
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. It should be noted that emission inventories are developed for many purposes, including SIPs, Goods Movement activities, and for other planning and regulatory needs. For this edition of the Almanac, the current emissions data represent a calendar year 2006 snapshot that was developed by growing the 2004 inventory to 2006 and by updating the mobile source estimates using the EMFAC2007 and OFFROAD2007 models. These emissions data remain the same as presented in the previous edition and will be updated in the 2009 Almanac.

National, State, and local agencies have implemented many control measures during the three decades to improve air quality. As a result, all national air pollutant standards are attained statewide, except for ozone and particulate matter. However, the challenges that California faces in attainment of these two pollutants is substantial. The severity of California's ozone and PM_{2.5} air quality problem is illustrated in Figures 2-1 through 2-4. California has over 65 percent of the population exposure to unhealthy ozone concentrations (above the national standard), when compared to the rest of the nation, although we only have ten percent of the population. The same challenges exist for attainment of PM_{2.5}. As show in Figure 2-2, Californian's experience roughly half of the total national population exposure to unhealthy PM_{2.5} concentrations.

Figure 2-3 shows the national 8-hour ozone design values for the top 15 urban areas in the nation, based on data for 2003 to 2005. The design values in all these areas exceed the national 8-hour standard of 0.08 ppm. Eight of the top 15 areas are located in California, with the South Coast Air Basin and San Joaquin Valley areas ranking first

and second. This table indicates that we are still far from attainment of the national standard.

In contrast, the PM_{2.5} problem is prevalent in both the eastern United States and in California. Figure 2-4 shows the top PM_{2.5} areas in the nation and their design values for 2003 to 2005. California has two areas that rank in the top 15 in the nation. Values in California's two areas continue to be significantly above the level of the standard.

Although we face many challenges in attaining ozone and PM_{2.5} standards statewide, we have made substantial progress. This progress is a result of our long history of emission control programs and as part of the recently adopted 2007 SIP. The 2007 SIP includes a new series of far reaching and aggressive emission control programs to be developed and implemented at the local, State, and National levels over the next 15 years. These programs are designed to bring the entire State into attainment for the current ozone and PM_{2.5} standards.

The summary table shows emission data by three major source categories: stationary sources, area-wide sources, and mobile sources. Emission 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), PM₁₀, PM_{2.5}, CO, and ammonia (NH₃).

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 PM₁₀ 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 PM₁₀ 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 PM₁₀ and PM_{2.5} can also be very localized, and basinwide annual averages do not give any information about these sources.

