributes approximately 50 percent to ambient PM10.

Figure M-2 (a-d). Seasonal Variation in PM10 and PM2.5 Concentrations.

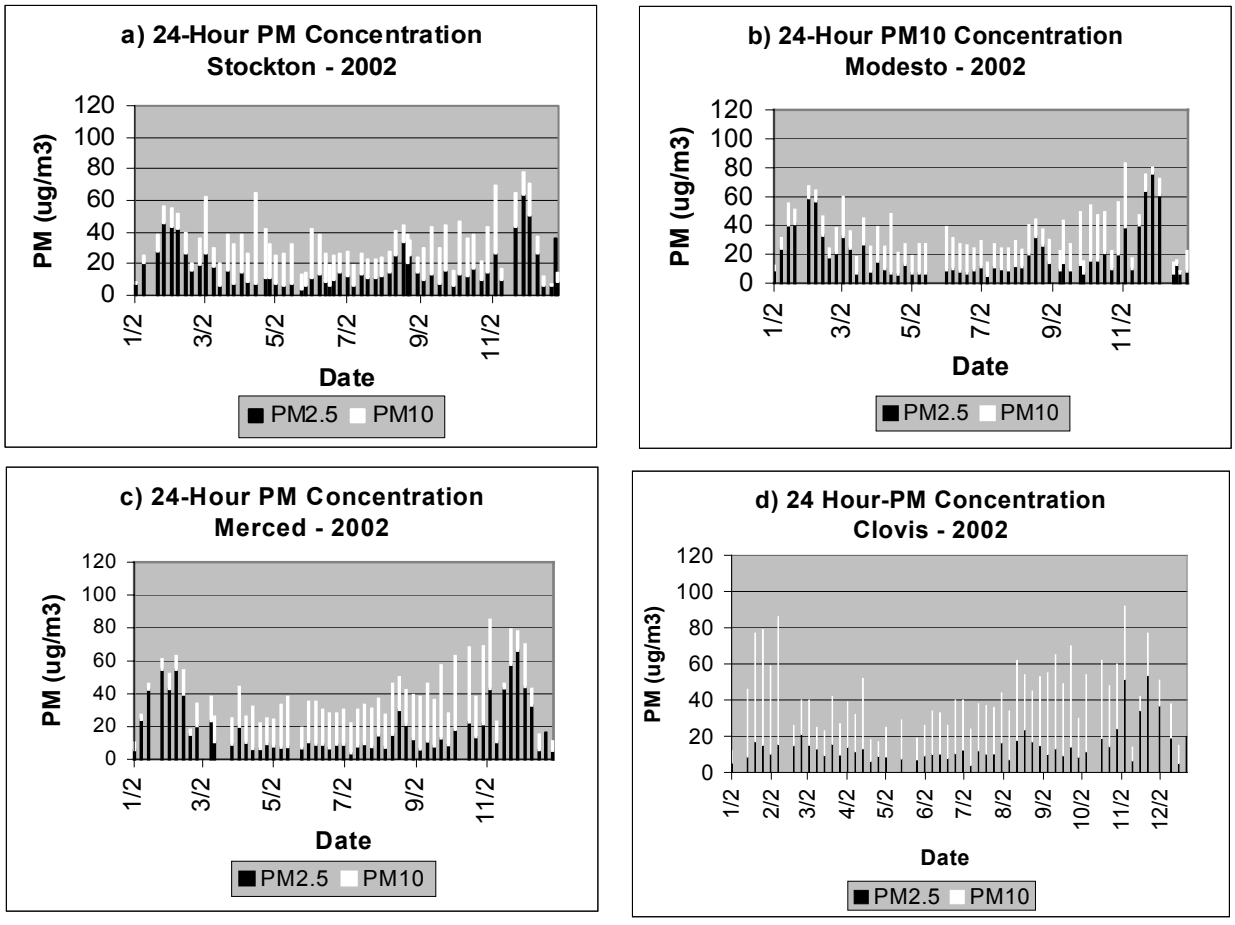


Figure M-2 (e-g). Seasonal Variation in PM10 and PM2.5 Concentrations.

