Chapter 2

Current Emissions and Air Quality -- Criteria Pollutants

Introduction

This chapter provides statewide information on current emissions and air quality, relative to the State and national ambient air quality standards (see Chapter 5 for information on toxic air contaminants). This section gives a national perspective on how California's air quality compares with that in other areas of the nation. The second section of this chapter includes a summary table of the Statewide Emission Inventory. The table shows emissions data by three major source categories: stationary sources, area-wide sources, and mobile sources. Emissions data for natural sources are provided in Appendix E. The remaining sections of this Chapter provide information on emissions (including the high emitting facilities) and air quality on a statewide basis. This information is organized by pollutant, for ozone (and ozone precursor emissions), particulate matter (PM_{10} and $PM_{2.5}$), CO, and ammonia (NH_3).

Emissions are reported as annual averages, in tons per day. For most sources and pollutants that are not seasonal, this describes emissions very well. However, for some pollutants such as PM_{10} and $PM_{2.5}$, annual averages do not give an accurate indication of the seasonal nature of emissions. Therefore, they may appear to be artificially low. Many sources of PM_{10} and $PM_{2.5}$ are seasonal, including wildfires, agricultural processes, residential wood combustion, or dust storms in the Owens Valley and Mono Lake areas. Many sources of PM_{10} and $PM_{2.5}$ can also be very localized, and basinwide annual averages do not give any information about these sources.

State and local agencies have implemented many control measures during the last three decades to improve air quality. As a result, there has been a steady decline in both emissions and pollutant concentrations. However, two criteria pollutants, ozone and particulate matter, still pose air quality problems. Significant progress has been made towards attainment of CO standards. With the exception of the City of Calexico in Imperial County, both the national and State CO standards have been attained statewide. Although substantial progress has been made in reducing ozone and PM levels, it will be a challenge to reduce emissions sufficiently to attain these standards statewide.

Figure 2-1 shows the national 8-hour ozone design values for the top 15 urban areas in the nation, based on data for 2002 to 2004. The design values in all these areas exceed the national 8-hour standard of 0.08 ppm. Seven of the top 15 areas are located in California, with the Los Angeles South Coast Air Basin and San Joaquin Valley areas ranking first and second. This table indicates the severity of the ozone air quality problem in California.

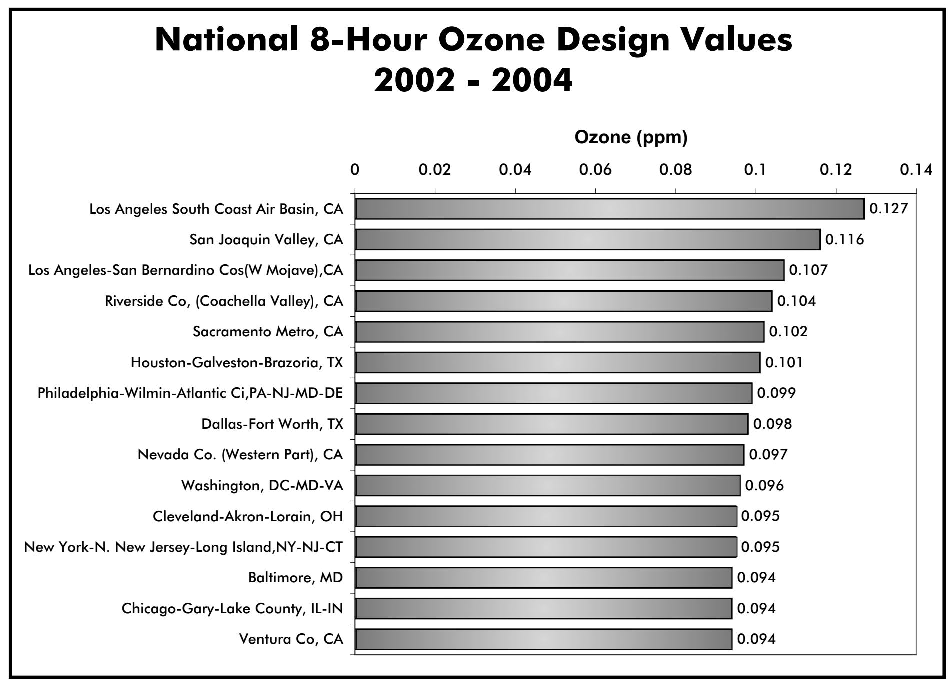

Figure 2-1

Attainment of the standards for particulate matter (PM_{10} and $PM_{2.5}$) is also a significant problem. The PM_{10} problem is most prevalent in the western United States. Eight western areas are classified as serious PM_{10} nonattainment areas. Half of these, the Coachella Valley, the Owens Valley, the San Joaquin Valley, and the South Coast Air Basin, are located in California. In contrast, the $PM_{2.5}$ problem is prevalent in both the eastern United States and in California. Because of the complex nature of the PM problem, it will be many years before the standards are attained.

Carbon monoxide poses much less of a problem here in California than PM. Figure 2-2 shows the four areas in the nation that averaged at least one day with CO concentrations above the level of the national standard during 2002 to 2004. The Calexico area (Imperial County) ranked third. Calexico is the only area in California where the national CO standard is still violated. However, the Calexico area has made considerable progress towards attainment. Peak levels have declined significantly in the last five years, as have the number of days that the standard is exceeded. The State's stringent motor vehicle emission standards and clean fuels programs continue to be effective in reducing ambient CO concentrations.

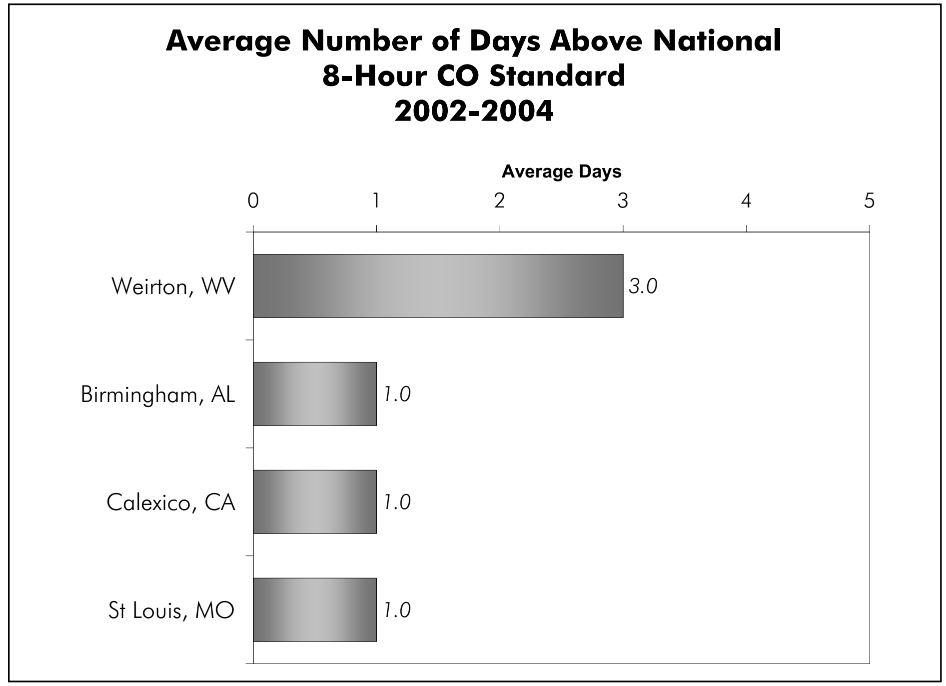

Figure 2-2

2005 Statewide Emission Inventory
Summary

Division / Major Category	Emissions (tons/day, annual average) ROG	CO	NO_x	SO_x	PM_{10} *	$PM_{2.5}$ *	NH_3 **
Stationary Sources	**473**	**372**	**420**	**112**	**136**	**91**	**63**
Fuel Combustion	48	299	324	38	36	34	7
Waste Disposal	14	2	3	1	2	1	47
Cleaning and Surface Coatings	210	1	0	0	1	1	2
Petroleum Production and Marketing	145	23	9	46	2	2	2
Industrial Processes	55	48	84	28	94	52	5
Area-Wide Sources	**751**	**2719**	**112**	**11**	**1939**	**654**	**504**
Solvent Evaporation	448	0	0	0	0	0	30
Miscellaneous Processes	303	2719	112	11	1939	654	474
Mobile Sources	**1207**	**10674**	**2687**	**179**	**138**	**115**	**101**
Passenger Vehicles	349	3324	303	2	17	10	59
Light and Medium Duty Trucks	291	3151	357	2	14	9	39
Heavy Duty Trucks	95	733	771	8	16	14	3
Other On-road	35	421	88	1	2	2	1
Aircraft and Trains	46	300	216	20	13	12	-
Ships and Commercial Boats***	17	43	339	144	25	24	-
Recreational Boats and Vehicles	158	916	37	1	11	8	-
Off-Road Equipment	169	1664	455	1	32	26	-
Other Off-road	46	121	123	1	8	8	-
Total Statewide - All Sources ****	***2430***	***13766***	***3219***	***302***	***2213***	***860***	***670***

* Includes directly emitted particulate matter only.
** A refined methodology was developed for NH_3 emission estimates, which are reflected in the increased estimates as compared with last year's almanac.
*** An improved statewide methodology has been developed for estimating emissions from ship and commercial boat activities. This results in increased emissions for all pollutants for these categories.
**** Natural sources are provided in Appendix E. These summaries do not include emissions from wind blown dust - exposed lake beds from Owens and Mono Lakes. These emissions are estimated to be about 131 tons/day of PM_{10}.

Table 2-1

2005 Statewide Emission Inventory by Sub-Category

Division Major Category Sub-Category	Emissions (tons/day, annual average)						
	ROG	CO	NO_x	SO_x	PM_{10} *	$PM_{2.5}$ *	NH_3**
Stationary Sources (division total)	**473**	**372**	**420**	**112**	**136**	**91**	**63**
Fuel Combustion (major category total)	48	299	324	38	36	34	7
- Electric Utilities	4	50	25	3	6	6	4
- Cogeneration	4	46	27	2	4	4	2
- Oil And Gas Production (Combustion)	15	21	22	2	1	1	0
- Petroleum Refining (Combustion)	2	19	25	12	3	3	1
- Manufacturing And Industrial	6	59	94	13	7	7	2
- Food And Agricultural Processing	5	53	35	2	3	3	0
- Service And Commercial	10	41	76	3	7	6	0
- Other (Fuel Combustion)	2	8	20	1	5	4	0
Waste Disposal (major category total)	14	2	3	1	2	1	47
- Sewage Treatment	1	0	0	0	0	0	1
- Landfills	8	1	1	0	1	0	12
- Incinerators	1	1	2	0	1	1	0
- Soil Remediation	0	0	0	-	0	0	-
- Other (Waste Disposal)	4	0	0	-	0	0	35
Cleaning And Surface Coatings (major category total)	210	1	0	0	1	1	2
- Laundering	1	0	0	-	-	-	-
- Degreasing	38	-	-	-	0	0	0
- Coatings And Related Process Solvents (sub-category total)	130	0	0	0	1	1	0
- Auto Marine, & Aircraft	*24*	*0*	*0*	*0*	*0*	*0*	*0*
- Paper & Fabric	*3*	*0*	*0*	*0*	*0*	*0*	*0*
- Metal, Wood, & Plastic	*31*	*0*	*0*	*0*	*0*	*0*	*0*
- Other	*71*	*0*	*0*	*0*	*0*	*0*	*0*

* Includes directly emitted particulate matter only.

** A refined methodology was developed for NH_3 emission estimates, which are reflected in the increased estimates as compared with last year's almanac.

Table 2-2

2005 Statewide Emission Inventory by Sub-Category

Division / Major Category / Sub-Category	Emissions (tons/day, annual average)						
	ROG	CO	NO_x	SO_x	PM_{10} *	$PM_{2.5}$ *	NH_3**
Stationary Sources (division total) (continued)							
Cleaning And Surface Coatings (major category) (continued)							
- Printing	17	0	0	-	0	0	0
- Adhesives And Sealants	20	-	-	-	0	-	-
- Other (Cleaning And Surface Coatings)	5	0	0	0	0	0	2
Petroleum Production And Marketing (major category total)	145	23	9	46	2	2	2
- Oil And Gas Production	44	1	3	0	0	0	0
- Petroleum Refining	16	21	6	46	2	2	2
- Petroleum Marketing (sub-category total)	85	1	0	-	0	0	-
- Fuel Distribution Losses	*3*	*0*	*0*	*0*	*0*	*0*	*0*
- Fuel Storage Losses	*2*	*0*	*0*	*0*	*0*	*0*	*0*
- Vehicle Refueling	*47*	*0*	*0*	*0*	*0*	*0*	*0*
- Other	*32*	*0*	*0*	*0*	*0*	*0*	*0*
- Other (Petroleum Production And Marketing)	0	-	-	-	-	-	0
Industrial Processes (major category total)	55	48	84	28	94	52	5
- Chemical	20	1	2	3	4	4	0
- Food And Agriculture	19	2	9	1	15	7	0
- Mineral Processes	4	32	53	18	52	25	0
- Metal Processes	1	1	1	0	1	1	-
- Wood And Paper	3	1	2	0	14	9	-
- Glass And Related Products	0	1	10	4	1	1	1
- Electronics	1	-	-	-	0	0	-
- Other (Industrial Processes)	7	9	7	1	7	6	4

* Includes directly emitted particulate matter only.
** A refined methodology was developed for NH_3 emission estimates, which are reflected in the increased estimates as compared with last year's almanac.