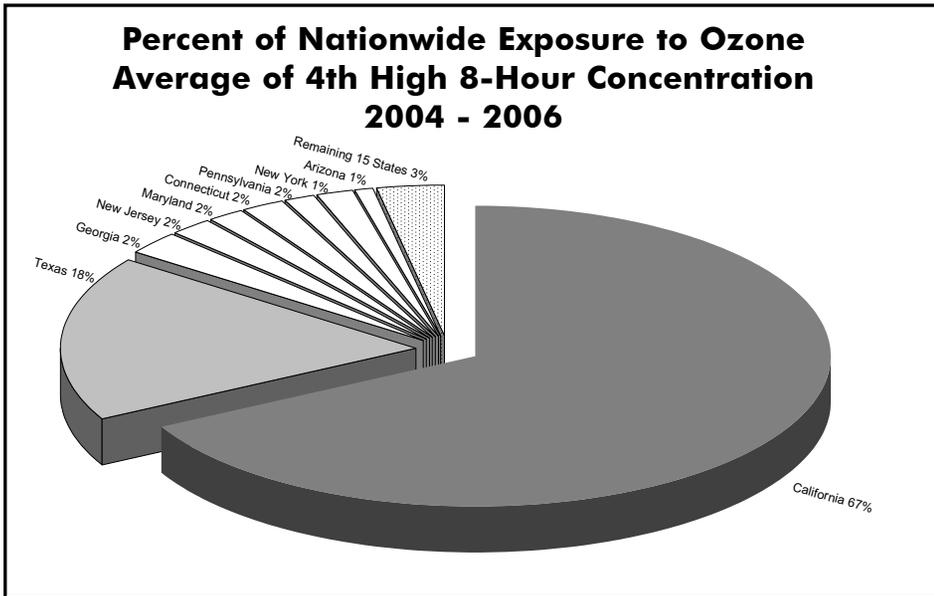


Figure 2-1

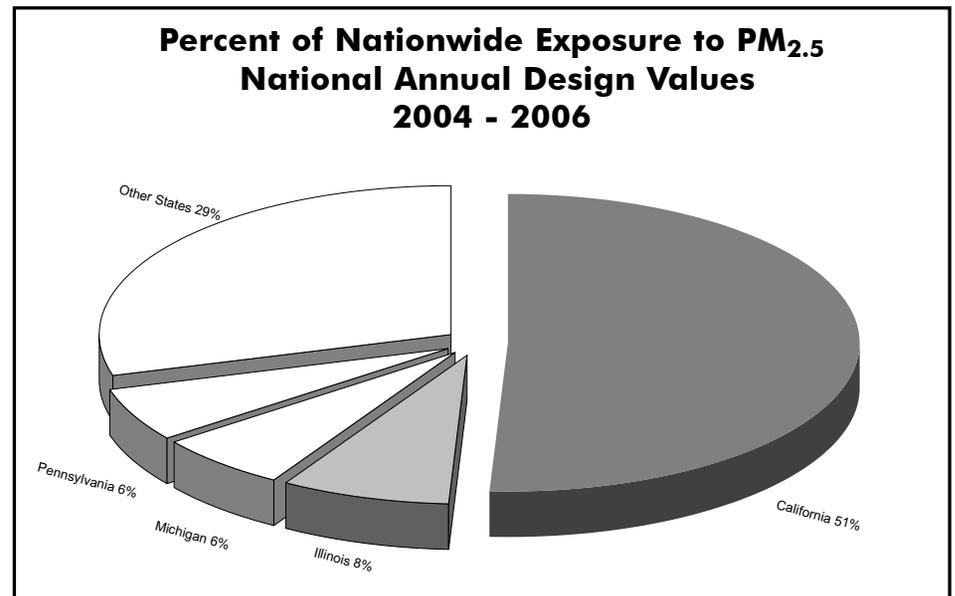


Figure 2-2

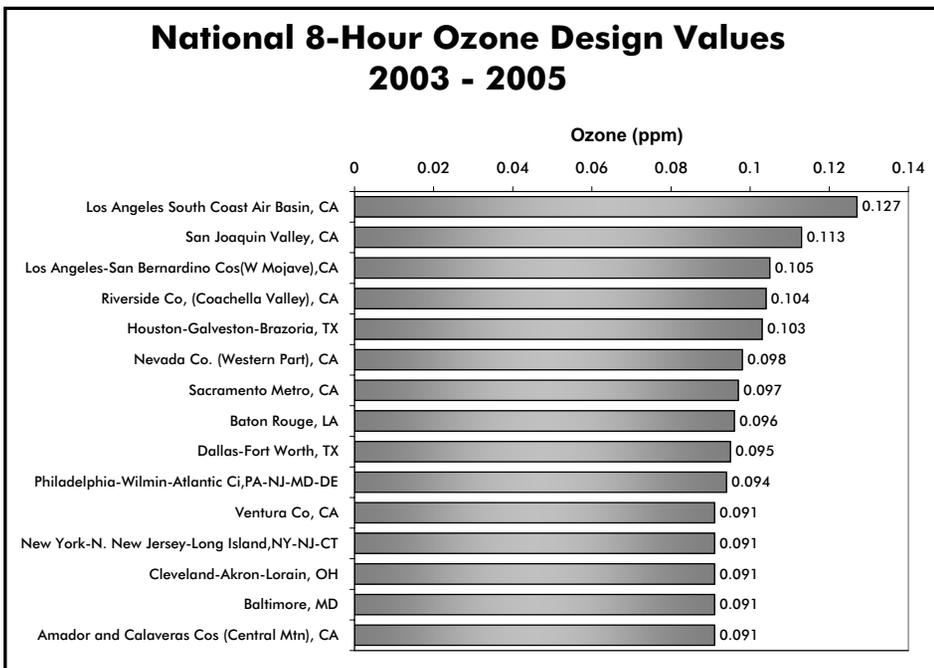


Figure 2-3

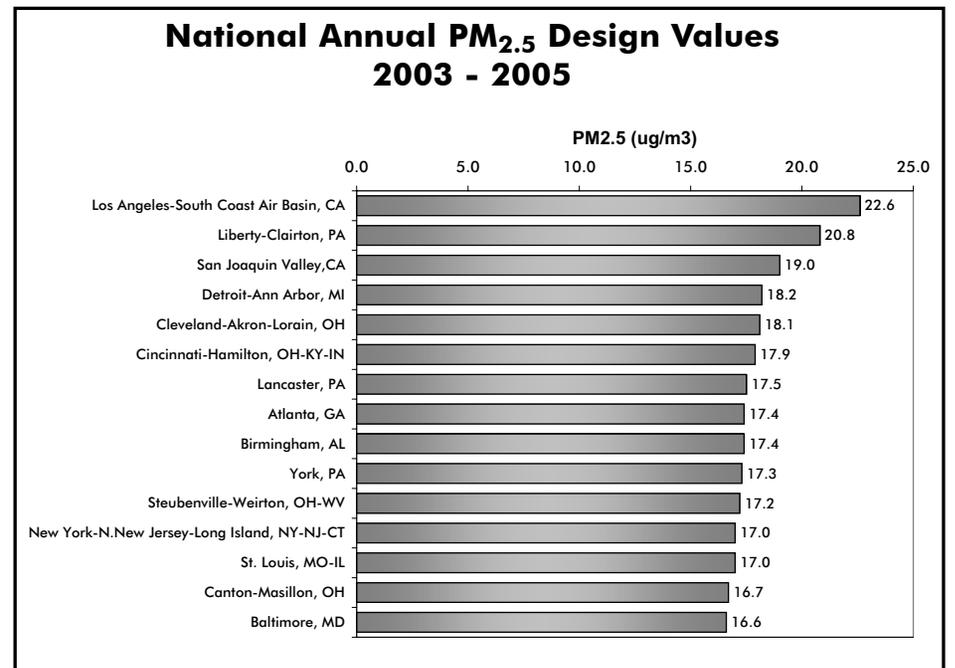


Figure 2-4

2006 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	381	346	380	114	136	83	78
Fuel Combustion	28	274	286	42	34	32	10
Waste Disposal	18	2	3	1	1	1	50
Cleaning And Surface Coatings	142	1	0	0	1	1	0
Petroleum Production And Marketing	134	14	9	43	3	2	1
Industrial Processes	59	56	81	29	97	47	16
Area-Wide Sources	658	1974	98	6	1777	450	599
Solvent Evaporation	413	0	0	0	0	0	35
Miscellaneous Processes	246	1974	98	6	1777	450	564
Mobile Sources	1282	10136	3081	184	173	146	61
Light Duty Passenger Vehicles	283	2658	229	2	16	9	29
Light and Medium Duty Trucks	262	2972	352	2	19	12	30
Heavy Duty Trucks	143	984	1190	9	49	43	2
Other On-Road	55	575	77	0	2	1	0
Aircraft and Trains	46	300	201	11	13	13	-
Ships and Commercial Boats	15	45	327	153	25	24	-
Recreational Boats and Vehicles	209	925	38	1	9	7	-
Off-Road Equipment	210	1559	551	4	33	30	-
Other Off-Road	58	117	116	1	7	7	0
Total Statewide - All Sources**	2322	12456	3558	305	2086	680	738

* Includes directly emitted particulate matter only.

** 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 PM₁₀.

Note: All emissions data remain the same as presented in the previous edition and will be updated in the 2009 edition of the Almanac.

Table 2-1

2006 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)	381	346	380	114	136	83	78
Fuel Combustion (major category total)	28	274	286	42	34	32	10
- Electric Utilities	3	49	26	3	6	6	4
- Cogeneration	4	44	23	1	4	4	1
- Oil And Gas Production (Combustion)	4	19	20	2	2	2	0
- Petroleum Refining (Combustion)	3	14	24	16	3	3	1
- Manufacturing And Industrial	4	56	90	14	6	6	3
- Food And Agricultural Processing	5	52	34	3	3	3	0
- Service And Commercial	5	32	50	3	5	5	0
- Other (Fuel Combustion)	2	8	18	1	5	4	0
Waste Disposal (major category total)	18	2	3	1	1	1	50
- Sewage Treatment	1	0	0	0	0	0	2
- Landfills	8	1	1	0	1	0	11
- Incinerators	0	1	1	0	0	0	0
- Soil Remediation	1	0	0	-	0	0	0
- Other (Waste Disposal)	8	0	0	-	0	0	37
Cleaning And Surface Coatings (major category total)	142	1	0	0	1	1	0
- Laundering	1	0	0	-	-	-	-
- Degreasing	32	-	-	-	0	0	0
- Coatings And Related Process Solvents (sub-category total)	66	0	0	0	1	1	0
- <i>Auto Marine, & Aircraft</i>	24	0	0	0	0	0	0
- <i>Paper & Fabric</i>	3	0	0	0	0	0	0
- <i>Metal, Wood, & Plastic</i>	24	0	0	0	0	0	0
- <i>Other</i>	15	0	0	0	1	1	0

* Includes directly emitted particulate matter only.

Table 2-2

2006 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	0
Petroleum Production And Marketing (major category total)	134	14	9	43	3	2	1
- Oil And Gas Production	43	1	3	0	0	0	0
- Petroleum Refining	14	12	6	43	3	2	1
- Petroleum Marketing (sub-category total)	77	0	0	-	0	0	-
- Fuel Distribution Losses	4	0	0	0	0	0	0
- Fuel Storage Losses	2	0	0	0	0	0	0
- Vehicle Refueling	38	0	0	0	0	0	0
- Other	33	0	0	0	0	0	0
- Other (Petroleum Production And Marketing)	0	-	-	-	-	-	0
Industrial Processes (major category total)	59	56	81	29	97	47	16
- Chemical	22	1	1	4	4	4	0
- Food And Agriculture	19	2	9	1	15	7	0
- Mineral Processes	5	41	54	20	53	20	1
- Metal Processes	1	1	1	0	1	1	-
- Wood And Paper	3	1	2	0	13	8	-
- Glass And Related Products	0	1	9	3	2	1	1
- Electronics	1	-	-	-	0	0	-
- Other (Industrial Processes)	9	8	5	1	10	6	14

* Includes directly emitted particulate matter only.

Table 2-2 (continued)

2006 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)	658	1974	98	6	1777	450	599
Solvent Evaporation (major category total)	413	0	0	0	0	0	35
- Consumer Products	236	-	-	-	-	-	-
- Architectural Coatings And Related Process Solvent (sub-category total)	92	-	-	-	-	-	-
- <i>Architectural Coating</i>	76	0	0	0	0	0	0
- <i>Thinning & Cleanup Solvents</i>	16	0	0	0	0	0	0
- Pesticides/Fertilizers (sub-category total)	53	-	-	-	-	-	35
- <i>Farm Use</i>	51	0	0	0	0	0	0
- <i>Commercial Use</i>	2	0	0	0	0	0	0
- Asphalt Paving / Roofing	32	-	-	-	0	0	-
- Other (Solvent Evaporation)	-	-	-	-	-	-	-
Miscellaneous Processes (major category total)	246	1974	98	6	1777	450	564
- Residential Fuel Combustion (sub-category total)	54	791	71	4	114	110	6
- <i>Wood Combustion</i>	50	763	10	1	108	104	6
- <i>Cooking And Space Heating</i>	3	25	52	2	5	5	0
- <i>Other</i>	0	4	10	0	1	1	0
- Farming Operations (sub-category total)	116	-	-	-	161	40	495
- <i>Tilling, Harvesting, & Growing</i>	0	0	0	0	126	19	0
- <i>Livestock</i>	116	0	0	0	34	21	495

* Includes directly emitted particulate matter only.