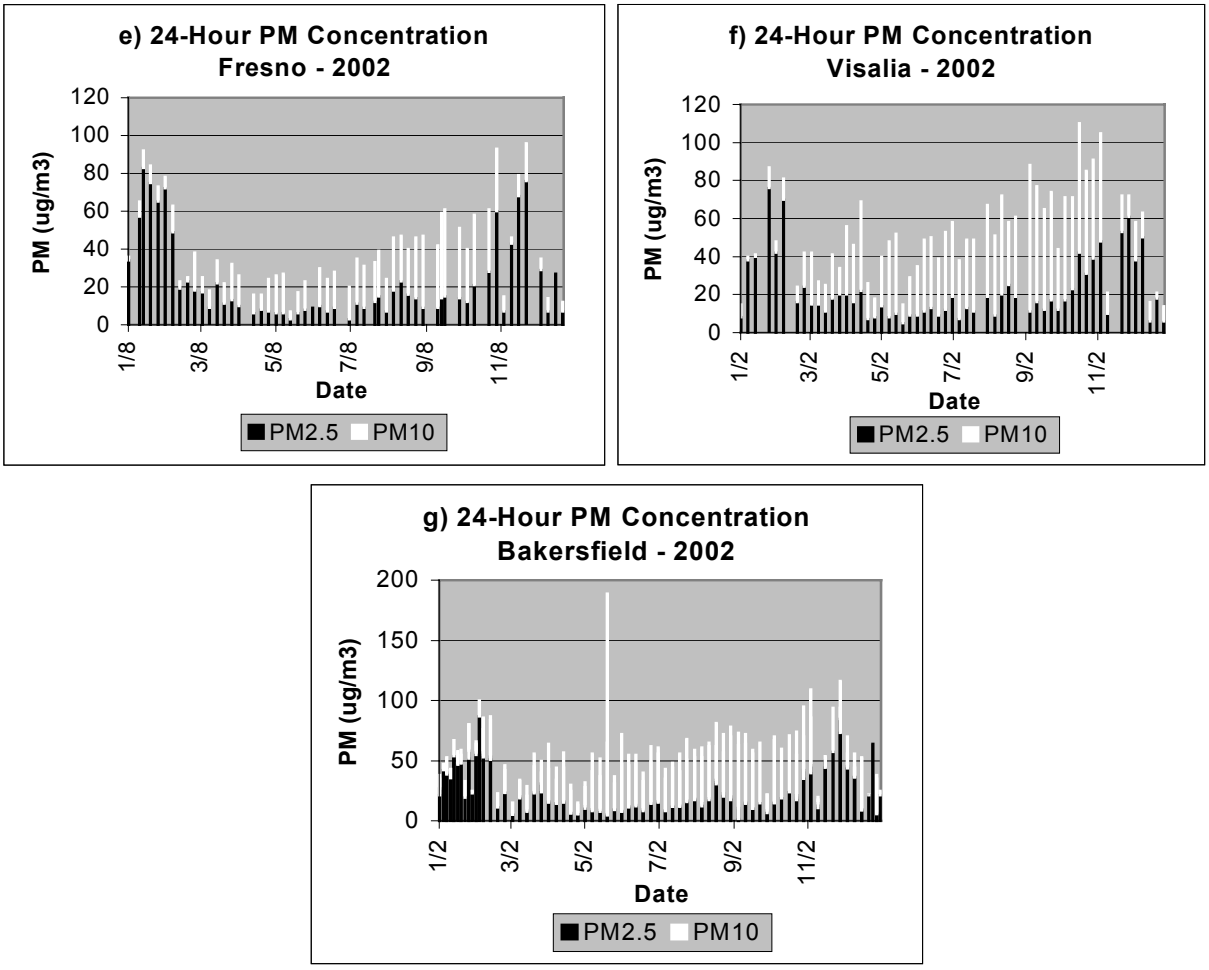
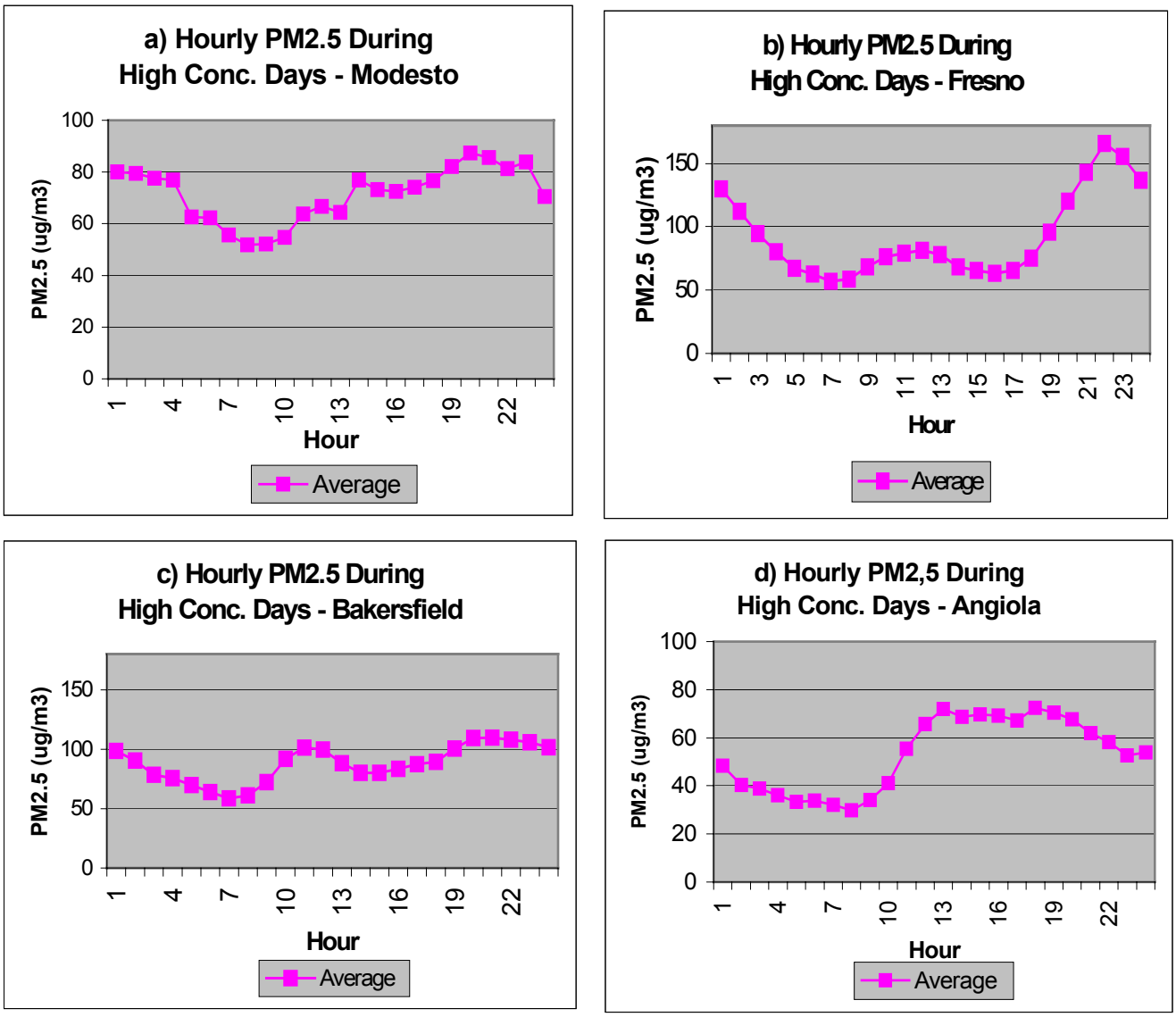