Table 2-2 (continued)

2005 Statewide Emission Inventory by Sub-Category

Division / Major Category / Sub-Category	ROG	CO	NO_x	SO_x	PM_{10}*	$PM_{2.5}$*	NH_3**
	Emissions (tons/day, annual average)						
Area-Wide Sources (division total)	**751**	**2719**	**112**	**11**	**1939**	**654**	**504**
Solvent Evaporation (major category total)	448	0	0	0	0	0	30
- Consumer Products	259	-	-	-	-	-	-
- Architectural Coatings And Related Process Solvent (sub-category total)	102	-	-	-	-	-	-
- Architectural Coating	*86*	*0*	*0*	*0*	*0*	*0*	*0*
- Thinning & Cleanup Solvents	*15*	*0*	*0*	*0*	*0*	*0*	*0*
- Pesticides/Fertilizers (sub-category total)	55	-	-	-	-	-	30
- Farm Use	*53*	*0*	*0*	*0*	*0*	*0*	*0*
- Commercial Use	*2*	*0*	*0*	*0*	*0*	*0*	*0*
- Asphalt Paving / Roofing	31	-	-	-	0	0	-
- Other (Solvent Evaporation)	-	-	-	-	-	-	-
Miscellaneous Processes (major category total)	303	2719	112	11	1939	654	474
- Residential Fuel Combustion (sub-category total)	54	791	75	4	114	110	6
- Wood Combustion	*51*	*762*	*10*	*1*	*109*	*105*	*6*
- Cooking And Space Heating	*3*	*25*	*55*	*2*	*5*	*5*	*0*
- Other	*1*	*4*	*10*	*0*	*1*	*1*	*0*
- Farming Operations (sub-category total)	120	-	-	-	170	51	411
- Tilling,Harvesting, & Growing	*0*	*0*	*0*	*0*	*133*	*30*	*0*
- Livestock	*120*	*0*	*0*	*0*	*37*	*22*	*411*

* Includes directly emitted particulate matter only.

** A refined methodology was developed for NH_3 emission estimates, which are reflected in the increased estimates as compared with last year's almanac.

Table 2-2 (continued)

2005 Statewide Emission Inventory by Sub-Category

Division Major Category Sub-Category	Emissions (tons/day, annual average)						
	ROG	CO	NO_x	SO_x	PM_{10} *	$PM_{2.5}$ *	NH_3**
Area-Wide Sources (division total) (continued)							
Miscellaneous Processes (major category) (continued)							
- Construction And Demolition (sub-category total)	-	-	-	-	196	41	-
- Building	*0*	*0*	*0*	*0*	*108*	*22*	*0*
- Road Construction Dust	*0*	*0*	*0*	*0*	*87*	*18*	*0*
- Paved Road Dust	-	-	-	-	411	69	-
- Unpaved Road Dust	-	-	-	-	521	130	-
- Fugitive Windblown Dust (sub-category total)	-	-	-	-	306	67	-
- Farm Lands	*0*	*0*	*0*	*0*	*175*	*39*	*0*
- Pasture Lands	*0*	*0*	*0*	*0*	*18*	*4*	*0*
- Unpaved Roads	*0*	*0*	*0*	*0*	*113*	*24*	*0*
- Fires	1	10	0	-	1	1	-
- Managed Burning And Disposal (sub-category total)	122	1917	37	7	192	168	2
*- Agricultural Burning ****	*17*	*166*	*7*	*0*	*20*	*19*	*2*
- Non-Agricultural Burning	*104*	*1744*	*29*	*7*	*172*	*149*	*0*
- Other	*1*	*7*	*0*	*0*	*1*	*1*	*0*
- Cooking	7	0	-	-	26	16	-
- Other (Miscellaneous Processes)	0	1	0	-	1	1	56

* Includes directly emitted particulate matter only.
** A refined methodology was developed for NH_3 emission estimates, which are reflected in the increased estimates as compared with last year's almanac.
*** Agricultural burning includes the prescribed burning of prunings and field crops. Non-agricultural burning includes prescribed burning activities associated with range improvement, forest management, wildland fire use, and weed abatement.

Table 2-2 (continued)

2005 Statewide Emission Inventory by Sub-Category

Division / Major Category / Sub-Category	ROG	CO	NO_x	SO_x	PM_{10} *	$PM_{2.5}$ *	NH_3**
	Emissions (tons/day, annual average)						
Mobile Sources (division total)	**1207**	**10674**	**2687**	**179**	**138**	**115**	**101**
On-Road Motor Vehicles (major category total)	770	7629	1518	12	50	34	101
- Light Duty Passenger (sub-category total)	349	3324	303	2	17	10	59
- Non-Evaporative	*197*	*3323*	*301*	*2*	*17*	*10*	*59*
- Evaporative	*151*	*0*	*0*	*0*	*0*	*0*	*0*
- Diesel	*0*	*1*	*2*	*0*	*0*	*0*	*0*
- Light Duty Trucks(<3750 lbs.) (sub-category total)	131	1412	125	1	5	3	15
- Non-Evaporative	*72*	*1410*	*121*	*1*	*5*	*3*	*15*
- Evaporative	*58*	*0*	*0*	*0*	*0*	*0*	*0*
- Diesel	*0*	*2*	*4*	*0*	*0*	*0*	*0*
- Light Duty Trucks (>3750 lbs) (sub-category total)	103	1144	145	1	7	4	17
- Non-Evaporative	*61*	*1143*	*143*	*1*	*6*	*4*	*17*
- Evaporative	*42*	*0*	*0*	*0*	*0*	*0*	*0*
- Diesel	*0*	*1*	*2*	*0*	*0*	*0*	*0*
- Medium Duty Trucks (sub-category total)	57	595	86	0	3	2	7
- Non-Evaporative	*36*	*594*	*83*	*0*	*3*	*2*	*7*
- Evaporative	*20*	*0*	*0*	*0*	*0*	*0*	*0*
- Diesel	*0*	*1*	*3*	*0*	*0*	*0*	*0*
- Light Heavy Duty Gas Trucks (<10000 lbs) (sub-category total)	18	115	17	0	0	0	1
- Non-Evaporative	*10*	*115*	*17*	*0*	*0*	*0*	*1*
- Evaporative	*8*	*0*	*0*	*0*	*0*	*0*	*0*
- Light Heavy Duty Gas Trucks (>10000 lbs) (sub-category total)	5	34	6	0	0	0	0
- Non-Evaporative	*2*	*34*	*6*	*0*	*0*	*0*	*0*
- Evaporative	*3*	*0*	*0*	*0*	*0*	*0*	*0*
- Medium Heavy Duty Gas Trucks (sub-category total)	26	204	21	0	0	0	0
- Non-Evaporative	*17*	*204*	*21*	*0*	*0*	*0*	*0*
- Evaporative	*10*	*0*	*0*	*0*	*0*	*0*	*0*

* Includes directly emitted particulate matter only.

** A refined methodology was developed for NH_3 emission estimates, which are reflected in the increased estimates as compared with last year's almanac.

Table 2-2 (continued)

2005 Statewide Emission Inventory by Sub-Category

Division Major Category Sub-Category	Emissions (tons/day, annual average) ROG	CO	NO_x	SO_x	PM_{10} *	$PM_{2.5}$ *	NH_3**
On-Road Motor Vehicles (major category) (continued)							
- Heavy Heavy Duty Gas Trucks (sub-category total)	20	256	39	0	0	0	0
- Non-Evaporative	*15*	*256*	*39*	*0*	*0*	*0*	*0*
- Evaporative	*5*	*0*	*0*	*0*	*0*	*0*	*0*
- Light Heavy Duty Gas Trucks (<10000 lbs)	1	3	19	0	0	0	0
- Light Heavy Duty Gas Trucks (>10000 lbs)	1	3	15	0	0	0	0
- Medium Heavy Duty Diesel Trucks	4	25	138	2	4	3	0
- Heavy Heavy Duty Diesel Trucks	21	94	515	6	11	9	0
- Motorcycles (Mcy) (sub-category total)	20	166	5	-	0	0	0
- Non-Evaporative	*14*	*166*	*5*	*0*	*0*	*0*	*0*
- Evaporative	*6*	*0*	*0*	*0*	*0*	*0*	*0*
- Heavy Duty Diesel Urban Buses	2	9	45	0	1	1	-
- Heavy Duty Gas Urban Buses (sub-category total)	6	69	8	0	0	0	0
- Non-Evaporative	*6*	*69*	*8*	*0*	*0*	*0*	*0*
- Evaporative	*0*	*0*	*0*	*0*	*0*	*0*	*0*
- School Buses (sub-category total)	2	19	15	0	1	0	0
- Non-Evaporative	*1*	*16*	*1*	*0*	*0*	*0*	*0*
- Evaporative	*0*	*0*	*0*	*0*	*0*	*0*	*0*
- Diesel	*1*	*3*	*14*	*0*	*1*	*0*	*0*
- Motor Homes (sub-category total)	6	158	15	0	0	0	0
- Non-Evaporative	*5*	*158*	*12*	*0*	*0*	*0*	*0*
- Evaporative	*0*	*0*	*0*	*0*	*0*	*0*	*0*
- Diesel	*0*	*0*	*3*	*0*	*0*	*0*	*0*

* Includes directly emitted particulate matter only.

** A refined methodology was developed for NH_3 emission estimates, which are reflected in the increased estimates as compared with last year's almanac.

Table 2-2 (continued)

2005 Statewide Emission Inventory by Sub-Category

Division / Major Category / Sub-Category	ROG	CO	NO_x	SO_x	PM_{10} *	$PM_{2.5}$ *	NH_3**
	Emissions (tons/day, annual average)						
Mobile Sources (division total) (continued)							
Other Mobile Sources (major category total)	436	3045	1169	166	88	80	0
- Aircraft	37	267	55	3	8	7	-
- Trains	8	33	162	17	5	5	-
- Ships And Commercial Boats ***	17	43	339	144	25	24	-
- Residual Oil	*6*	*17*	*222*	*138*	*19*	*18*	*0*
- Diesel	*7*	*16*	*78*	*1*	*4*	*3*	*0*
- Gasoline	*0*	*0*	*0*	*0*	*0*	*0*	*0*
- Other Fuel	*3*	*10*	*39*	*5*	*3*	*3*	*0*
- Recreational Boats	107	653	32	0	10	8	-
- Non-Evaporative	*100*	*652*	*30*	*0*	*10*	*8*	*0*
- Evaporative	*6*	*0*	*0*	*0*	*0*	*0*	*0*
- Diesel	*1*	*1*	*3*	*0*	*0*	*0*	*0*
- Off-Road Recreational Vehicles (sub-category total)	51	263	5	0	0	0	-
- Snowmobiles	*44*	*140*	*3*	*0*	*0*	*0*	*0*
- Motorcycles	*2*	*45*	*0*	*0*	*0*	*0*	*0*
- All-Terrain Vehicles	*2*	*42*	*0*	*0*	*0*	*0*	*0*
- Four-Wheel Drive Vehicles	*3*	*37*	*2*	*0*	*0*	*0*	*0*
- Off-Road Equipment (sub-category total)	169	1664	455	1	32	29	-
- Lawn And Garden Equipment	*101*	*779*	*15*	*1*	*3*	*2*	*0*
- Non-Evaporative	*70*	*776*	*9*	*0*	*3*	*2*	*0*
- Evaporative	*31*	*0*	*0*	*0*	*0*	*0*	*0*
- Diesel	*1*	*3*	*6*	*0*	*0*	*0*	*0*
- Commercial & Industrial Equipment	*69*	*885*	*440*	*1*	*29*	*26*	*0*
- Non-Evaporative	*26*	*635*	*28*	*0*	*2*	*2*	*0*
- Evaporative	*2*	*0*	*0*	*0*	*0*	*0*	*0*
- Diesel	*40*	*166*	*386*	*0*	*27*	*25*	*0*
- Natural Gas	*1*	*83*	*26*	*0*	*0*	*0*	*0*
- Farm Equipment (sub-category total)	17	121	123	1	8	8	-
- Non-Evaporative	*2*	*66*	*2*	*0*	*0*	*0*	*0*
- Evaporative	*0*	*0*	*0*	*0*	*0*	*0*	*0*
- Diesel	*14*	*55*	*120*	*1*	*8*	*7*	*0*
- Fuel Storage and Handling	30	-	-	-	-	-	-
Total Statewide - All Sources**	***2430***	***13766***	***3219***	***302***	***2213***	***860***	***670***

* Includes directly emitted particulate matter only.
** A refined methodology was developed for NH_3 emission estimates, which are reflected in the increased estimates as compared with last year's almanac.
*** An improved statewide methodology has been developed for estimating emissions from ship and commercial boat activities. This results in increased emissions for all pollutants for these categories.
**** Natural sources are provided in Appendix E. These summaries do not include emissions from wind blown dust - exposed lake beds from Owens and Mono Lakes. These emissions are estimated to be about 131 tons/day of PM_{10}.

Table 2-2 (continued)

Ozone

2005 Statewide Emission Inventory - Ozone Precursors by Category

NO_x Sources - Statewide

NO_x is a group of gaseous compounds of nitrogen and oxygen, many of which contribute to the formation of ozone, PM_{10}, and $PM_{2.5}$. Most NO_x emissions are produced by the combustion of fuels. Industrial sources report NO_x emissions to local air districts and to the ARB. Other sources of NO_x emissions are estimated by the local air districts and the ARB. Mobile sources (including on-road and other) make up about 83 percent of the total statewide NO_x emissions. Area-wide sources, which include residential fuel combustion, managed burning and disposal, commercial cooking, and fires, contribute only a small portion of the total NO_x emissions.