Table 2-2 (continued)

2006 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)	-	-	-	-	205	20	-
- Building	0	0	0	0	116	12	0
- Road Construction Dust	0	0	0	0	89	9	0
- Paved Road Dust	-	-	-	-	392	59	-
- Unpaved Road Dust	-	-	-	-	479	52	-
- Fugitive Windblown Dust (sub-category total)	-	-	-	-	286	45	-
- Farm Lands	0	0	0	0	160	28	0
- Pasture Lands	0	0	0	0	13	2	0
- Unpaved Roads	0	0	0	0	113	15	0
- Fires	1	10	0	-	1	1	-
- Managed Burning And Disposal (sub-category total)	68	1171	26	2	109	100	4
- Agricultural Burning**	23	245	14	1	30	28	3
- Non-Agricultural Burning	40	881	10	1	73	65	1
- Other	5	46	1	0	7	7	0
- Cooking	7	0	-	-	30	23	-
- Other (Miscellaneous Processes)	0	2	0	-	1	1	60

* Includes directly emitted particulate matter only.

** 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)

2006 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
Mobile Sources (division total)	1282	10136	3081	184	173	146	61
On-Road Motor Vehicles (major category total)	743	7189	1849	14	85	66	61
- Light Duty Passenger (sub-category total)	283	2658	229	2	16	9	29
- Non-Evaporative	154	2657	227	2	16	9	29
- Evaporative	129	0	0	0	0	0	0
- Diesel	0	1	2	0	0	0	0
- Light Duty Trucks(<3750 lbs.) (sub-category total)	90	939	85	1	4	2	6
- Non-Evaporative	52	935	76	0	4	2	6
- Evaporative	38	0	0	0	0	0	0
- Diesel	0	4	9	0	0	0	0
- Light Duty Trucks (>3750 lbs) (sub-category total)	117	1347	173	1	10	7	13
- Non-Evaporative	67	1346	172	1	10	7	13
- Evaporative	51	0	0	0	0	0	0
- Diesel	0	0	1	0	0	0	0
- Medium Duty Trucks (sub-category total)	55	687	94	1	5	3	10
- Non-Evaporative	37	687	93	1	5	3	10
- Evaporative	18	0	0	0	0	0	0
- Diesel	0	0	1	0	0	0	0
- Light Heavy Duty Gas Trucks (<10000 lbs) (sub-category total)	31	268	38	0	1	0	2
- Non-Evaporative	20	268	38	0	1	0	2
- Evaporative	11	0	0	0	0	0	0
- Light Heavy Duty Gas Trucks (>10000 lbs) (sub-category total)	10	81	10	0	0	0	0
- Non-Evaporative	6	81	10	0	0	0	0
- Evaporative	4	0	0	0	0	0	0
- Medium Heavy Duty Gas Trucks (sub-category total)	20	178	18	0	0	0	0
- Non-Evaporative	15	178	18	0	0	0	0
- Evaporative	5	0	0	0	0	0	0

* Includes directly emitted particulate matter only.

Table 2-2 (continued)

2006 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
Mobile Sources (division total) (continued)							
On-Road Motor Vehicles (major category) (continued)							
- Heavy Heavy Duty Gas Trucks (sub-category total)	11	158	22	0	0	0	0
- Non-Evaporative	10	158	22	0	0	0	0
- Evaporative	1	0	0	0	0	0	0
- Light Heavy Duty Gas Trucks (<10000 lbs)	1	6	35	0	0	0	0
- Light Heavy Duty Gas Trucks (>10000 lbs)	1	4	26	0	0	0	0
- Medium Heavy Duty Diesel Trucks	3	30	159	2	5	4	0
- Heavy Heavy Duty Diesel Trucks	66	260	883	7	43	38	0
- Motorcycles (Mcy) (sub-category total)	47	441	11	-	0	0	0
- Non-Evaporative	35	441	11	0	0	0	0
- Evaporative	11	0	0	0	0	0	0
- Heavy Duty Diesel Urban Buses	1	6	29	0	1	0	0
- Heavy Duty Gas Urban Buses (sub-category total)	1	11	2	0	0	0	0
- Non-Evaporative	1	11	2	0	0	0	0
- Evaporative	0	0	0	0	0	0	0
- School Buses (sub-category total)	1	14	14	0	1	0	0
- Non-Evaporative	1	11	1	0	0	0	0
- Evaporative	0	0	0	0	0	0	0
- Diesel	0	3	13	0	1	0	0
- Other Buses (sub-category total)	2	22	10	0	0	0	0
- Non-Evaporative	1	21	3	0	0	0	0
- Evaporative	0	0	0	0	0	0	0
- Diesel	0	1	7	0	0	0	0
- Motor Homes (sub-category total)	3	81	11	0	0	0	0
- Non-Evaporative	3	81	7	0	0	0	0
- Evaporative	0	0	0	0	0	0	0
- Diesel	0	0	4	0	0	0	0

* Includes directly emitted particulate matter only.

Table 2-2 (continued)

2006 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
Mobile Sources (division total) (continued)							
Other Mobile Sources (major category total)	539	2946	1232	170	88	81	0
- Aircraft	34	266	53	3	9	9	-
- Trains	12	34	149	8	5	4	-
- Ships And Commercial Boats	15	45	327	153	25	24	-
- Residual Oil	6	18	230	147	20	19	0
- Diesel	6	16	70	2	3	3	0
- Gasoline	0	3	0	0	0	0	0
- Other Fuel	2	8	26	5	2	2	0
- Recreational Boats	143	741	35	0	8	6	-
- Non-Evaporative	102	740	33	0	8	6	0
- Evaporative	40	0	0	0	0	0	0
- Diesel	1	1	2	0	0	0	0
- Off-Road Recreational Vehicles (sub-category total)	66	184	2	1	1	1	-
- All-Terrain Vehicles	16	47	0	1	0	0	0
- Motorcycles	39	62	0	0	0	0	0
- Snowmobiles	8	21	0	0	0	0	0
- Golf Carts, Specialty Carts & Minibikes	4	54	0	1	0	0	0
- Off-Road Equipment (sub-category total)	210	1559	551	4	33	30	-
- Lawn And Garden Equipment	96	565	15	0	2	1	0
- Non-Evaporative	50	562	8	0	1	1	0
- Evaporative	45	0	0	0	0	0	0
- Diesel	1	3	6	0	0	0	0
- Commercial & Industrial Equipment	114	993	536	4	31	29	0
- Non-Evaporative	28	653	30	0	2	2	0
- Evaporative	13	0	0	0	0	0	0
- Diesel	72	251	485	4	29	27	0
- Natural Gas	1	89	22	0	0	0	0
- Farm Equipment (sub-category total)	24	117	116	1	7	7	-
- Non-Evaporative	2	65	2	0	0	0	0
- Evaporative	3	0	0	0	0	0	0
- Diesel	18	53	114	1	7	6	0
- Fuel Storage and Handling	34	-	-	-	-	-	-
Total Statewide - All Sources**	2322	12456	3558	305	2086	680	738

* Includes directly emitted particulate matter only.

** 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 PM₁₀.

Table 2-2 (continued)

Ozone

2006 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, PM₁₀, 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 87 percent of the total statewide NO_x emissions. Area-wide sources, which include residential fuel combustion and managed burning and disposal, contribute only a small portion of the total NO_x emissions. The emissions data remain the same as presented in the previous edition and will be updated in the 2009 Almanac.

NO _x Emissions (annual average)		
Emissions Source	tons/day	Percent
Stationary Sources	380	11%
Area-wide Sources	98	3%
On-Road Mobile	1849	52%
Gasoline Vehicles	740	21%
Diesel Vehicles	1108	31%
Other Mobile	1232	35%
Gasoline Vehicles	306	9%
Diesel Vehicles	826	23%
Other	101	3%
Total Statewide	3558	100%

Table 2-3

ROG Sources - Statewide

ROG are VOCs that are photochemically reactive and contribute to the formation of ozone, as well as PM₁₀ 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, farming operations, and other evaporative emissions. The emissions data remain the same as presented in the previous edition and will be updated in the 2009 Almanac.