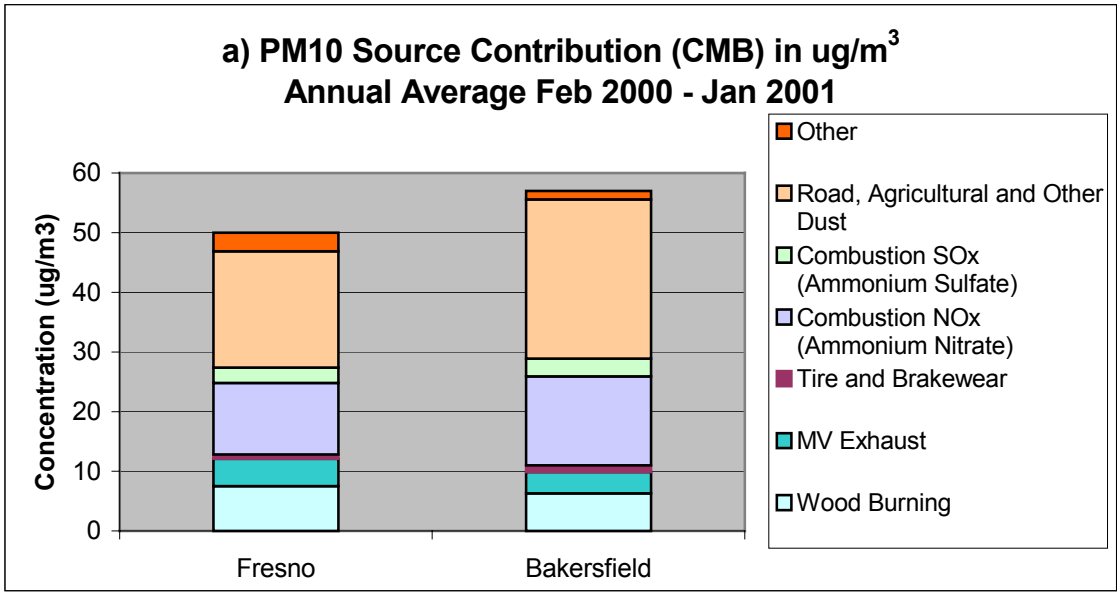
Figure M-3 presents the average hourly variation in PM2.5 levels for the days within the year with the highest PM2.5 concentrations at three urban sites of Modesto (a); Fresno-1st Street (b); and Bakersfield-California (c); and at the rural Angiola site (d). The site at Angiola was operated during the 2000 California Regional PM10 and PM2.5 Air Quality Study (CRPAQS). In general, at the three urban sites the average hourly PM2.5 concentrations were highest during the evening. The concentration peak is broader at Modesto and sharper, with shorter duration at Fresno. Peak evening concentrations generally reflect the influence of lowering inversion heights which trap pollutants close to the surface, as well as increased activity from evening commute traffic and residential wood combustion during winter months. In addition, a smaller concentration peak occurs from 10 a.m.-1 p.m. At Angiola, a broader mid-day peak of PM2.5 concentrations occurs. Mid-day peaks can often reflect the influence of daytime secondary PM formation.