NO_X Emissions (annual average)		
Emissions Source	**tons/day**	**Percent**
Stationary Sources	420	13%
Area-wide Sources	112	3%
On-Road Mobile	1518	47%
Gasoline Vehicles	792	25%
Diesel Vehicles	726	23%
Other Mobile	1169	36%
Gasoline Vehicles	296	9%
Diesel Vehicles	754	23%
Other	120	4%
Total Statewide	***3219***	***100%***

Table 2-3

ROG Sources - Statewide

Reactive organic gases (ROG) are volatile organic compounds that are photochemically reactive and contribute to the formation of ozone, as well as PM_{10} and $PM_{2.5}$. These emissions result primarily from incomplete fuel combustion and the evaporation of chemical solvents and fuels. On-road mobile sources are the largest contributors to statewide ROG emissions. Stationary sources of ROG emissions include processes that use solvents (such as dry cleaning, degreasing, and coating operations) and petroleum-related processes (such as petroleum refining and marketing and oil and gas extraction). Area-wide ROG sources include consumer products, pesticides, aerosol and architectural coatings, asphalt paving and roofing, and other evaporative emissions.

ROG Emissions (annual average)		
Emissions Source	**tons/day**	**Percent**
Stationary Sources	473	19%
Area-wide Sources	751	31%
On-Road Mobile	770	32%
Gasoline Vehicles	742	31%
Diesel Vehicles	28	1%
Other Mobile	436	18%
Gasoline Vehicles	324	13%
Diesel Vehicles	71	3%
Other	42	2%
Total Statewide	***2430***	***100%***

Table 2-4

Largest Stationary Sources Statewide

Largest Stationary Sources of NO_x Statewide

Air Basin	Facility Name	City	Tons/Year
Mojave Desert	Cemex - Black Mountain Quarry	Apple Valley	4754
Mojave Desert	TXI Riverside Cement Company	Oro Grande	4235
Mojave Desert	California Portland Cement	Mojave	2942
Mojave Desert	Mitsubishi Cement 2000	Lucerne Valley	2770
San Francisco Bay Area	Valero Refining Company	Benicia	2064
Mojave Desert	Searles Valley Minerals	Trona	2021
San Francisco Bay Area	Shell Martinez Refinery	Martinez	1733
San Francisco Bay Area	Tesoro Refining And Marketing	Martinez	1493
Mojave Desert	National Cement	Lebec	1283
Mojave Desert	PG&E Topock Compressor Station	Needles	1140

Table 2-5

Largest Stationary Sources of ROG Statewide

Air Basin	Facility Name	City	Tons/Year
San Francisco Bay Area	Chevron Products Company	Richmond	1482
San Francisco Bay Area	Tesoro Refining And Marketing	Martinez	1422
San Francisco Bay Area	Shell Martinez Refinery	Martinez	1158
South Coast	ChevronTexaco Products	El Segundo	1011
South Coast	ExxonMobil Oil Corporation	Torrance	677
San Francisco Bay Area	New United Motor Manufacturing	Fremont	526
South Coast	BP West Coast Products Carson Refinery	Carson	526
San Joaquin Valley	Crimson Resource Management (Natural Gas)	Taft	445
San Francisco Bay Area	Valero Refining Company	Benicia	384
San Francisco Bay Area	ConocoPhillips - San Francisco	Rodeo	325

Table 2-6

Facility totals are the most recent available data. Some facilities may have reduced or increased emissions since these data were collected. These changes will be reflected in subsequent almanacs.
The list of facilities does not include military bases, landfills, or airports.

Statewide Emissions Maps - Ozone Precursors

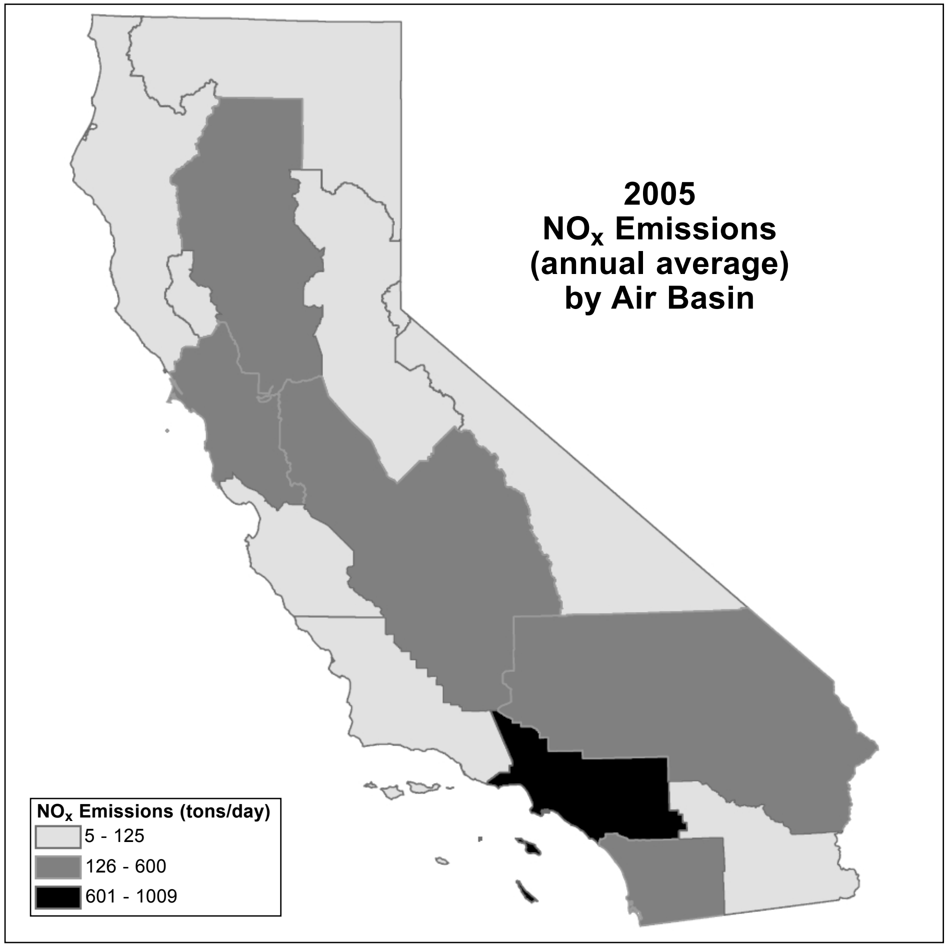

Figure 2-3

Figure 2-4

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Ozone - 2004 Air Quality

Air quality as it relates to ozone has improved greatly in California over the last several decades, although not uniformly throughout the State. However, despite aggressive emission controls, maximum measured ozone concentrations still exceed the State 1-hour standard in 10 of the 15 air basins. Maximum measured values exceed the national 8-hour standard in eight air basins. California's highest ozone concentrations occur in the South Coast Air Basin, where the peak 1 and 8-hour indicators are close to two times the level of the State 1-hour and national 8-hour standards.

Ozone concentrations are generally lower near the coast than they are inland, and rural areas tend to be cleaner than urban areas. This can be explained in part by the characteristics of ozone, including pollutant reactivity, transport, and deposition. Based on current ozone concentrations, substantial additional emission control measures will be needed to attain the standards throughout the State. 2004 air quality data for California's five largest air basins can be found in Chapter 4, along with information on 8-hour ozone concentrations, and preliminary 2005 ozone data.

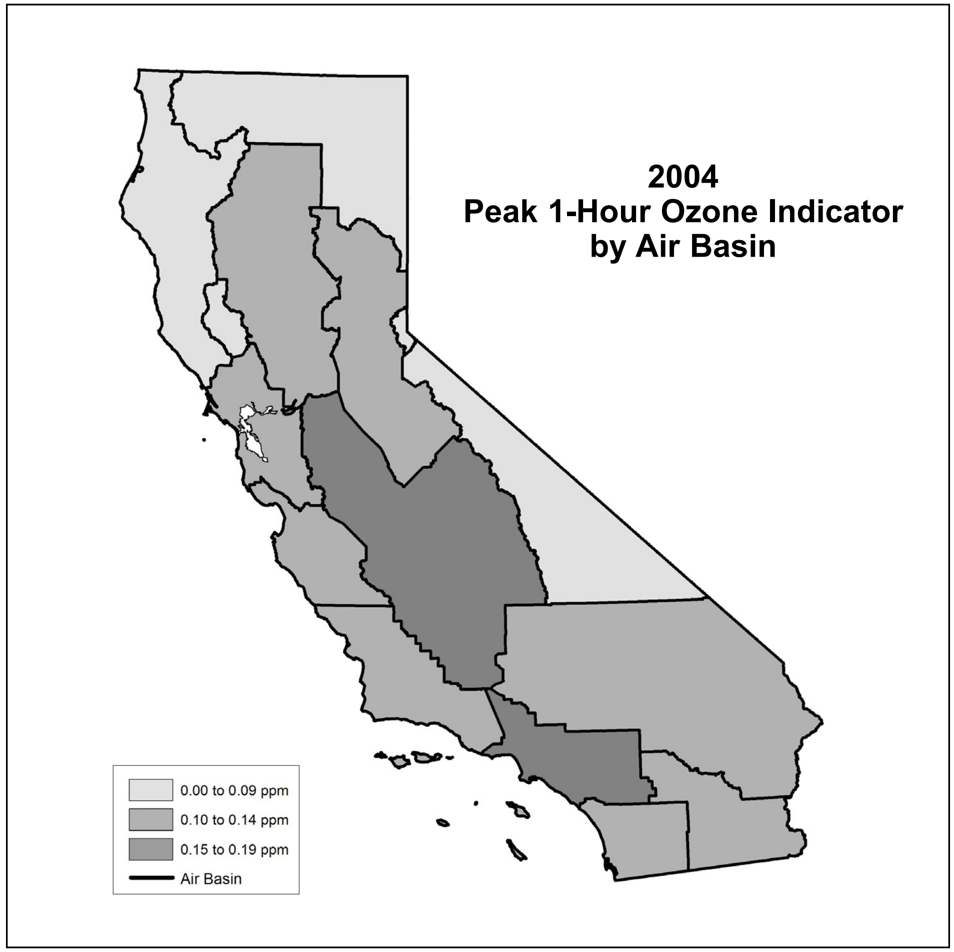

Figure 2-5

Ozone - 2004 Air Quality Tables

Maximum Peak 1-Hour and 8-Hour Indicator and Exceedance Days by Air Basin

AIR BASIN	2004 Maximum Peak Indicator in parts per million		Number of Days in 2004 above the Standard		
			State	National	
	1-Hour	8-Hour	1-Hour	1-Hour	8-Hour
Great Basin Valleys Air Basin	0.09	0.09	0	0	0
Lake County Air Basin	0.08	0.07	0	0	0
Lake Tahoe Air Basin	0.09	0.08	1	0	0
Mojave Desert Air Basin	0.14	0.12	75	4	49
Mountain Counties Air Basin	0.14	0.12	33	2	32
North Central Coast Air Basin	0.10	0.09	0	0	0
North Coast Air Basin	0.08	0.07	0	0	0
Northeast Plateau Air Basin	0.08	0.07	0	0	0
Sacramento Valley Air Basin	0.13	0.12	29	1	20
Salton Sea Air Basin	0.13	0.12	48	1	37
San Diego Air Basin	0.11	0.10	12	1	8
San Francisco Bay Area Air Basin	0.13	0.10	7	0	0
San Joaquin Valley Air Basin	0.15	0.13	106	9	109
South Central Coast Air Basin	0.12	0.10	23	0	18
South Coast Air Basin	0.18	0.15	105	28	88

Table 2-7

Top Sites with Peak 1-Hour Indicator Values above the State 1-Hour Ozone Standard

Mojave Desert Air Basin
- Joshua Tree-National Monument
- Phelan-Beekley Rd. & Phelan Rd.
- Lancaster-43301 Division Street
- Hesperia-Olive Street
- Victorville-14306 Park Avenue

Mountain Counties Air Basin
- Cool-Highway 193
- Placerville-Gold Nugget Way
- Colfax-City Hall
- Grass Valley-Litton Building
- San Andreas-Gold Strike Road

North Central Coast Air Basin
- Pinnacles National Monument
- Hollister-Fairview Road

Sacramento Valley Air Basin
- Folsom-Natoma Street
- Sacramento-Del Paso Manor
- Sloughhouse
- Auburn-Dewitt C Avenue
- Roseville-N Sunrise Blvd.
- Sutter Buttes - S Butte

Salton Sea Air Basin
- Palm Springs-Fire Station
- El Centro-9th Street
- Calexico-Grant Street
- Indio-Jackson Street
- Calexico-East

San Diego Air Basin
- Alpine-Victoria Drive
- San Diego-Overland Avenue
- Camp Pendleton
- Escondido-East Valley Parkway
- El Cajon-Redwood Avenue
- Otay Mesa-Paseo International

San Francisco Bay Area Air Basin
- Livermore-793 Rincon Avenue
- San Martin-Murphy Avenue
- Los Gatos
- Gilroy-9th Street
- Concord-2975 Treat Blvd.

San Joaquin Valley Air Basin
- Parlier
- Fresno-1st Street
- Arvin-Bear Mountain Blvd.
- Clovis-North Villa Avenue
- Fresno-Sierra Skypark #2

South Central Coast Air Basin
- Simi Valley-Cochran Street
- Ojai-Ojai Avenue
- Piru-3301 Pacific Avenue
- Thousand Oaks-Moorpark Road
- Paradise Rd.-Los Padres Nat'l Forest

South Coast Air Basin
- Santa Clarita
- Fontana-Arrow Highway
- Redlands-Dearborn
- Crestline
- Glendora-Laurel

Sites with 1-hour peak indicator values above the level of the State ozone standard during 2004. The top five sites in each air basin are listed in descending order of their peak indicator value. If an air basin is not listed, the peak indicator values at sites in that air basin were not above the State 1-hour ozone standard.

Table 2-8

The Nature of Particulate Matter (PM_{10} and $PM_{2.5}$)

PM_{10} is a mixture of particles and droplets that vary in size and chemical composition, depending on each particle's origin. PM_{10} includes the subsets of "coarse" particles, those between 2.5 microns and 10 microns in diameter ($PM_{2.5-10}$), and "fine" particles, those 2.5 microns or smaller ($PM_{2.5}$). Particulate matter can be directly emitted into the air in the form of dust and soot (primary PM) or, similar to ozone, it can be formed in the atmosphere from the reaction of gaseous precursors such as NO_x, SO_x, ROG, and ammonia (secondary PM). Primary particles are mostly coarse in size, but include some fine particles, while secondary particles are mostly fine.