ROG Emissions (annual average)		
Emissions Source	tons/day	Percent
Stationary Sources	381	16%
Area-wide Sources	658	28%
On-Road Mobile	743	32%
Gasoline Vehicles	672	29%
Diesel Vehicles	71	3%
Other Mobile	539	23%
Gasoline Vehicles	391	17%
Diesel Vehicles	111	5%
Other	37	2%
Total Statewide	2322	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	4111
Mojave Desert	California Portland Cement	Mojave	2975
Mojave Desert	Mitsubishi Cement 2000	Lucerne Valley	2770
Mojave Desert	Searles Valley Minerals	Trona	2001
San Francisco Bay Area	Valero Refining Company	Benicia	1963
San Francisco Bay Area	Shell Martinez Refinery	Martinez	1782
San Francisco Bay Area	Tesoro Refining And Marketing	Martinez	1511
Mojave Desert	National Cement	Lebec	1300
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	Tesoro Refining And Marketing	Martinez	1555
San Francisco Bay Area	Chevron Products Company	Richmond	1311
San Francisco Bay Area	Shell Martinez Refinery	Martinez	1235
San Joaquin Valley	Pactiv Corporation (Packaging)	Visalia	828
South Coast	ChevronTexaco Products	El Segundo	775
South Coast	BP West Coast Products Carson Refinery	Carson	745
South Coast	ExxonMobil Oil Corporation	Torrance	713
San Francisco Bay Area	New United Motor Manufacturing	Fremont	556
San Francisco Bay Area	Valero Refining Company	Benicia	494
San Francisco Bay Area	ConocoPhillips - San Francisco	Rodeo	464

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

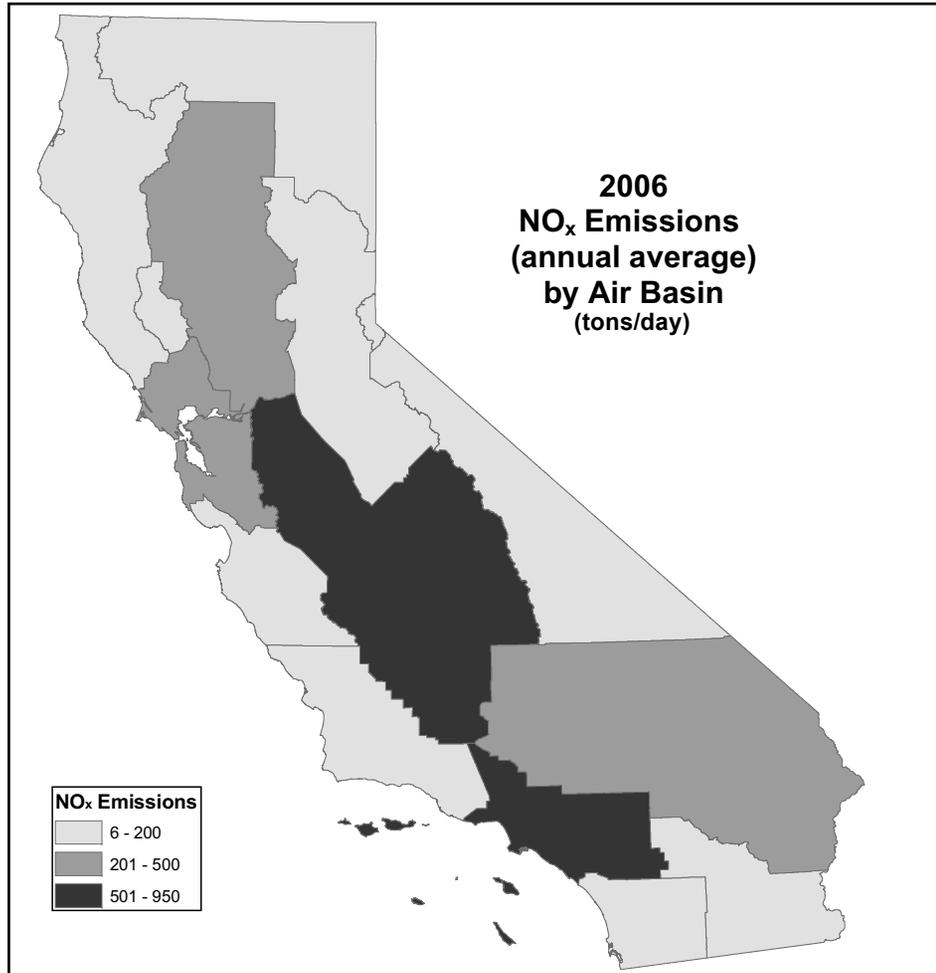


Figure 2-5

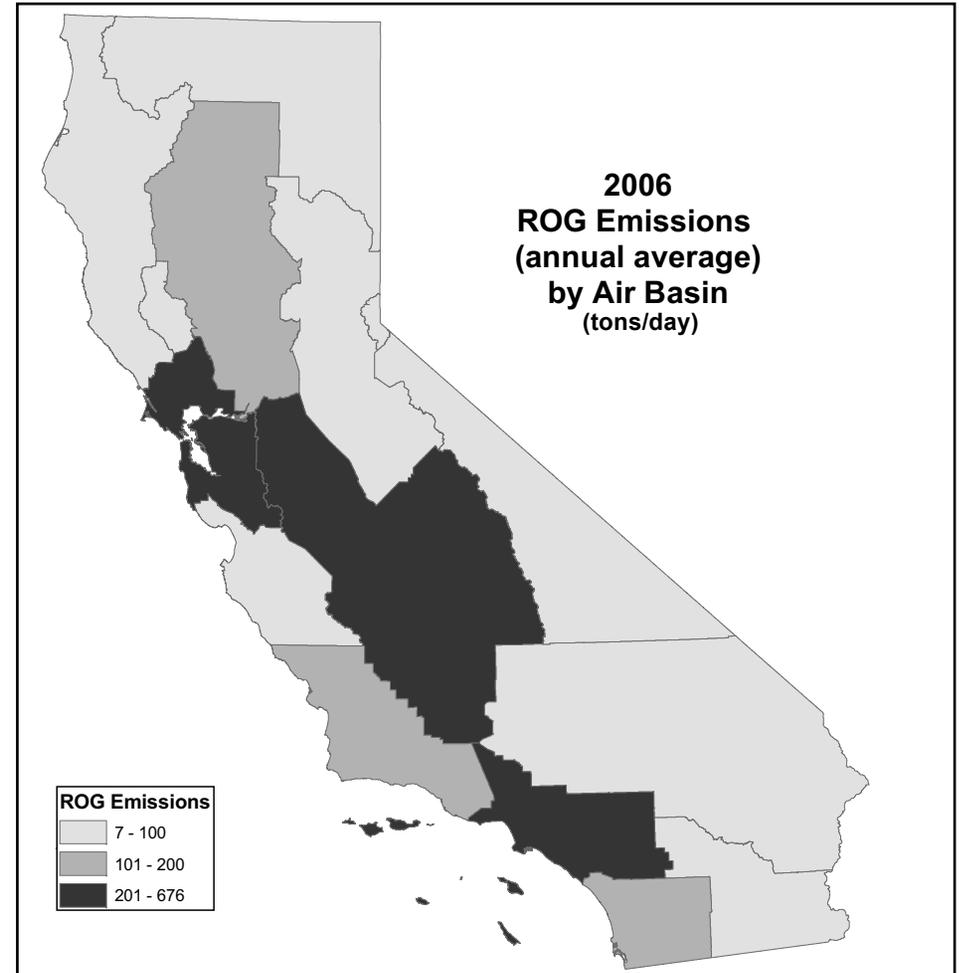


Figure 2-6

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Ozone - 2006 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 and national 8-hour standards in 10 of the 15 air basins. California's highest ozone concentrations occur in the South Coast Air Basin, where the peak 1-hour and 8-hour indicators are close to two times the level of the State standards.