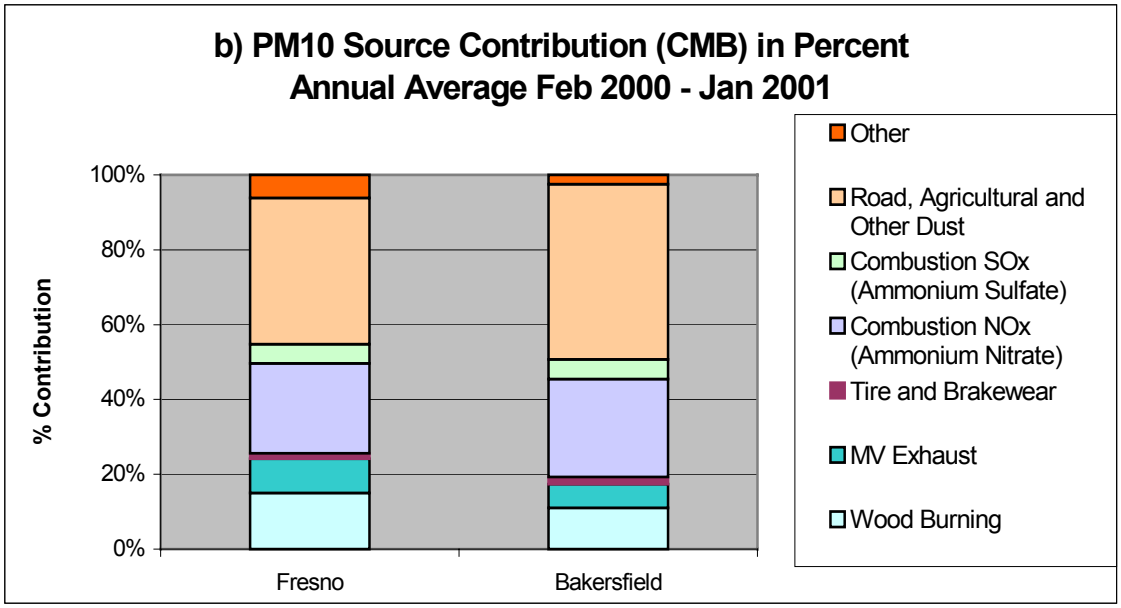
Figure M-3. Hourly Variation in PM10 and PM2.5 Concentrations.