Sources of ambient PM include: combustion sources such as trucks and passenger cars, off-road equipment, industrial processes, residential wood burning, and forest/agricultural burning; fugitive dust from paved and unpaved roads, construction, mining, and agricultural activities; and ammonia sources such as livestock operations, fertilizer application, and motor vehicles. In general, combustion processes emit and form fine particles, whereas particles from dust sources tend to fall in the coarse range.

The levels and chemical make-up of ambient PM vary widely from one area to another. In some areas, PM levels vary strongly by season. This is due to seasonal activity increase for some emissions sources and to weather conditions that are conducive to the build-up of PM. Seasonal sources of PM include wildfires, agricultural processes, dust storms, and residential wood burning. Stagnant conditions and cool temperatures during the winter contribute to the formation of secondary ammonium nitrate and ammonium sulfate, leading to higher ambient $PM_{2.5}$ concentrations. Dry weather and windy conditions cause higher coarse PM emissions, resulting in elevated PM_{10} concentrations.

The remainder of the discussion on PM includes summarized emission inventory data for directly emitted PM_{10} and $PM_{2.5}$, summarized information on ambient PM_{10} and $PM_{2.5}$ concentrations, and description of the link between source emissions and ambient PM concentrations in selected regions of the State.

Consistent with last year's almanac, is the reporting of both State and national annual averages for PM_{10} and $PM_{2.5}$. State and national annual averages may differ for several reasons: 1) the State and national criteria for assessing data completeness are different, 2) different monitors are approved for assessing compliance with each standard, and 3) the State standard uses local conditions while the national standard uses standard conditions for data reporting.

Directly Emitted Particulate Matter (PM_{10})

2005 Statewide Emission Inventory - Directly Emitted PM_{10} by Category

Area-wide sources account for about 88 percent of the statewide emissions of directly emitted PM_{10}. The major area-wide source of PM_{10} is fugitive dust, especially dust from unpaved and paved roads, agricultural operations, and construction and demolition. Fugitive dust emissions from unpaved and paved roads are related to motor vehicle population levels due to vehicular travel on both types of roads. Other sources of PM_{10} emissions include brake and tire wear, residential wood burning, and industrial sources. Exhaust emissions from mobile sources contribute a relatively small portion of directly emitted PM_{10} emissions but are a major source of the ROG and NO_x that form secondary particles. The section titled *PM_{10} and $PM_{2.5}$ - Linking Emissions Sources with Air Quality* describes how emissions from specific sources are linked to measured PM_{10} levels

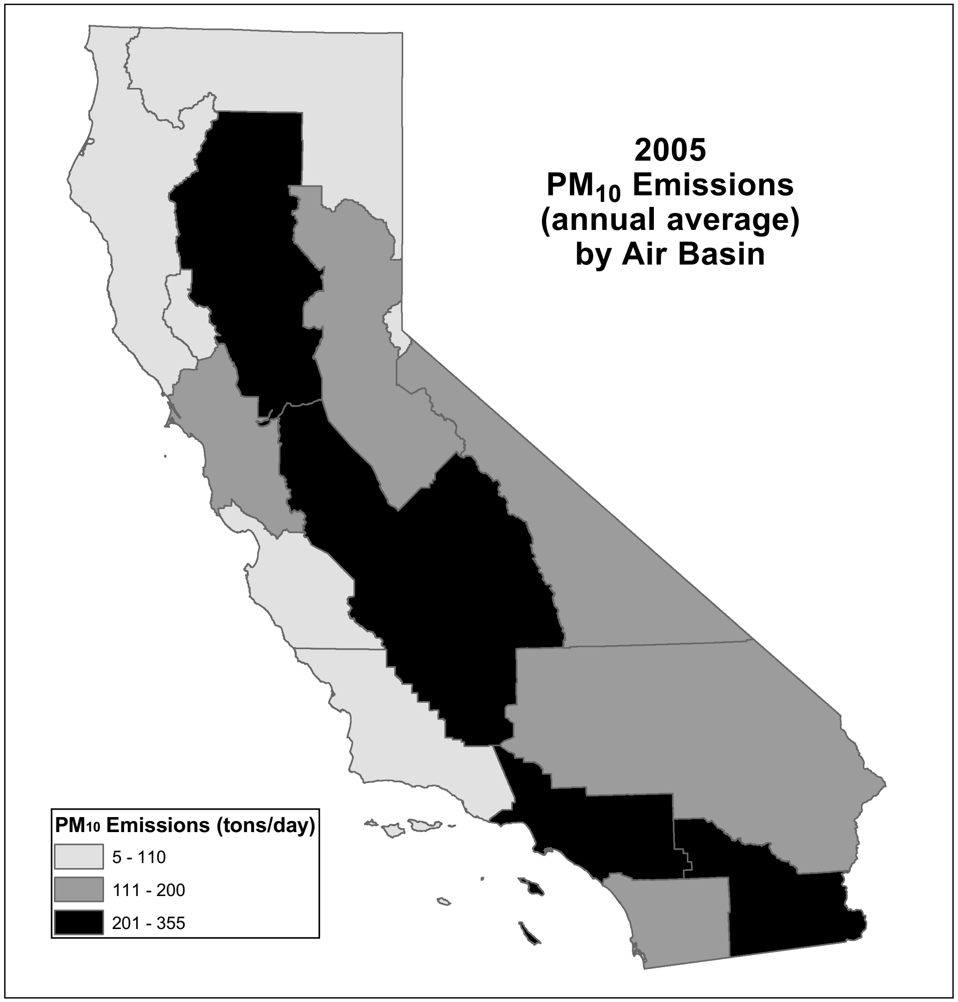

Figure 2-6

PM_{10} Emissions (annual average)		
Emissions Source	**tons/day**	**Percent**
Stationary Sources	136	6%
Area-wide Sources	1939	88%
On-Road Mobile	50	2%
Gasoline Vehicles	33	1%
Diesel Vehicles	17	1%
Other Mobile	88	4%
Gasoline Vehicles	34	2%
Diesel Vehicles	44	2%
Other	10	0%
Total Statewide	***2213***	***100%***

Table 2-9

Largest Stationary Sources Statewide

Largest Stationary Sources of Directly Emitted PM_{10} Statewide

Air Basin	Facility Name	City	Tons/Year
Mojave Desert	Mitsubishi Cement 2000	Lucerne Valley	1468
Mojave Desert	Cemex - Black Mountain Quarry	Apple Valley	955
Mojave Desert	TXI Riverside Cement Company	Oro Grande	753
Mountain Counties	Sierrapine Ltd Ampine Division	Martell	518
South Coast	ChevronTexaco Products	El Segundo	350
Mojave Desert	Antelope Valley Aggregate	Littlerock	345
Mojave Desert	California Portland Cement	Mojave	329
Mojave Desert	Searles Valley Minerals	Trona	320
San Francisco Bay Area	Shell Martinez Refinery	Martinez	308
Mojave Desert	National Cement	Lebec	295

Facility totals are the most recent available data. Some facilities may have reduced or increased emissions since these data were collected. These changes will be reflected in subsequent editions of the almanac.
The list of facilities does not include military bases, landfills, or airports.

Table 2-10

Directly Emitted Particulate Matter ($PM_{2.5}$)

2005 Statewide Emission Inventory - Directly Emitted $PM_{2.5}$ by Category

Area-wide sources account for about 76 percent of the statewide emissions of directly emitted $PM_{2.5}$. The major area-wide source of $PM_{2.5}$ is fugitive dust, especially dust from unpaved and paved roads, agricultural operations, and construction and demolition. Fugitive dust emissions from unpaved and paved roads are related to motor vehicle population levels due to vehicular travel on both types of roads. Other sources of $PM_{2.5}$ emissions include brake and tire wear, residential wood burning, and industrial sources. Exhaust emissions from mobile sources contribute only a very small portion of directly emitted $PM_{2.5}$ emissions, but are a major source of the ROG and NO_x that form secondary particles. The section titled *PM_{10} and $PM_{2.5}$ - Linking Emissions Sources with Air Quality* describes how emissions from specific sources are linked to measured $PM_{2.5}$ levels

$PM_{2.5}$ Emissions (annual average)		
Emissions Source	**tons/day**	**Percent**
Stationary Sources	91	11%
Area-wide Sources	654	76%
On-Road Mobile	34	4%
Gasoline Vehicles	19	2%
Diesel Vehicles	15	2%
Other Mobile	80	9%
Gasoline Vehicles	30	3%
Diesel Vehicles	40	5%
Other	10	1%
Total Statewide	***860***	***100%***

Table 2-11

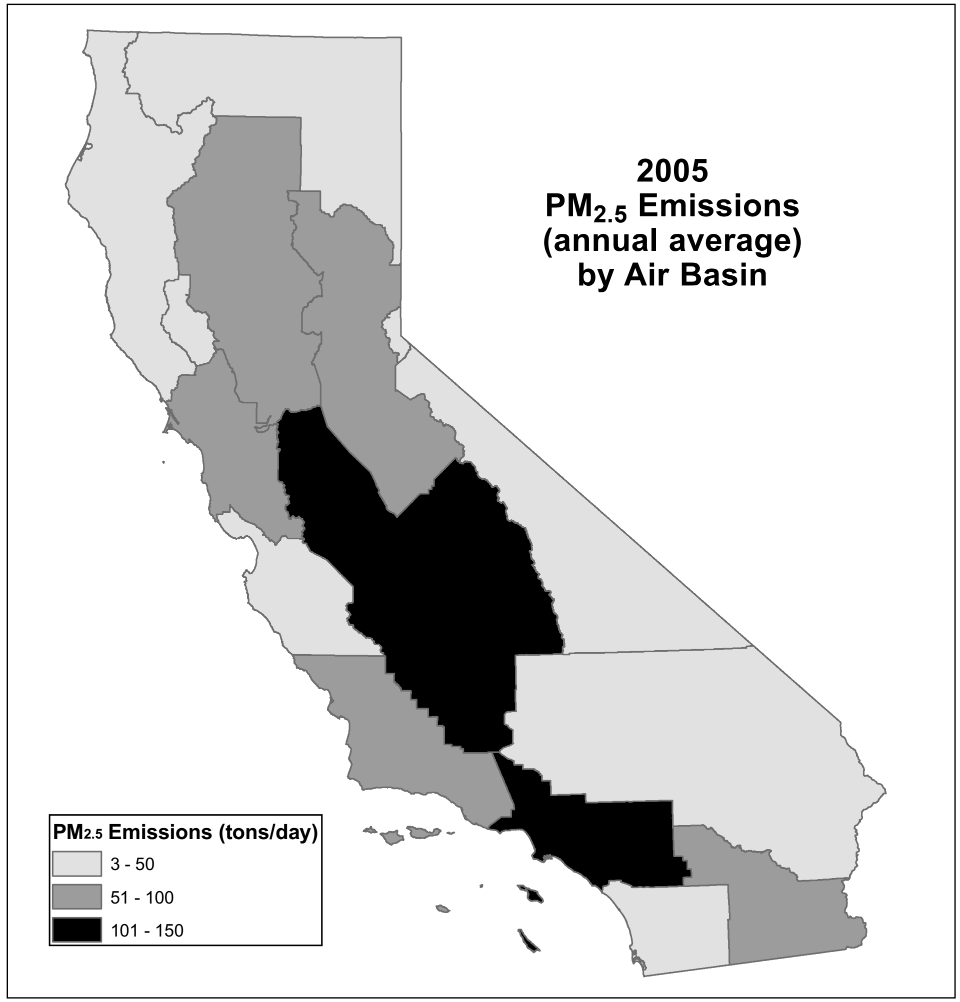

Figure 2-7

Largest Stationary Sources Statewide

Largest Stationary Sources of Directly Emitted $PM_{2.5}$ Statewide

Air Basin	Facility Name	City	Tons/Year
Mojave Desert	Mitsubishi Cement 2000	Lucerne Valley	928
Mountain Counties	Sierrapine Ltd Ampine Division	Martell	414
Mojave Desert	Cemex - Black Mountain Quarry	Apple Valley	413
Mojave Desert	TXI Riverside Cement Company	Oro Grande	343
South Coast	ChevronTexaco Products	El Segundo	298
San Francisco Bay Area	Shell Martinez Refinery	Martinez	297
Mojave Desert	Searles Valley Minerals	Trona	226
Sacramento Valley	Johns-Manville (Insulation)	Willows	220
San Francisco Bay Area	Chevron Products Company	Richmond	206
Mojave Desert	National Cement	Lebec	198

Facility totals are the most recent available data. Some facilities may have reduced or increased emissions since these data were collected. These changes will be reflected in subsequent editions of the almanac.
The list of facilities does not include military bases, landfills, or airports.

Table 2-12

PM_{10} - 2004 Air Quality

Most areas of California have either 24-hour or annual PM_{10} concentrations that exceed the State standards. Some areas exceed both State standards. Several areas, both urban and rural, also exceed the national standards. The highest annual average values during 2004 occurred in the Great Basin Valleys, Salton Sea, South Coast, San Joaquin Valley, Sacramento Valley, and San Diego Air Basins. The 2004 data are summarized in Table 2-13. The highest 24-hour concentrations generally occurred in the desert areas where wind-blown dust contributes to local PM_{10} problems. However, the 2004 maximum 24-hour concentrations are not equivalent to the values used for area designations, which consider frequency of occurrence and potential impact from exceptional or unusual events. Current area designations can be found on the ARB website at *www.arb.ca.gov/desig/adm/adm.htm*.

Particles resulting from combustion contribute to high PM_{10} in a number of urban areas. While many of the control programs implemented for ozone will also reduce PM_{10}, more controls specifically for PM_{10} will be needed to reach attainment.