Ozone concentrations are generally lower near the coast than they are inland. The inland regions typically experience some of the higher ozone concentrations. This is because there are many more days with hot temperatures and stagnant conditions that are conducive to ozone formation. Typically, they also have mountain ranges which keep pollutants trapped. Based on current ozone concentrations, substantial additional emission control measures will be needed to attain the standards throughout the State. 2006 air quality data for California's five largest air basins can be found in Chapter 4, along with preliminary 2007 ozone data.

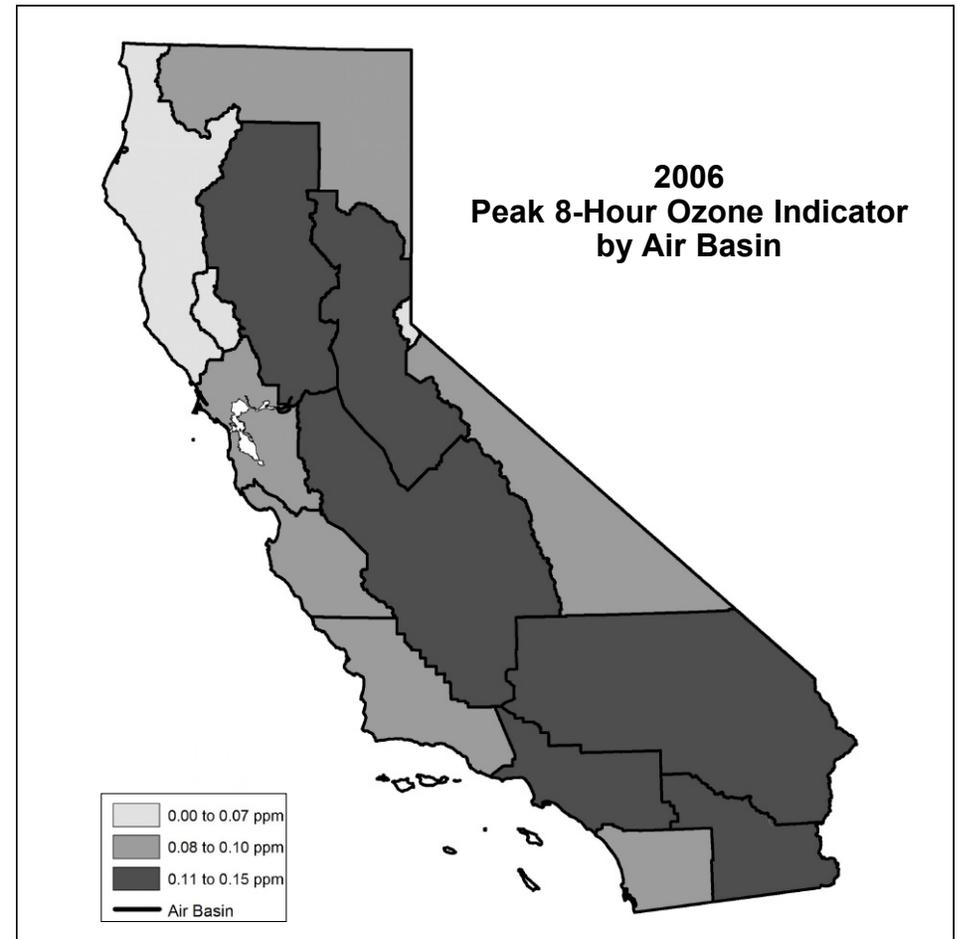


Figure 2-7

Ozone - 2006 Air Quality Tables

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

AIR BASIN	2006 Maximum Peak Indicator in parts per million		Number of Days in 2006 above the Standard		
	1-Hour	8-Hour	State		National
			1-Hour	8-Hour	8-Hour
Great Basin Valleys Air Basin	0.091	0.090	0	33	2
Lake County Air Basin	0.076	0.068	0	1	0
Lake Tahoe Air Basin	0.079	0.074	0	2	0
Mojave Desert Air Basin	0.132	0.119	61	124	50
Mountain Counties Air Basin	0.122	0.111	50	103	44
North Central Coast Air Basin	0.095	0.085	2	20	2
North Coast Air Basin	0.075	0.067	0	0	0
Northeast Plateau Air Basin	0.078	0.073	0	2	0
Sacramento Valley Air Basin	0.130	0.115	44	88	39
Salton Sea Air Basin	0.131	0.119	51	94	32
San Diego Air Basin	0.111	0.099	23	68	14
San Francisco Bay Area Air Basin	0.123	0.097	18	22	12
San Joaquin Valley Air Basin	0.140	0.119	90	141	86
South Central Coast Air Basin	0.113	0.101	24	78	22
South Coast Air Basin	0.158	0.141	102	130	85

Table 2-7

National 8-Hour Nonattainment Areas: Design Values and 8-Hour Exceedance Days by Area

Area	Design Values	Exceedance Days	Percent above Standard
South Coast	0.121	85	45%
San Joaquin Valley	0.110	86	30%
Sacramento Metro	0.097	42	15%
Ventura	0.090	17	10%
San Diego	0.088	14	5%
San Francisco Bay Area	0.080	12	Meets standard*
Western Nevada County	0.096	26	15%
Central Mountain Counties	0.093	14	10%
Southern Mountain Counties	0.086	6	5%
Eastern Kern	0.086	8	5%
Coachella	0.102	26	20%
Antelope Valley and Western Mojave Desert	0.103	50	25%
Imperial	0.085	11	5%
Butte County	0.084	7	Meets standard*
Sutter Buttes	0.082	7	Meets standard*

* This area has air quality that meets the national ozone standard of 0.08 ppm but is still designated as nonattainment.

Table 2-8

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

Great Basin Valleys Air Basin

- Death Valley Nat'l Monument

Lake Tahoe Air Basin

- South Lake Tahoe-1901 Airport Rd

Mojave Desert Air Basin

- Joshua Tree-National Monument
- Hesperia-Olive Street
- Phelan-Beekley Rd & Phelan Rd
- Lancaster-43301 Division Street
- Victorville-14306 Park Avenue

Mountain Counties Air Basin

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

North Central Coast Air Basin

- Pinnacles National Monument
- Hollister-Fairview Road
- Scotts Valley-Scotts Valley Drive

Northeast Plateau Air Basin

- Yreka-Foothill Drive

Sacramento Valley Air Basin

- Folsom-Natoma Street
- Sloughhouse
- Sacramento-Del Paso Manor
- Auburn-Dewitt C Avenue
- Roseville-N Sunrise Blvd

Salton Sea Air Basin

- Palm Springs-Fire Station
- Indio-Jackson Street
- Westmorland-W 1st Street
- El Centro-9th Street
- Joshua Tree National Park

San Diego Air Basin

- Alpine-Victoria Drive
- Escondido-East Valley Parkway
- Camp Pendleton
- San Diego-Overland Avenue
- El Cajon-Redwood Avenue

San Francisco Bay Area Air Basin

- Livermore-793 Rincon Avenue
- San Martin-Murphy Avenue
- Bethel Island Road
- Concord-2975 Treat Blvd
- Los Gatos

San Joaquin Valley Air Basin

- Arvin-Bear Mountain Blvd
- Sequoia and Kings Canyon Nat'l Park
- Bakersfield-5558 California Avenue
- Fresno-1st Street
- Edison

South Central Coast Air Basin

- Simi Valley-Cochran Street
- Ojai-Ojai Avenue
- Carrizo Plains School-9640 Carrizo
- Piru-3301 Pacific Avenue
- Thousand Oaks-Moorpark Road

South Coast Air Basin

- Crestline
- Redlands-Dearborn
- San Bernardino-4th Street
- Fontana-Arrow Highway
- Banning Airport

Sites with 8-hour peak indicator values above the level of the State ozone standard during 2006. 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 8-hour ozone standard. If more than 5 sites are listed, there were multiple sites with the same maximum concentration.