Figures M-4 and M-5 present the results of the chemical mass balance modeling performed in support of the 2003 San Joaquin Valley APCD State Implementation Plan for PM10 using ambient PM data collected as part of California's routine monitoring network and CRPAQS. Figure M-4 illustrates sources contributing to the annual average PM10 levels expressed in $\mu g/m^3$ (a) and as percent of PM10 (b) at two urban sites – Fresno and Bakersfield. The source attribution results are similar at both sites. The largest contributor to ambient PM10 is dust from roads, agricultural activities, and other dust producing activities (approximately 40 to 45 percent). The total contribution of dust sources is higher at Bakersfield, resulting in higher PM10 concentrations at this site.

Figure M-4. Source Attribution of Annual Average PM10 at Two Urban Sites Using Chemical Mass Balance.





Secondary ammonium nitrate formed in the atmosphere from chemical reactions of NOx from mobile and stationary combustion sources is the second largest contributor to PM10 (approximately 25 percent). Wood burning contributes approximately 15 percent to PM10, with the total contribution slightly higher at Fresno. Secondary ammonium sulfate formed in the atmosphere from chemical reactions of SOx from mobile and stationary source combustion sources also contributes to PM10.

Figure M-5 illustrates sources contributing to the PM10 levels during a winter episode expressed in $\mu g/m^3$ (a) and as percent of PM10 (b) at four urban sites – Modesto, Fresno, Clovis, and Bakersfield. The colder, more stagnant conditions during this time of the year are conducive to the buildup of PM, including the formation of secondary ammonium nitrate. Ammonium nitrate contributed approximately 40 percent at Fresno to approximately 55 percent at Modesto. In addition, increased activity from residential wood combustion also occurs, with higher total contributions at Fresno, Modesto, and Bakersfield. Particles emitted in motor vehicle exhaust account for a slightly higher contribution to PM10 at Fresno. Dust sources also contribute significantly at Bakersfield, Fresno, and Clovis, with a lower contribution at Modesto.