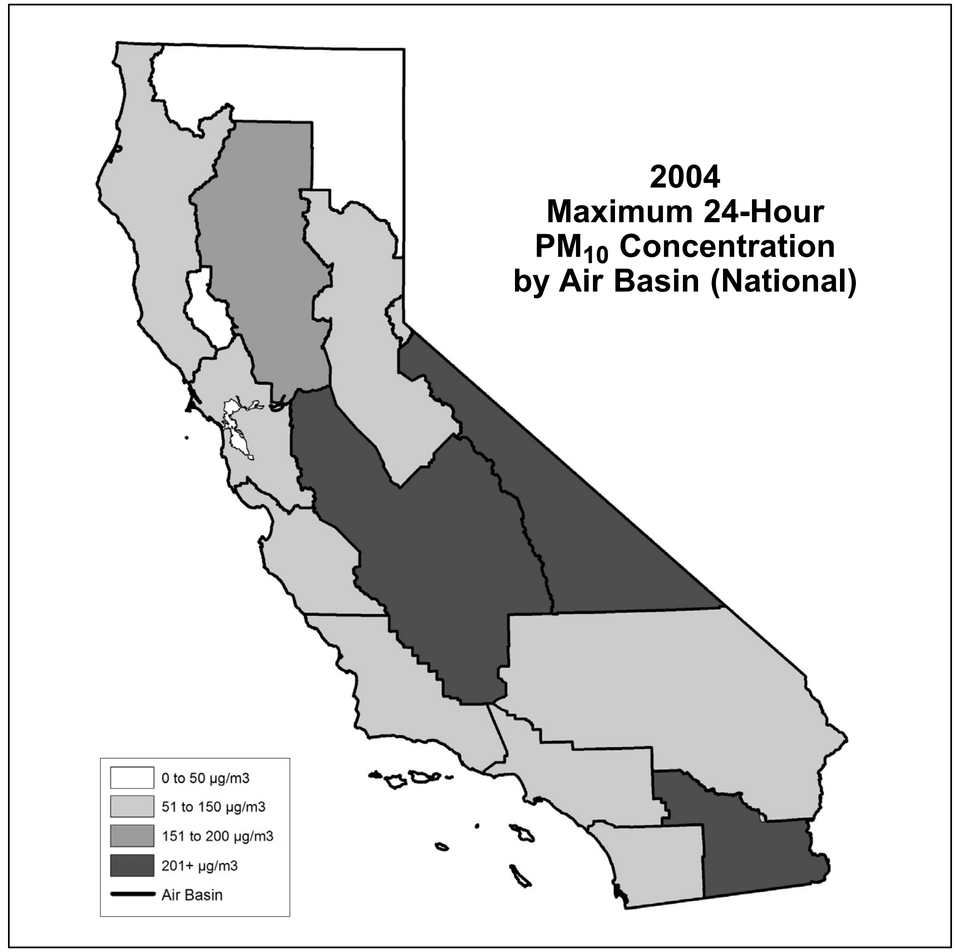

Figure 2-8

PM_{10} - 2004 Air Quality Tables

Maximum 24-Hour and Annual PM_{10} Concentrations by Air Basin

AIR BASIN	2004 Maximum 24-Hour Concentration in micrograms/cubic meter		2004 Maximum Annual Average of Quarters in micrograms/cubic meter	
	State	National	State	National
Great Basin Valleys Air Basin	4797	4913	68.3	25.4
Lake County Air Basin	22		10.0	
Lake Tahoe Air Basin	112	130	37.5	44.2
Mojave Desert Air Basin	83	88	18.3	33.1
Mountain Counties Air Basin	124	133	26.3	28.0
North Central Coast Air Basin	83	80	28.2	27.3
North Coast Air Basin	64	61	20.6	20.7
Northeast Plateau Air Basin	29	32	12.8	13.6
Sacramento Valley Air Basin	171	169	43.2	42.6
Salton Sea Air Basin	364	354	60.3	60.8
San Diego Air Basin	138	137	51.7	51.2
San Francisco Bay Area Air Basin	65	63	26.0	25.3
San Joaquin Valley Air Basin	219	217	43.6	44.6
South Central Coast Air Basin	69	146	28.8	31.4
South Coast Air Basin	133	137	53.5	54.8

* The table lists the highest value for each statistic. Within an air basin, the highest value for each statistic may reflect a different site or different monitor. In addition, the State and national requirements for data completeness are different. This may result in marked differences between the State and national values for the same statistic. For example, in the Great Basin Valleys and the Mojave Desert Air Basins, due to differing State and national data completeness criteria, the State and national maximum annual averages reflect values from two different sites.

24-hour data - The table may include data from extreme, exceptional, or unusual concentration events: however, there is a mechanism in place to review for these types of events during the area designation process.

Annual average data - Extreme, exceptional, or unusual concentration events do not generally significantly influence the annual average. However, their exclusion can be considered on a case-by-case basis.

Table 2-13

Top Sites with 24-Hour Concentrations above the State PM_{10} Standard

Great Basin Valleys Air Basin
- Dirty Sox
- Shell Cut-Highway 190
- Mono Lake North Shore
- Flat Rock-Highway 190
- Olancha-Walker Creek Road

Lake Tahoe Air Basin
- South Lake Tahoe-Sandy Way

Mojave Desert Air Basin
- Trona-Athol and Telegraph
- Ridgecrest-100 W. California Ave.
- Victorville-14306 Park Avenue
- China Lake-Powerline Road

Mountain Counties Air Basin
- Yosemite Village-Visitor Center
- Quincy-N Church Street

North Central Coast Air Basin
- Davenport
- Santa Cruz-2544 Soquel Avenue
- Moss Landing-Sandholt Road

North Coast Air Basin
- Eureka-Health Dept. 6th and I Street

Sacramento Valley Air Basin
- Woodland-Gibson Road
- Willows-E Laurel Street
- Colusa-Sunrise Blvd.
- Chico-Manzanita Avenue
- Yuba City-Almond Street

Salton Sea Air Basin
- Brawley-220 Main Street
- El Centro-9th Street
- Westmorland-West 1st Street
- Calexico-Grant Street
- Indio-Jackson Street

San Diego Air Basin
- Otay Mesa-Paseo International
- San Diego-12th Avenue
- Escondido-East Valley Parkway
- El Cajon-Redwood Avenue

San Francisco Bay Area Air Basin
- San Jose-Tully Road
- Redwood City
- Pittsburg-10th Street
- San Jose-Jackson Street
- San Francisco-Hunters Point

San Joaquin Valley Air Basin
- Corcoran-Patterson Avenue
- Hanford-South Irwin Street
- Bakersfield-5558 California Avenue
- Bakersfield-Golden State Highway
- Visalia-North Church Street

South Central Coast Air Basin
- Thousand Oaks-Moorpark Road
- Nipomo-Regional Park
- El Rio-Rio Mesa School #2
- Lompoc-South H Street
- Santa Maria-906 South Broadway

South Coast Air Basin
- Riverside-Rubidoux
- San Bernardino-4th Street
- Fontana-Arrow Highway
- Ontario-1408 Francis Street
- Redlands-Dearborn

Sites with 24-hour PM_{10} concentrations above the level of the State PM_{10} standard during 2004. The top five sites in each air basin are listed in descending order of their maximum 24-hour concentration. If an air basin is not listed, the 24-hour PM_{10} concentrations at sites in that air basin were not above the State 24-hour PM_{10} standard. If more than 5 sites are listed, there were multiple sites with the same maximum concentration.

Table 2-14

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$PM_{2.5}$ - 2004 Air Quality

As explained in the Introduction section of Chapter 1, the U.S. EPA promulgated new national standards (24-hour and annual average) for $PM_{2.5}$ in July 1997. In June 2002, the ARB established a new, more health-protective State annual average $PM_{2.5}$ standard. The installation of federally approved $PM_{2.5}$ mass monitors throughout California began in 1998 and is now complete, with monitors at 81 sites. Detailed information on California's $PM_{2.5}$ network can be found on the ARB website at *www.arb.ca.gov/aqd/pm25/pmfnet02.htm*.

The majority of sites in California's $PM_{2.5}$ network began sampling in early 1999. The 2004 data are summarized in Table 2-15. Sites in the South Coast Air Basin recorded the highest national 24-hour concentrations and 98th percentile 24-hour concentrations. However, the 2004 maximum 24-hour concentrations are not equivalent to the values used for area designations, which consider frequency of occurrence and potential impact from exceptional or unusual events. Current area designations can be found on the ARB website at *www.arb.ca.gov/desig/adm/adm.htm*. Sites in the South Coast and San Joaquin Valley Air Basins recorded the highest annual average concentrations in the State. The annual averages for these areas were about twice the level of the State annual $PM_{2.5}$ standard.

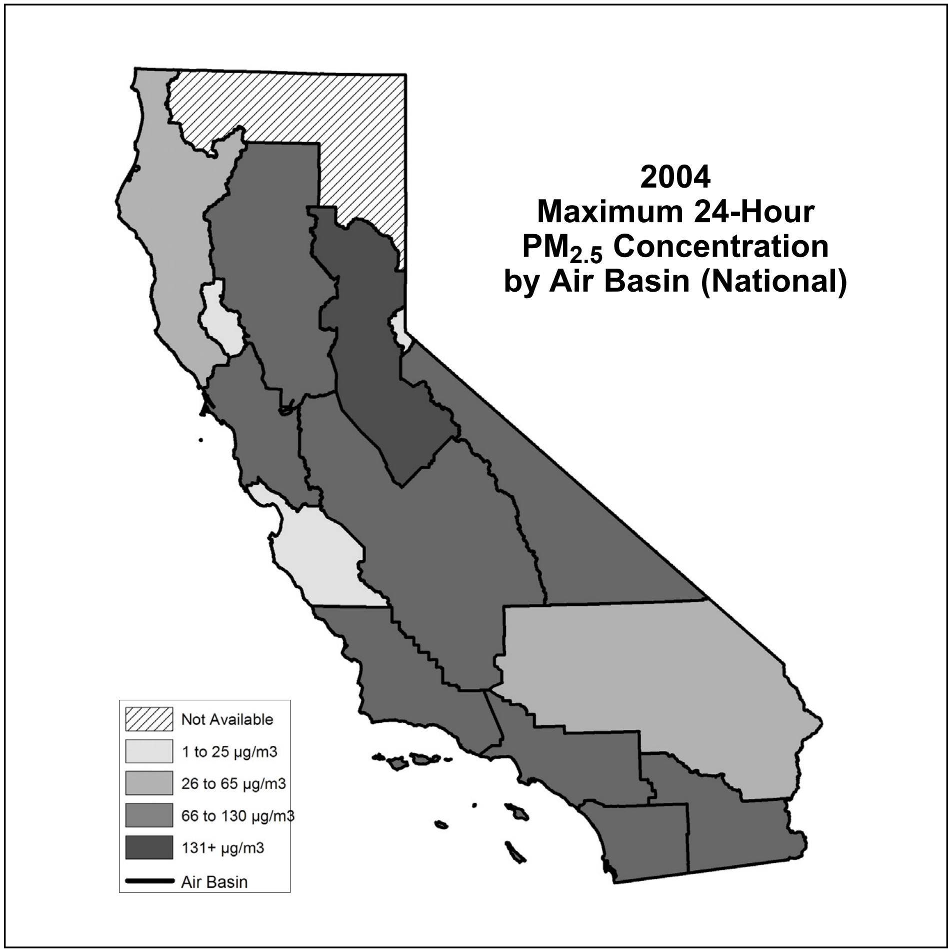

Figure 2-9

$PM_{2.5}$ - 2004 Air Quality Tables

Maximum 24-Hour, 98th Percentile, and Annual $PM_{2.5}$ Concentrations by Air Basin

AIR BASIN	2004 Maximum 24-Hr Concentration in micrograms/cubic meter		98th Percentile 24-Hr Conc. (ug/m^3)*	2004 Max Avg of Quarterly Means in micrograms/cubic meter*	
	State	National		State	National
Great Basin Valleys Air Basin	81.0	81.0	Incomplete Data	Incomplete Data	Incomplete Data
Lake County Air Basin	18.1	18.1	9.0	4.4	4.4
Lake Tahoe Air Basin	23.2	20.0	Incomplete Data	Incomplete Data	Incomplete Data
Mojave Desert Air Basin	34.0	34.0	20.0	10.8	10.8
Mountain Counties Air Basin	148.4	44.0	33.0	11.7	11.7
North Central Coast Air Basin	22.6	22.6	15.5	6.8	7.0
North Coast Air Basin	25.6	25.6	23.1	7.0	8.2
Northeast Plateau Air Basin	Incomplete Data	Incomplete Data	Incomplete Data	Incomplete Data	Incomplete Data
Sacramento Valley Air Basin	76.3	65.0	54.0	16.5	15.1
Salton Sea Air Basin	76.0	74.2	31.9	16.1	11.8
San Diego Air Basin	67.3	67.3	37.4	14.1	14.1
San Francisco Bay Area Air Basin	73.7	73.7	39.8	11.6	11.6
San Joaquin Valley Air Basin	77.0	71.0	54.0	18.2	18.9
South Central Coast Air Basin	91.9	41.2	36.7	12.5	12.6
South Coast Air Basin	93.8	93.8	72.4	16.6	22.1

The table lists the highest value for each statistic. Within an air basin, the highest value for each statistic may reflect a different site. In addition, the State and national requirements for data completeness are different. This may result in marked differences between the State and national values for the same statistic (e.g., maximum annual averages for the Salton Sea and South Coast air basins).

* These statistics and determination of their validity are calculated according to the methods specified in 40 CFR Part 50, Appendix N. Validity is based on the number of measurements available per quarter and therefore, depends on data completeness. Both the 98th percentile concentration and the average of quarters concentration relate to the national $PM_{2.5}$ standards, while only the average of quarters concentration relates to the State $PM_{2.5}$ standard.