The Nature of Particulate Matter (PM₁₀ and PM_{2.5})

PM₁₀ is a mixture of particles and droplets that vary in size and chemical composition, depending on each particle's origin. PM₁₀ 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, leading to higher ambient PM_{2.5} concentrations. Warm, stagnant conditions during the summer lead to the formation of secondary ammonium sulfate, contributing to higher PM_{2.5} concentrations. Dry weather and windy conditions cause higher coarse PM emissions, resulting in elevated PM₁₀ concentrations.

The remainder of the discussion on PM includes summarized emission inventory data for directly emitted PM₁₀ and PM_{2.5}, summarized information on ambient PM₁₀ 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 statistics for PM₁₀ and PM_{2.5}. State and national values 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 PM and national PM_{2.5} standards use local conditions while the national PM₁₀ standard uses standard conditions for data reporting.

Directly Emitted Particulate Matter (PM₁₀)

2006 Statewide Emission Inventory - Directly Emitted PM₁₀ by Category

Area-wide sources account for about 85 percent of the statewide emissions of directly emitted PM₁₀. The major area-wide source of PM₁₀ 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 PM₁₀ 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 PM₁₀ emissions but are a major source of the ROG and NO_x that form secondary particles. The section titled *PM₁₀ and PM_{2.5} - Linking Emissions Sources with Air Quality* describes how emissions from specific sources are linked to measured PM₁₀ levels. The emissions data remain the same as presented in the previous edition and will be updated in the 2009 Almanac.

PM ₁₀ Emissions (annual average)		
Emissions Source	tons/day	Percent
Stationary Sources	136	7%
Area-wide Sources	1777	85%
On-Road Mobile	85	4%
Gasoline Vehicles	36	2%
Diesel Vehicles	49	2%
Other Mobile	88	4%
Gasoline Vehicles	33	2%
Diesel Vehicles	44	2%
Other	11	1%
Total Statewide	2086	100%

Table 2-10

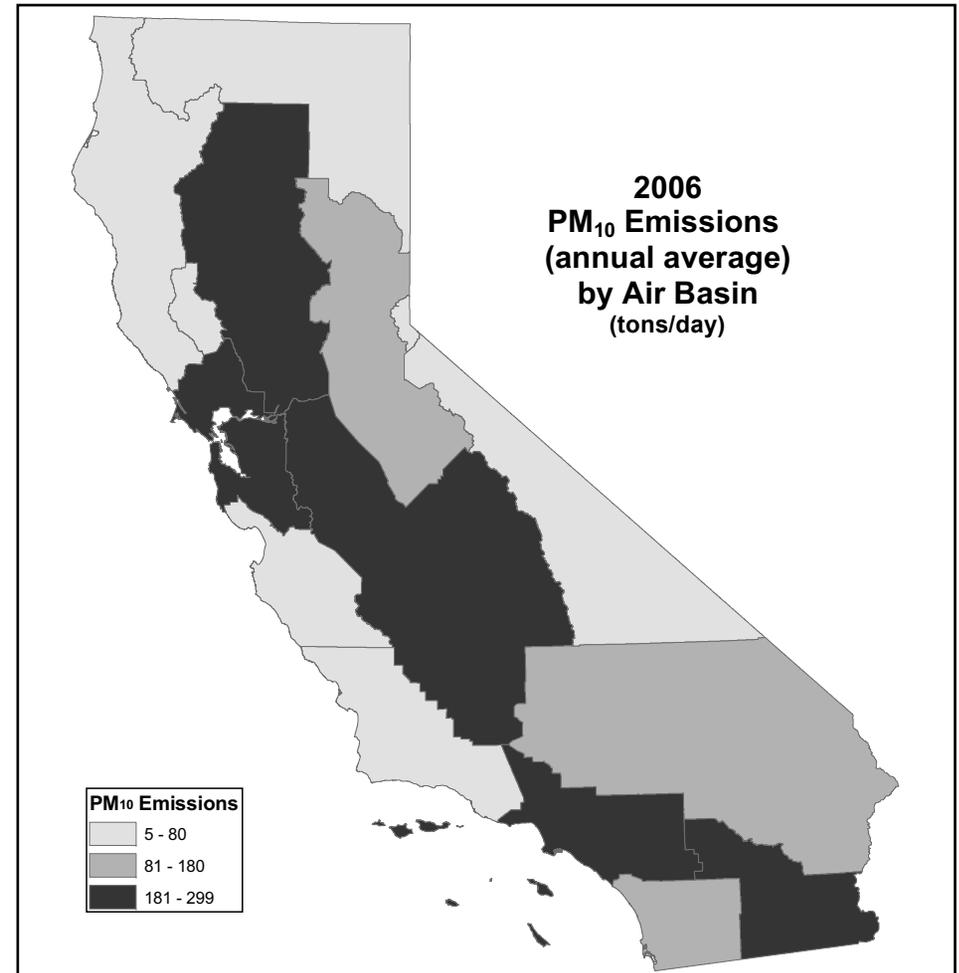


Figure 2-8

Largest Stationary Sources Statewide

Largest Stationary Sources of Directly Emitted PM₁₀ Statewide

Air Basin	Facility Name	City	Tons/Year
Mojave Desert	Mitsubishi Cement 2000	Lucerne Valley	1468
Mojave Desert	TXI Riverside Cement Company	Oro Grande	755
Mojave Desert	Antelope Valley Aggregate	Little Rock	691
Mountain Counties	Sierrapine Ltd Ampine Division	Martell	518
San Francisco Bay Area	Shell Martinez Refinery	Martinez	373
South Coast	ChevronTexaco Products	El Segundo	356
Mojave Desert	California Portland Cement	Mojave	329
Mojave Desert	National Cement	Lebec	309
South Coast	BP West Coast Products Carson Refinery	Carson	298
Mojave Desert	Granite Construction	Little Rock	297

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 2-11

Directly Emitted Particulate Matter (PM_{2.5})

2006 Statewide Emission Inventory - Directly Emitted PM_{2.5} by Category

Area-wide sources account for about 66 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 *PM₁₀ and PM_{2.5} - Linking Emissions Sources with Air Quality* describes how emissions from specific sources are linked to measured PM_{2.5} levels. The emissions data remain the same as presented in the previous edition and will be updated in the 2009 Almanac.

PM _{2.5} Emissions (annual average)		
Emissions Source	tons/day	Percent
Stationary Sources	83	12%
Area-wide Sources	450	66%
On-Road Mobile	66	10%
Gasoline Vehicles	22	3%
Diesel Vehicles	43	6%
Other Mobile	81	12%
Gasoline Vehicles	29	4%
Diesel Vehicles	41	6%
Other	11	2%
Total Statewide	680	100%