Figure M-5 (a). Source Attribution of Winter PM10 at Four Urban Sites Using Chemical Mass Balance.

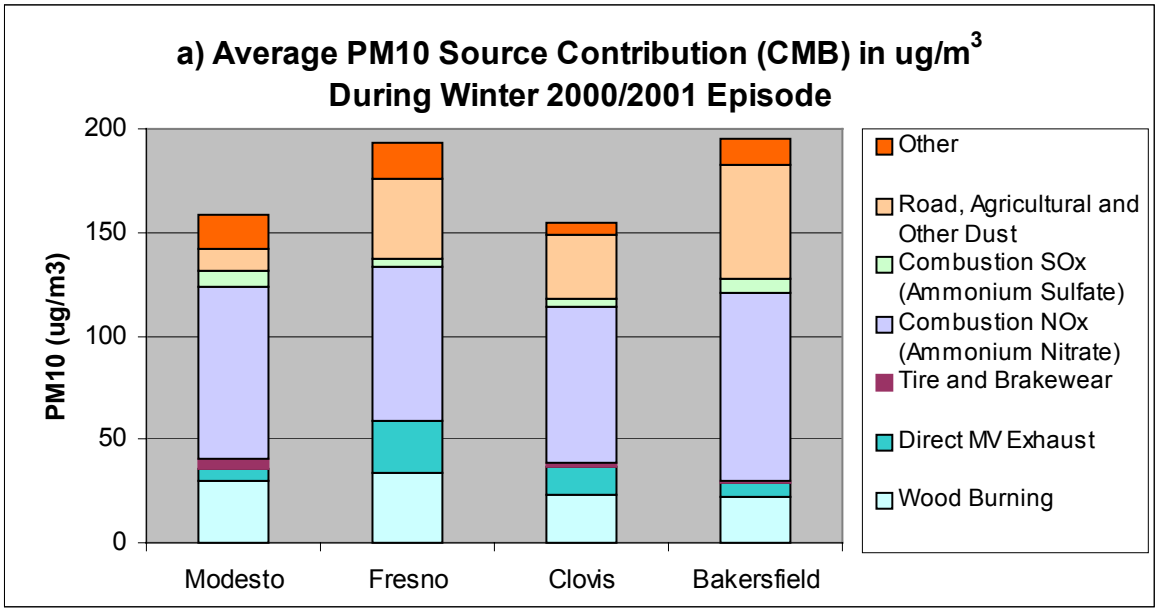


Figure M-5 (b). Source Attribution of Winter PM10 at Four Urban Sites Using Chemical Mass Balance.