24-hour data - The table may include data from extreme, exceptional, or unusual concentration events: however, there is a mechanism in place to review for these types of events during the area designation process.

Annual average data - Extreme, exceptional, or unusual concentration events do not generally significantly influence the annual average. However, their exclusion can be considered on a case-by-case basis.

Table 2-15

PM_{10} and $PM_{2.5}$ - Linking Emissions Sources with Air Quality

The size, concentration, and chemical composition of PM vary by region and by season. A number of areas exhibit strong seasonal patterns. Other areas have a much more uniform distribution with PM concentrations remaining high throughout the year. In yet other areas, isolated PM exceedances can occur at any time of the year.

In the San Joaquin Valley, the San Francisco Bay Area, and the Sacramento region, there is a strong seasonal variation in PM, with higher PM_{10} and $PM_{2.5}$ concentrations in the fall and winter months (refer to Figure 2-10). In the winter, PM_{10} and $PM_{2.5}$ concentrations remain elevated for extended periods. These higher concentrations are caused by increased activity for some emission sources and meteorological conditions that are conducive to the build-up of PM. During the winter, the $PM_{2.5}$ size fraction drives the PM concentrations, and the major contributor to high levels of ambient $PM_{2.5}$ is the secondary formation of PM caused by the reaction of NO_x and ammonium to form ammonium nitrate. The San Joaquin Valley also records high PM_{10} levels during the fall. During this season, both the coarse fraction and the $PM_{2.5}$ fraction drove the PM concentrations.

In the eastern South Coast region, PM_{10} and $PM_{2.5}$ concentrations remain high throughout the year (refer to Figure 2-11). The more uniform activity patterns of emission sources, as well as less variable weather patterns, leads to this more uniform concentration pattern. In other areas, high PM can be more episodic than seasonal. For example, in the Owens Lake area of the Great Basin Valleys Air Basin, episodic fugitive dust events lead to very high PM_{10} levels, with soil dust as the major contributor to ambient PM_{10}.

Analysis of PM chemical composition data collected from a variety of routine and special monitoring programs provides insight into the fraction of $PM_{2.5}$ that is secondary. Data were obtained from the California $PM_{2.5}$ and PM_{10} monitoring networks, California Regional PM_{10}/$PM_{2.5}$ Air Quality Study, Children's Health Study,

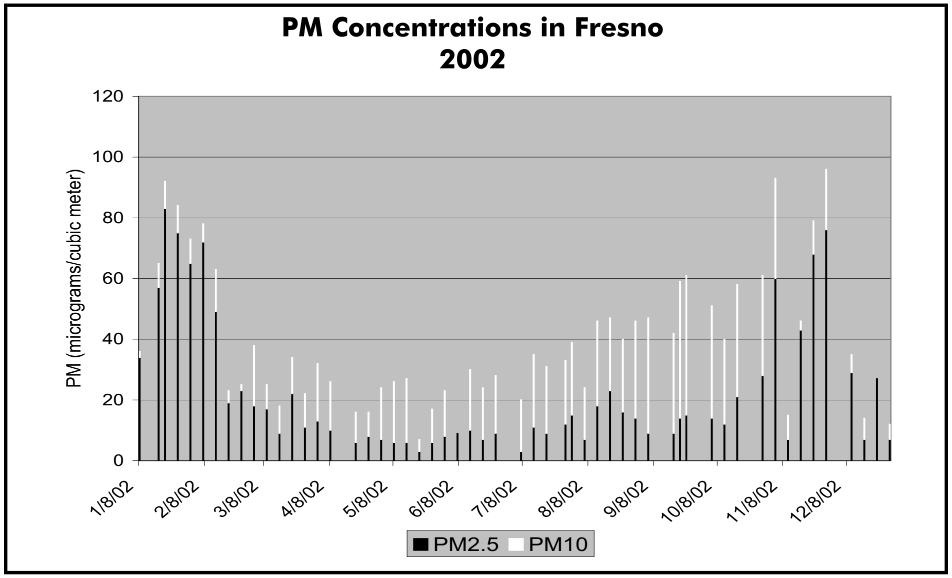

Figure 2-10

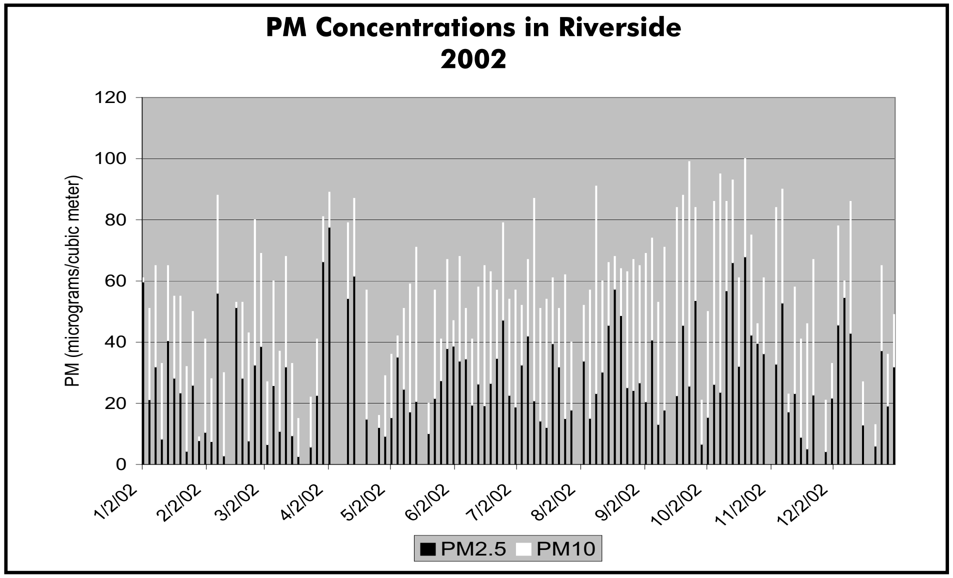

Figure 2-11

Integrated Monitoring and Protected Visual Environments Program, and South Coast Air Quality Management District's PM Technical Enhancement Programs of 1995 and 1998-1999. Secondary $PM_{2.5}$ estimates include ammonium nitrate and ammonium sulfate components, which form through reactions in the atmosphere of nitrogen oxides and sulfur oxides emitted by motor vehicles and other combustion processes. $PM_{2.5}$ also includes secondary organic aerosols (SOA) resulting from atmospheric reactions of organic compounds emitted from combustion sources and biogenic processes. Since only limited information is available on how much of the measured $PM_{2.5}$ organic carbon component is secondary, SOA are not included in the secondary $PM_{2.5}$ estimates. However, available studies suggest that in the South Coast, on an annual average basis, SOA may constitute 6 to 16 percent of $PM_{2.5}$ (Schauer et. al. 1996) and in urban areas of the San Joaquin Valley, during the winter, SOA may contribute up to an average of eight percent of $PM_{2.5}$ (Schauer and Cass, 1998).

Chemical Mass Balance (CMB) models are used to establish which sources and how much of their emissions contribute to ambient PM concentrations. CMB models use chemical composition data from ambient PM samples and from emission sources. These data are often collected during special source attribution studies. The source attribution data presented in this section were derived from a variety of studies with differing degrees of chemical speciation. In general, however, the source categories can be interpreted in the following manner. The road and other dust, wood smoke, cooking, vehicle exhaust, and construction categories represent sources which directly emit particles. Road and other dust represents the combination of mechanically disturbed soil (paved and unpaved roads, agricultural activities) and wind-blown dust. Wood smoke generally represents residential wood combustion, but may also include combustion from other biomass burning such as agricultural or prescribed burning. The vehicle exhaust category represents direct motor vehicle exhaust particles from both gasoline and diesel vehicles. Construction reflects construction and demolition activities. Ammonium nitrate and ammonium sulfate represent secondary species (i.e., they form in the atmosphere from the emissions of nitrogen oxides (NO_x), sulfur oxides (SO_x), and ammonia). Combustion sources such as motor vehicles and stationary sources contribute to the NO_x that forms ammonium nitrate. Mobile sources such as diesel vehicles, locomotives, and ships and stationary combustion sources emit the SO_x that forms ammonium sulfate. Ammonia sources include animal feedlots, fertilizers, and motor vehicles. The other carbon sources category reflects organic sources not included in the source attribution models, such as natural gas combustion, as well as secondary organic carbon formation. The unidentified category represents the mass that cannot be accounted for by the identified source categories. It can include particle-bound water, as well as other unidentified sources.

Estimated Secondary Portion of $PM_{2.5}$ (annual average)	
Air Basin	Secondary $PM_{2.5}$ (%)
Great Basin Valleys	30
Lake County	30
Lake Tahoe	40
Mojave Desert	40
Mountain Counties	30
North Central Coast	40
North Coast	30
Northeast Plateau	30
Sacramento Valley	30
Salton Sea	40
San Diego	50
San Francisco Bay Area	40
San Joaquin Valley	40
South Central Coast	50
South Coast	60

Table 2-16

The figures on the following pages present the best available source attribution data from CMB modeling for selected regions. These presentations are representative of typical days when the State PM_{10}

standards are exceeded (refer to Chapter 1, for a review of the State standards). The fractions of the constituents shown can vary daily and from year to year, depending on factors such as meteorology.

A detailed description of PM_{10} and $PM_{2.5}$ characteristics in each of California's 35 air districts by air basin is included in the ARB's technical report titled "Characterization of Ambient PM_{10} and $PM_{2.5}$ in California, which can be found on the ARB website at *www.arb.ca.gov/pm/pm.htm.*

San Joaquin Valley Air Basin

Figures 2-12 and 2-13 illustrate contributions to ambient PM in the San Joaquin Valley during the winter and on an annual average basis. These are the results from analysis of data collected during the California Regional $PM_{10}/PM_{2.5}$ Air Quality Study. (San Joaquin Valley Air Pollution Control District, 2003)

During the winter in Fresno, secondary ammonium nitrate was the largest contributor to PM_{10}, formed from NOx emissions from mobile and stationary combustion sources, combined with ammonia. Emissions from wood smoke, vehicle exhaust, and road and agricultural sources also contribute significantly to PM_{10} levels. On an annual average basis, elevated concentrations of PM_{10} were associated with high levels of road and agricultural dust. Secondary ammonium nitrate, wood smoke, and vehicle exhaust particles also contributed significantly to annual PM_{10} concentrations.

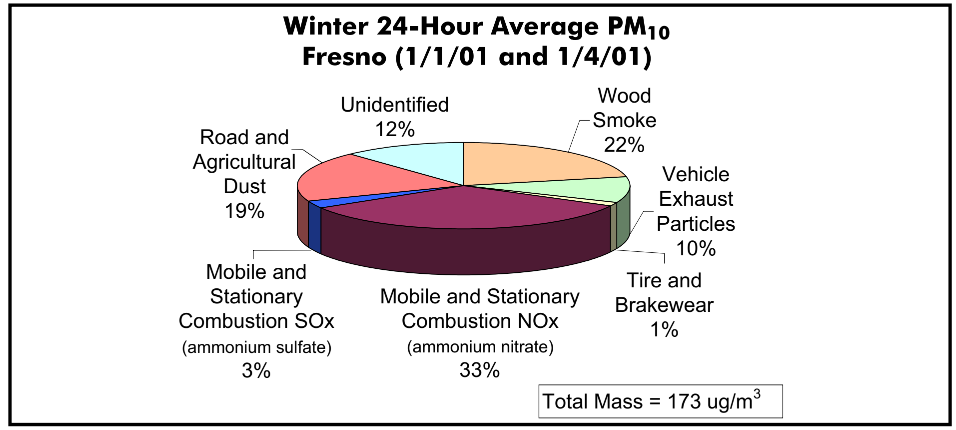

Figure 2-12

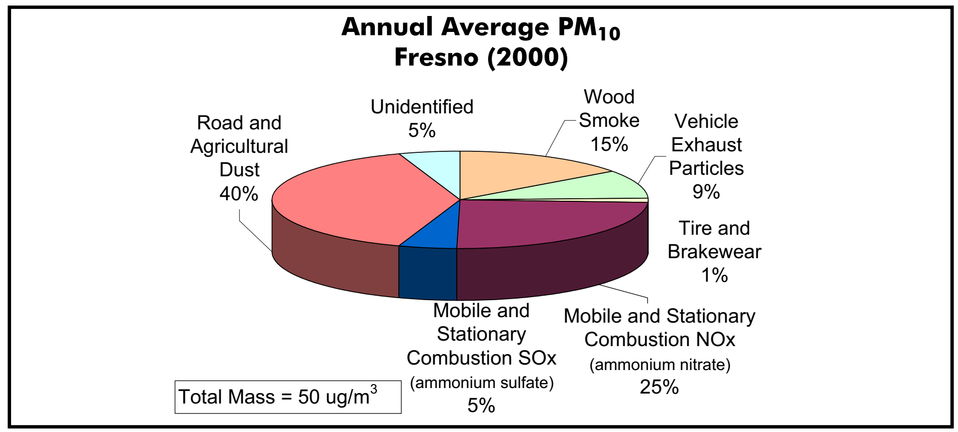

Figure 2-13

San Francisco Bay Area Air Basin

Figures 2-14 and 2-15 illustrate the sources of PM during the winter in the San Francisco Bay Area. The data are from the source apportionment analysis conducted by the Bay Area Air Quality Management District using samples collected during two special studies (Fairley, 1996, 2001).

During the winter, in San Jose, high PM concentrations are associated with high levels of wood smoke, primarily from residential wood combustion, and cooking. NO_x emitted from mobile and stationary combustion sources, in combination with ammonia, contributes about one-fourth of the PM levels in the form of ammonium nitrate. Particle emissions from mobile and stationary combustion sources are also a major contributor to $PM_{2.5}$. Road dust is a significant contributor to PM_{10}, but not $PM_{2.5}$.