Table 2-12

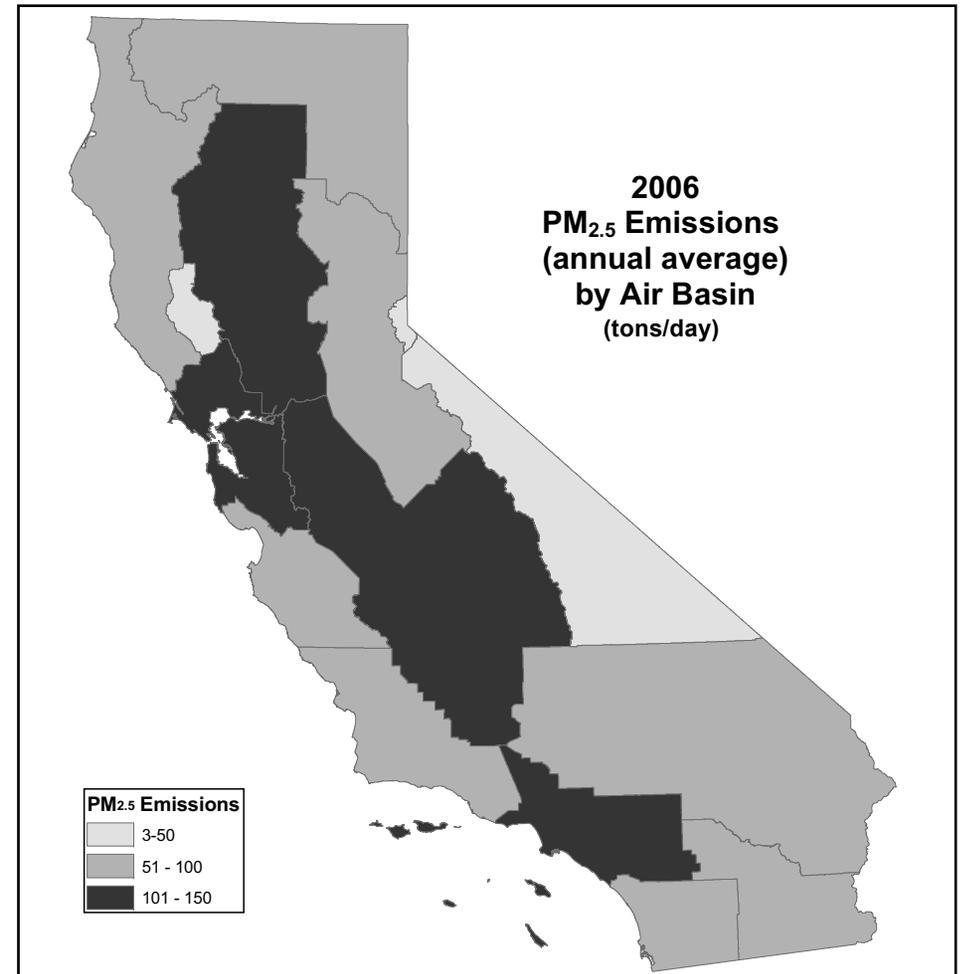


Figure 2-9

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
San Francisco Bay Area	Shell Martinez Refinery	Martinez	360
Mojave Desert	TXI Riverside Cement Company	Oro Grande	344
South Coast	ChevronTexaco Products	El Segundo	303
South Coast	BP West Coast Products Carson Refinery	Carson	284
Mojave Desert	Antelope Valley Aggregate	Littlerock	257
San Francisco Bay Area	Chevron Products Company	Richmond	232
Sacramento Valley	Johns-Manville (Insulation)	Willows	220
Mojave Desert	Searles Valley Minerals	Trona	213

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 2-13

PM₁₀ - 2006 Air Quality

Most areas of California have either 24-hour or annual PM₁₀ 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 2006 occurred in the Salton Sea, South Coast, San Diego, San Joaquin Valley, and Great Basin Valleys air basins. The 2006 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 PM₁₀ problems. However, the 2006 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/desig.htm.

Particles resulting from combustion contribute to high PM₁₀ in a number of urban areas. While many of the control programs implemented for ozone will also reduce PM₁₀, more controls specifically for PM₁₀ will be needed to reach attainment.

The table on the following page 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. For example, the State and national maximum 24-hour concentrations in the Great Basin Valleys, Mojave Desert, and Mountain Counties air basins reflect measurements from two different sites.

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. in the Mountain Counties and the San Diego air basins, due to differing State and national data completeness criteria, the State and national maximum annual averages reflect values from two different sites.)

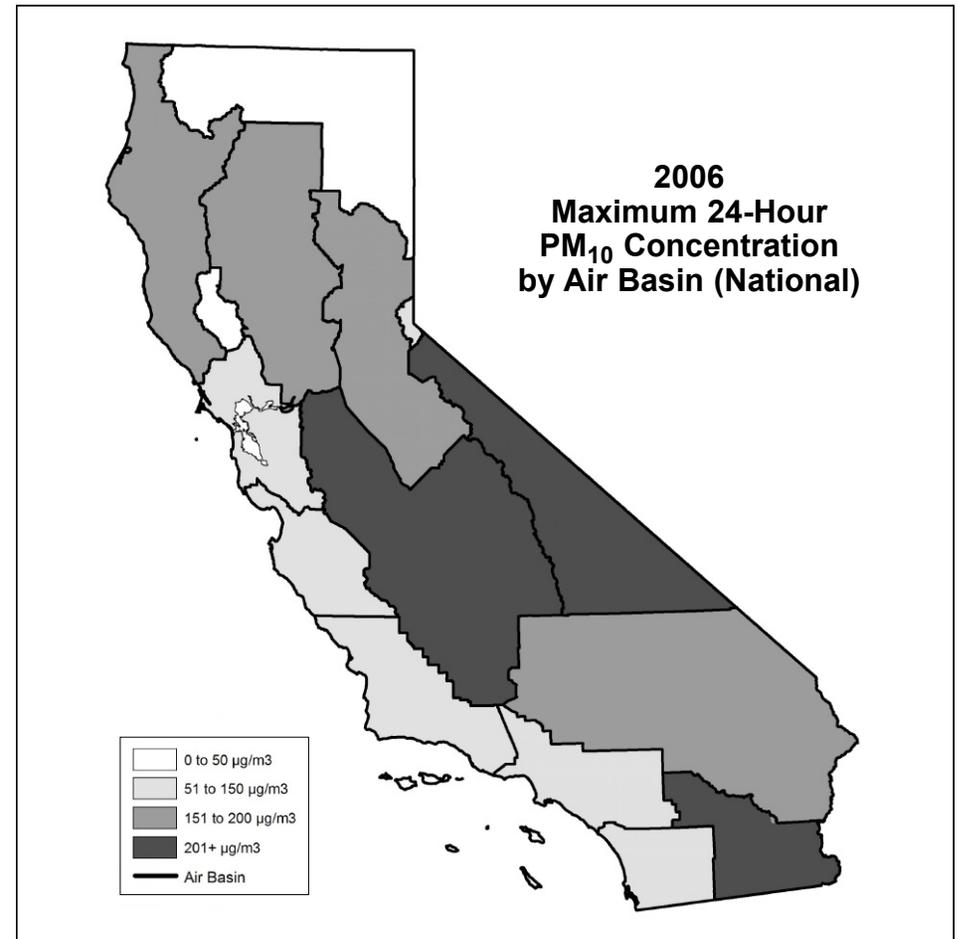


Figure 2-10

PM₁₀ - 2006 Air Quality Tables

Maximum 24-Hour and Annual PM₁₀ Concentrations by Air Basin

AIR BASIN	2006 Maximum 24-Hour Concentration ($\mu\text{g}/\text{m}^3$)		2006 Maximum Annual Average of Quarters ($\mu\text{g}/\text{m}^3$)	
	State	National	State	National
Great Basin Valleys Air Basin	7709.0	8299.0	63.1	93.2
Lake County Air Basin	32.8	*	11.7	*
Lake Tahoe Air Basin	*	66.6	*	17.1
Mojave Desert Air Basin	77.0	184.4	30.5	33.0
Mountain Counties Air Basin	97.0	167.1	17.6	29.0
North Central Coast Air Basin	65.0	63.0	25.0	23.9
North Coast Air Basin	153.9	160.6	21.9	25.8
Northeast Plateau Air Basin	43.7	49.6	13.4	14.1
Sacramento Valley Air Basin	111.0	159.6	28.8	37.8
Salton Sea Air Basin	261.0	248.0	71.6	70.9
San Diego Air Basin	134.0	133.0	54.1	53.7
San Francisco Bay Area Air Basin	106.3	103.9	35.0	34.1
San Joaquin Valley Air Basin	255.0	304.0	56.5	55.4
South Central Coast Air Basin	135.0	131.0	27.9	29.7
South Coast Air Basin	135.0	142.0	62.3	64.0

* Data provided may be incomplete or may not meet the reporting criteria required for the related standard.

** The 24-hour PM₁₀ max for each basin is based on data obtained from federal reference monitors and federal equivalent monitors operating in the basin.