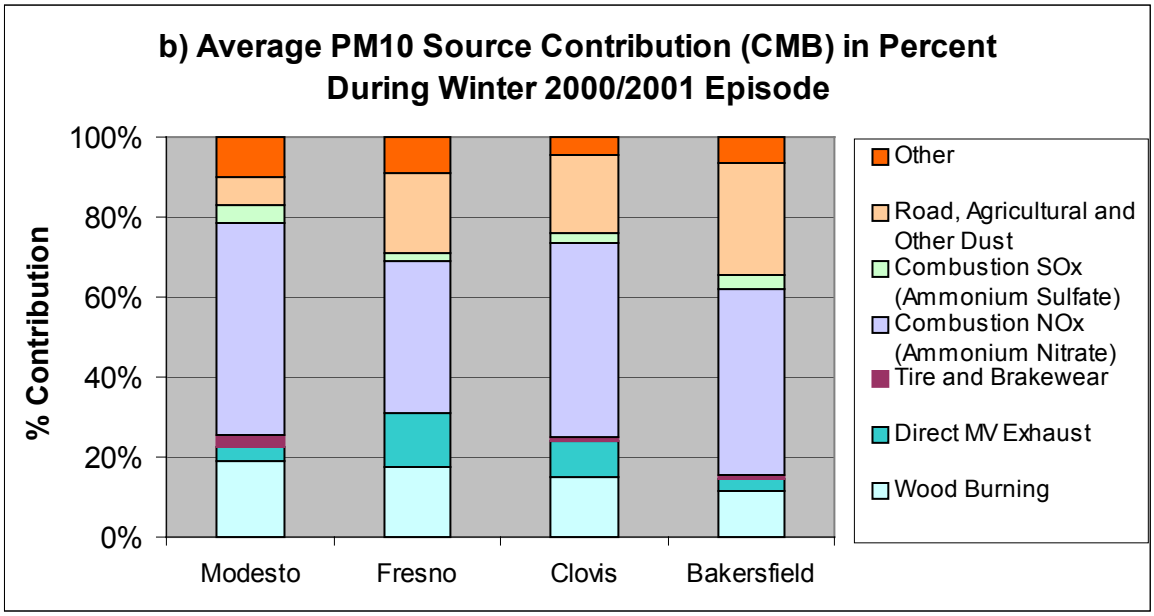
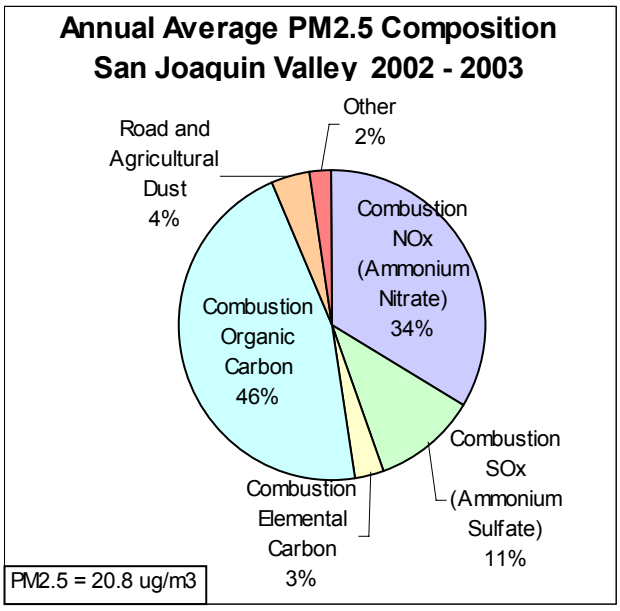


Figure M-6. Chemical Composition of Annual Average PM2.5 and Link to Emission Source Type.



Data for Figures M-6 and M-7 are from analysis of ambient PM2.5 data collected throughout the San Joaquin Valley from the State's PM2.5 speciation network and CRPAQS. Chemical components have been associated with possible emission sources based on emission inventory information. On an annual average basis throughout the San Joaquin Valley (Figure M-7), organic carbon is the major component of PM2.5 (46 percent). Ammonium nitrate and ammonium sulfate also contribute significantly to ambient PM2.5 (approximately 45 percent), with ammonium nitrate contributing three times as much as ammonium sulfate. Dust from roads and other dust producing activities, and elemental carbon from combustion processes contribute to a lesser extent.

Figure M-7 illustrates the chemical composition and corresponding emission source types on days when PM2.5 concentrations are well over the national 24-hour PM10 standard of 65 $\mu g/m^3$ in urban (a) and rural (b) areas of the San Joaquin Valley. On peak days secondary ammonium nitrate becomes the largest contributor to ambient PM2.5 at both urban and rural sites (approximately 50 to 60 percent), with a higher percent contribution at rural sites. Organic carbon constitutes approximately one third of PM2.5 at urban sites, but only 14 percent at rural sites. Elemental carbon resulting from mobile and stationary combustion processes, and ammonium sulfate also contribute to PM2.5, but to a lesser extent.

Figure M-7. Chemical Composition of PM2.5 on High Concentration Days and Link to Emission Source Type.

a) Urban **b) Rural**