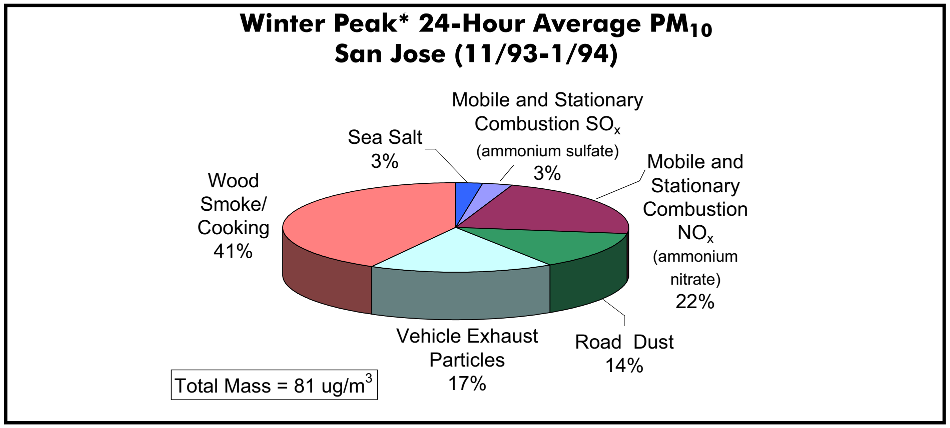

Figure 2-14

* Average of days with PM_{10} > 50 ug/m3

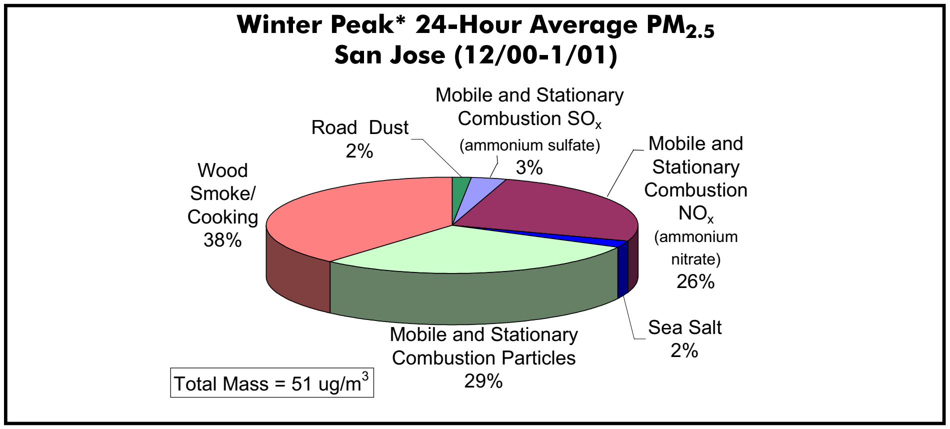

Figure 2-15

* Average of days with $PM_{2.5}$ > 40 ug/m3

Sacramento Valley Air Basin

Figures 2-16 and 2-17 illustrate source contributions to ambient PM_{10} and $PM_{2.5}$ during the winter in Sacramento. The data are from the analysis of ambient air samples collected from November through January, during the six year period of 1991 through 1996 (Motallebi, 1999).

NO_x emissions from mobile and stationary combustion sources, combined with ammonia to form ammonium nitrate, are the largest contributor to ambient PM levels. Vehicle exhaust particle emissions and wood smoke from residential wood combustion also contribute significantly. While road and other dust is a significant component of ambient PM_{10}, its contribution to $PM_{2.5}$ is minor.

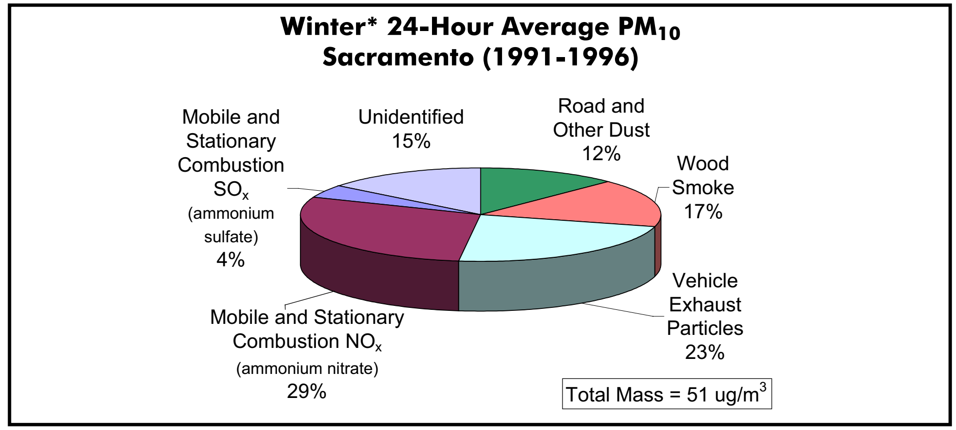

Figure 2-16

* Average of days with PM_{10} > 40 ug/m^3

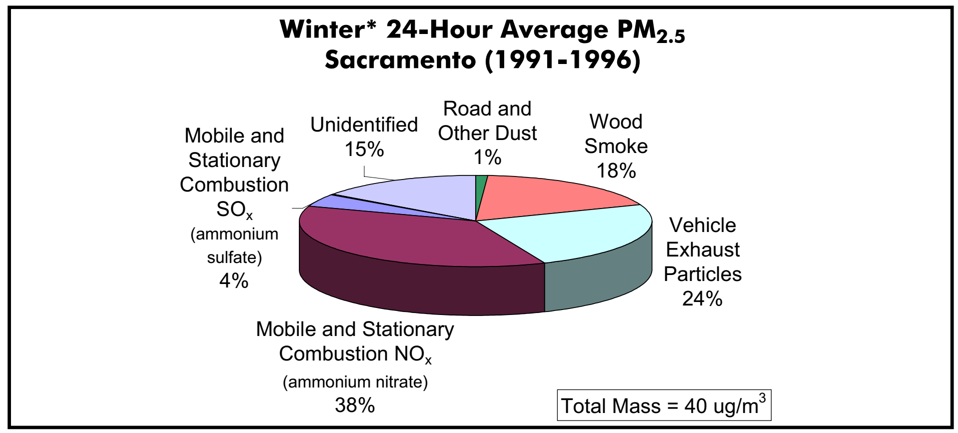

Figure 2-17

* Average of days with PM_{10} > 40 ug/m^3

South Coast Air Basin

Data for Figures 2-18, 2-19, 2-20, and 2-21 are from the source apportionment analysis that the South Coast Air Quality Management District (SCAQMD) performed for the 1997 Air Quality Management Plan. SCAQMD collected samples during a one-year special study from January 1995 to February 1996, as part of the PM_{10} Technical Enhancement Program (SCAQMD, 1996).

On an annual basis, in Central Los Angeles, dust from roads and construction is the major contributor to ambient PM_{10}. This is not the case for the episode on November 17, 1995. In both cases, NO_x and SO_x emitted from mobile and stationary combustion sources, combined with ammonia, contribute significantly in the form of ammonium nitrate and sulfate. Vehicle exhaust particles and emissions from other carbon sources also contribute to both annual and episodic ambient PM_{10} levels.

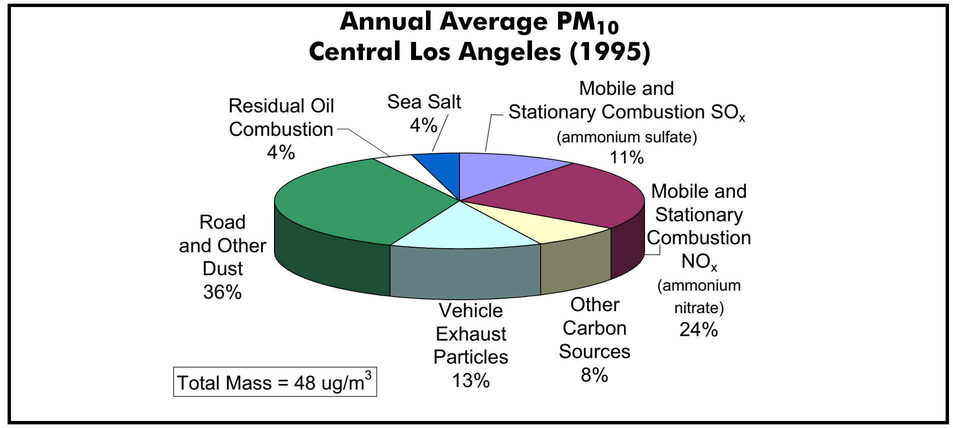

Figure 2-18

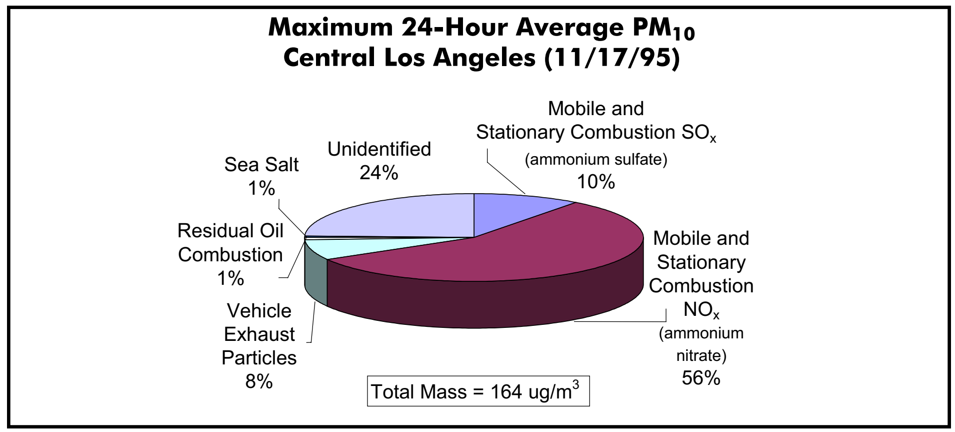

Figure 2-19

On an annual basis, in Rubidoux, dust from roads and construction is the major contributor to ambient PM_{10}. In contrast, dust was a minor contributor to the PM_{10} episode on November 17, 1995. In both cases, ammonium nitrate formed from NO_x emitted from mobile and stationary combustion sources, combined with ammonium, contributes significantly. Vehicle exhaust particles and emissions from other carbon sources also contribute to both annual and episodic ambient PM_{10} levels.

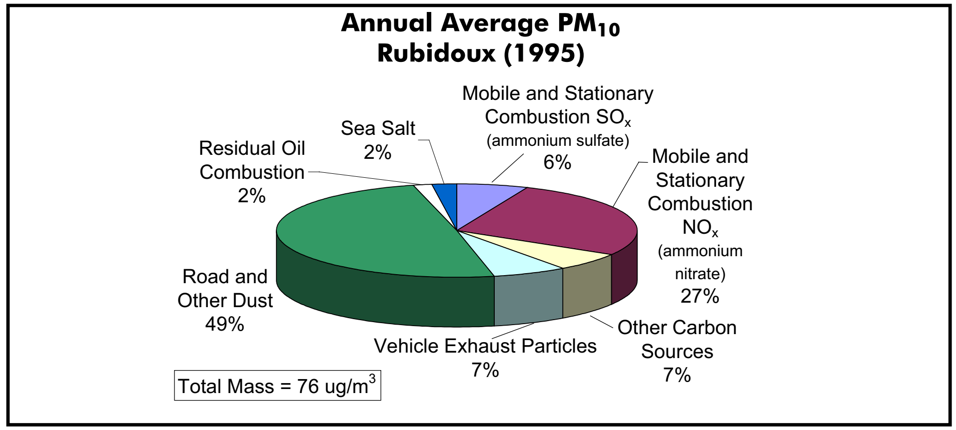

Figure 2-20

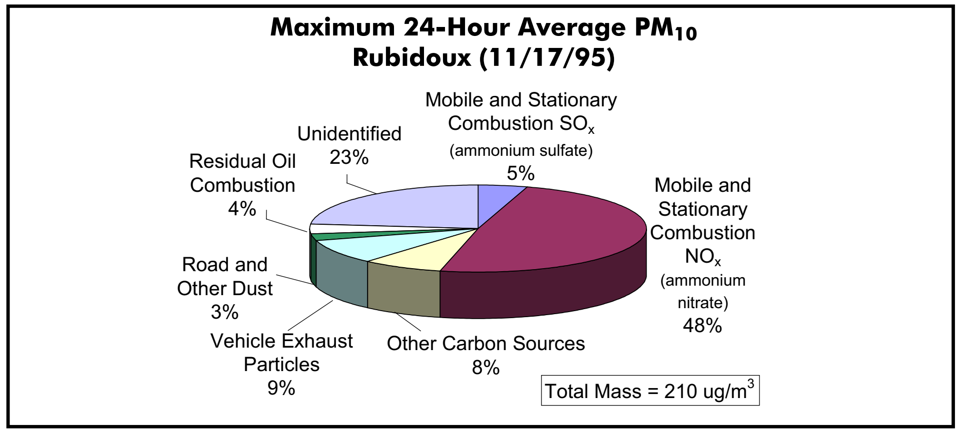

Figure 2-21

References for Particulate Matter:

Fairley, D. *Source Apportionment of Bay Area Particulates.* 1996; Personal communication.

Fairley, D. *$PM_{2.5}$ Source Apportionment for San Jose 4th Street.* 2001; Personal communication.

Motallebi, N. *Wintertime PM_{10} and $PM_{2.5}$ Source Apportionment at Sacramento, California.* Journal of the Air & Waste Management Association 1999; 49:PM-25-34.

South Coast Air Quality Management District. *"Modeling and Attainment Demonstrations"* in 1997 Air Quality Management Plan, Diamond Bar, California. 1996.

Schauer, J. J., Rogge, W. F., Hidemann, L. M., Mazurek, M. A., and Cass, G. R. *Source Apportionment of Airborne Particulate Matter Using Organic Compounds as Tracers.* Atmospheric Environment; 30: 22, 3837-3855, 1996.

San Joaquin Valley Air Pollution Control District. *2003 PM_{10} Plan: San Joaquin Valley Plan to Attain Federal Standards for Particulate Matter 10 Microns and Smaller.* Appendix N.

Carbon Monoxide

2005 Statewide Emission Inventory - Carbon Monoxide by Category

Carbon monoxide (CO) gas is formed as the result of incomplete combustion of fuels and waste materials such as gasoline, diesel fuel, wood, and agricultural debris. Mobile sources generate about 77 percent of the statewide CO emissions. Diesel-powered on-road and other mobile vehicles are small CO contributors. Stationary and area-wide sources of CO are the same types of fuel combustion sources that also generate NO_x. The stationary source contribution to statewide CO is small, due in part to widespread use of natural gas as a fuel and the presence of combustion controls.

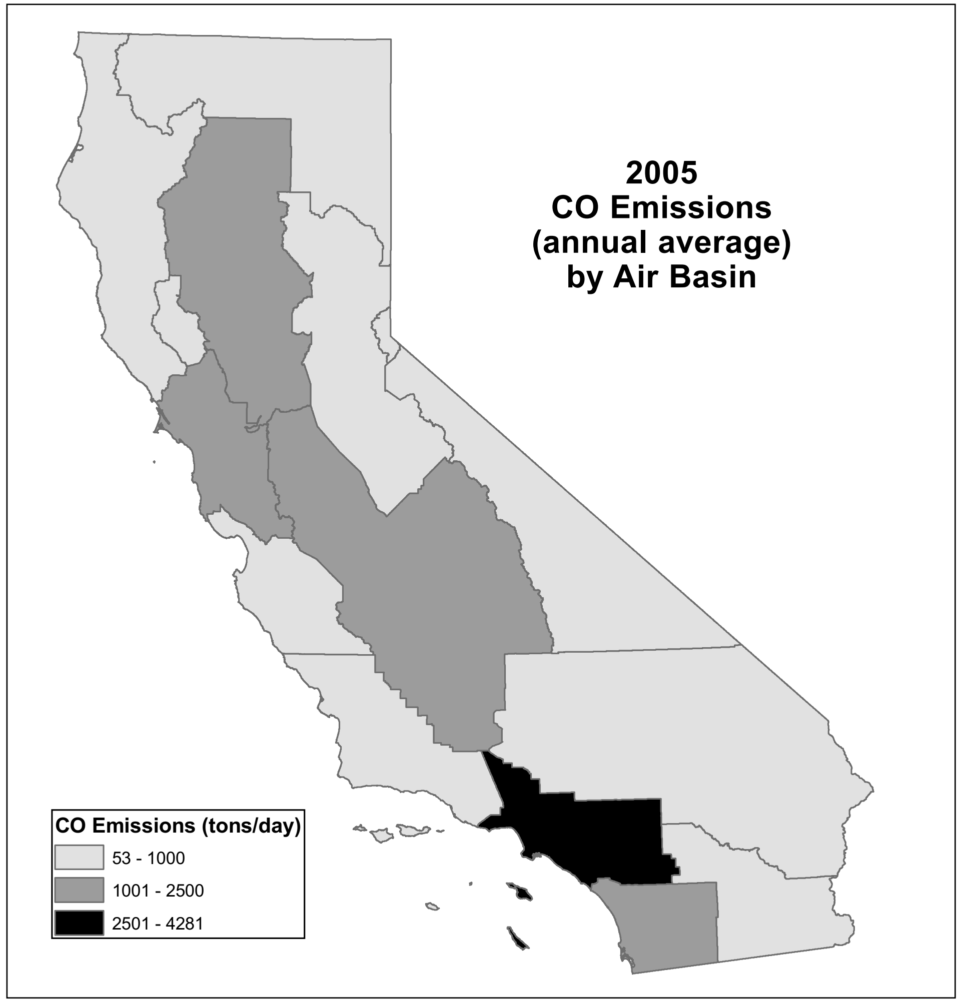

Figure 2-22

CO Emissions (annual average)		
Emissions Source	**tons/day**	**Percent**
Stationary Sources	372	3%
Area-wide Sources	2719	20%
On-Road Mobile	7629	55%
Gasoline Vehicles	7492	54%
Diesel Vehicles	137	1%
Other Mobile	3045	22%
Gasoline Vehicles	2409	18%
Diesel Vehicles	275	2%
Other	361	3%
Total Statewide	***13766***	***100%***

Table 2-17

Carbon Monoxide - 2004 Air Quality

The State and national carbon monoxide standards are now attained in most areas of California. The requirements for cleaner vehicles and fuels have been primarily responsible for the reductions in CO, despite significant increases in population, the number of vehicle miles traveled each day, and the apparent impact of emissions from Mexico.

However, there is still one problem area: the City of Calexico in Imperial County. While CO concentrations continue to decrease throughout most of the State, the CO problem in Calexico is unique in that this area shares a border with Mexico. There is a high likelihood that cross-border traffic contributes to the local CO problem in this area, and a regional and binational approach may be necessary to develop an effective control strategy. The Calexico area has made progress towards attainment. Peak levels have been declining as have the number of days that State and federal standards are exceeded. In 2004, Calexico had only one exceedance of the State and federal CO standards.

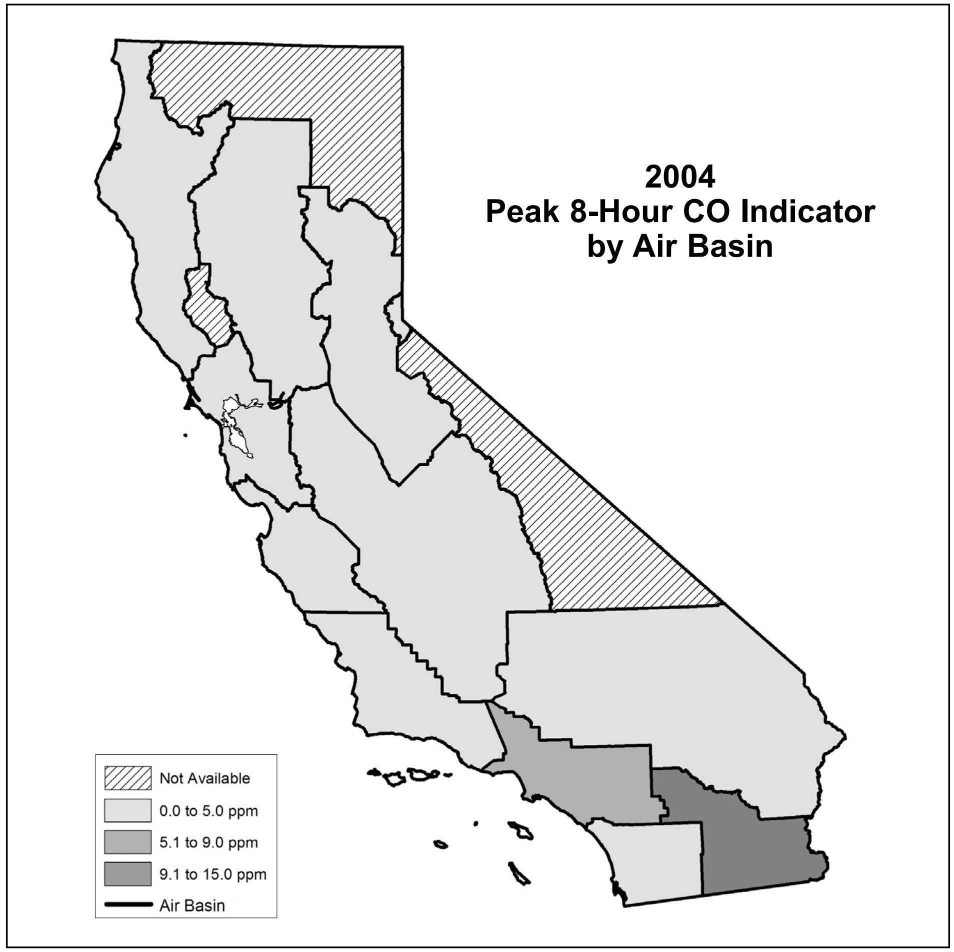

Figure 2-23

Carbon Monoxide - 2004 Air Quality Tables

Maximum Peak 8-Hour Indicator by Air Basin

AIR BASIN	2004 Maximum Peak 8-Hour Indicator in parts per million	Number of Days in 2004 above 8-Hour Standard	
		State	National
Great Basin Valleys Air Basin	Incomplete Data	Incomplete Data	Incomplete Data
Lake County Air Basin	Incomplete Data	Incomplete Data	Incomplete Data
Lake Tahoe Air Basin	1.9	0	0
Mojave Desert Air Basin	2	0	0
Mountain Counties Air Basin	4.8	0	0
North Central Coast Air Basin	1.2	0	0
North Coast Air Basin	2	0	0
Northeast Plateau Air Basin	Incomplete Data	Incomplete Data	Incomplete Data
Sacramento Valley Air Basin	4.2	0	0
Salton Sea Air Basin	10.5	1	1
San Diego Air Basin	4.6	0	0
San Francisco Bay Area Air Basin	4	0	0
San Joaquin Valley Air Basin	4.2	0	0
South Central Coast Air Basin	2.4	0	0
South Coast Air Basin	8.3	0	0

Table 2-18

Sites with Peak 8-Hour Indicator Values above the State CO Standard

Salton Sea Air Basin

- Calexico-Ethel Street

Only one site had peak 8-hour indicator values above the level of the State CO standard during 2004. If an air basin is not listed, the peak indicator values at sites in that air basin were not above the State CO standards.

Table 2-19

Ammonia

2005 Statewide Emission Inventory - Ammonia by Category

Area-wide sources account for 68 percent of the statewide emissions of ammonia. The major area-wide source of ammonia is livestock waste. Ammonia emissions from on-road vehicles are produced by three-way catalyst equipped gasoline vehicles. Ammonia emissions from stationary sources are primarily related to NO_x emission controls and the manufacture of a variety of products.

Ammonia emission sources have strong geographic differences. In the San Joaquin Valley, ammonia emissions are dominated by livestock and other agricultural sources. However, in the South Coast Air Basin, motor vehicle sources are more significant.

NH_3 Emissions (annual average)		
Emissions Source	**tons/day**	**Percent**
Stationary Sources	63	9%
Area-wide Sources	504	75%
On-Road Mobile	101	15%
Gasoline Vehicles	101	15%
Diesel Vehicles	0	0%
Other Mobile*	0	0%
Gasoline Vehicles*	0	0%
Diesel Vehicles*	0	0%
Other*	0	0%
Total Statewide	***670***	***100%***

* No data available

Table 2-20

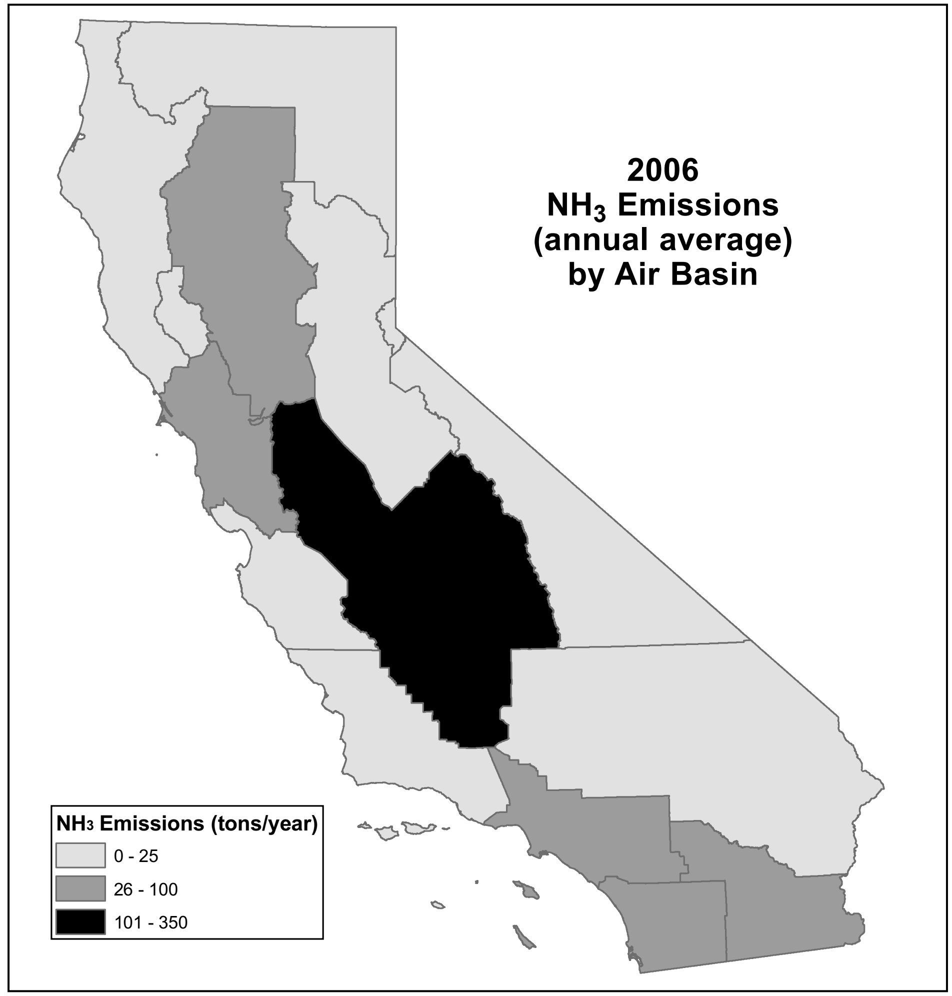

Figure 2-24

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