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 2-14

National Nonattainment Areas: Expected Exceedance Days and Max National Concentrations by Area

Area	2004-2006 Expected Number of Exceedances	2004-2006 Max High National 24-Hr Avg	Percent above Standard
Owens Valley	18.8	6338.0	4015%
Coso Junction	1.0	97.0	-35%
Mammoth Lakes	0.0	86.0	-45%
Mono Basin	22.2	4300.0	2695%
Sacramento County	0.3	110.0	-30%
San Joaquin Valley	0.0	154.0	meets standard
South Coast	0.0	137.0	-10%
Imperial Valley	11.9	248.0	64%
Coachella Valley	2.2	226.0	45%
San Bernardino County	1.0	80.0	-50%
Trona	0.0	88.0	-45%

Table 2-15

Top Sites with 24-Hour Concentrations above the State PM₁₀ Standard

Great Basin Valleys Air Basin

- Shell Cut-Highway 190
- Dirty Sox
- Flat Rock-Highway 190
- Mono Lake North Shore
- Keeler-Cerro Gordo Road

Mojave Desert Air Basin

- Barstow
- Trona-Athol and Telegraph
- Ridgecrest-100 West California Avenue
- Lancaster-43301 Division Street
- Mojave-923 Poole Street

Mountain Counties Air Basin

- Yosemite Village-Visitor Center

North Central Coast Air Basin

- Davenport
- Salinas-#3

North Coast Air Basin

- Weaverville-Courthouse
- Eureka-I Street
- Fort Bragg-N Franklin Street

Sacramento Valley Air Basin

- Sacramento-T Street
- Sacramento-3801 Airport Road
- Sacramento-Branch Center Road #2
- Chico-Manzanita Avenue
- West Sacramento-15th Street
- Woodland-Gibson Road

Salton Sea Air Basin

- Calexico-Grant Street
- Palm Springs-Fire Station
- Westmorland-W 1st Street
- Calexico-Ethel Street
- El Centro-9th Street

San Diego Air Basin

- Otay Mesa-Paseo International
- San Diego-1110 Beardsley Street
- Chula Vista
- Escondido-E Valley Parkway

San Francisco Bay Area Air Basin

- San Jose-Tully Road
- Santa Rosa-5th Street
- Bethel Island Road
- Concord-2975 Treat Blvd
- San Jose-Jackson Street

San Joaquin Valley Air Basin

- Corcoran-Patterson Avenue
- Bakersfield-Golden State Highway
- Oildale-3311 Manor Street
- Bakersfield-5558 California Avenue
- Visalia-North Church Street

South Central Coast Air Basin

- Nipomo-Guadalupe Road
- El Rio-Rio Mesa School #2
- Nipomo-Regional Park
- San Luis Obispo-3220 South Higuera St
- Paso Robles-Santa Fe Avenue
- Morro Bay

South Coast Air Basin

- Fontana-Arrow Highway
- Riverside-5130 Poinsettia Place
- Perris
- Long Beach-East Pacific Coast Highway
- Riverside-Rubidoux

Sites with 24-hour PM₁₀ concentrations above the level of the State PM₁₀ standard during 2006. 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 PM₁₀ concentrations at sites in that air basin were not above the State 24-hour PM₁₀ standard. If more than 5 sites are listed, there were multiple sites with the same maximum concentration.

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PM_{2.5} - 2006 Air Quality

As explained in the Introduction section of Chapter 1, the U.S. EPA has promulgated national 24-hour and annual average standards for PM_{2.5}. The ARB has established a more health-protective State annual average PM_{2.5} standard.

The 2006 data from California's PM_{2.5} network are summarized in Table 2-15. Sites in the Great Basin Valleys Air Basin recorded the highest national 24-hour concentrations, while sites in the San Joaquin Valley Air Basin recorded the highest 98th percentile 24-hour concentrations (see footnote on the following page for an explanation of the 98th percentile statistic). However, the 2006 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. 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 nearly twice the level of the State annual PM_{2.5} standard. Current area designations can be found on the ARB website at www.arb.ca.gov/desig/adm/adm.htm.

The table on the following page lists the highest value for each statistic. Within an air basin, the highest value for each statistic may reflect a different site or 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 (e.g. maximum 24-hour concentrations in the Mountain Counties and South Central Coast air basins, and maximum 24-hour concentrations and maximum annual averages for the Salton Sea and San Joaquin Valley air basins.)

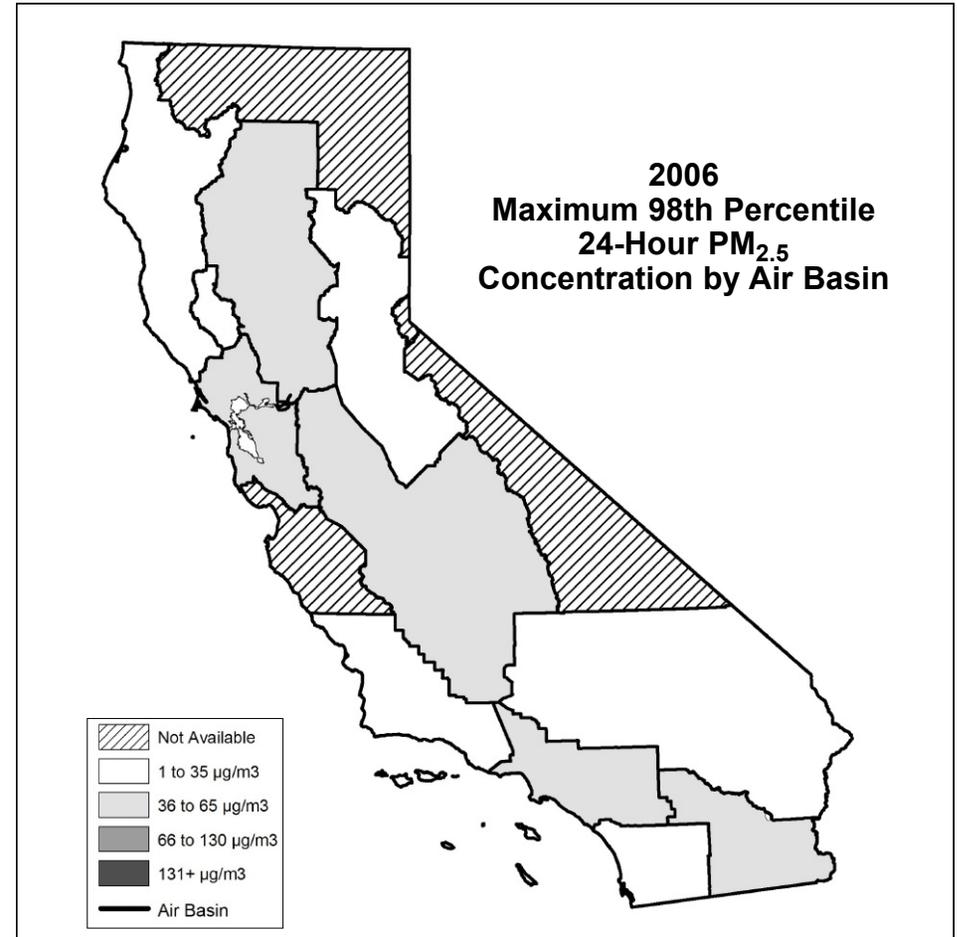


Figure 2-11

PM_{2.5} - 2006 Air Quality Tables

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

AIR BASIN	2006 Maximum 24-Hr Concentration ($\mu\text{g}/\text{m}^3$)		98th Percentile 24-Hr Conc. ($\mu\text{g}/\text{m}^3$)**	2006 Average of Quarterly Means ($\mu\text{g}/\text{m}^3$)**	
	State	National		State	National
Great Basin Valleys	193.0	193.0	Incomplete Data	Incomplete Data	Incomplete Data
Lake County	21.6	21.6	21.4	5.1	5.1
Lake Tahoe	Incomplete Data	Incomplete Data	Incomplete Data	Incomplete Data	Incomplete Data
Mojave Desert	22.0	22.0	19.0	10.3	10.4
Mountain Counties	62.7	51.0	31.0	8.6	10.9
North Central Coast	13.0	13.0	Incomplete Data	Incomplete Data	Incomplete Data
North Coast	35.0	35.0	17.4	6.8	6.8
Northeast Plateau	22.0	22.0	Incomplete Data	Incomplete Data	Incomplete Data
Sacramento Valley	78.6	78.0	59.0	15.2	13.2
Salton Sea	80.8	68.8	46.0	17.3	12.5
San Diego	63.3	63.3	28.4	13.1	13.1
San Francisco Bay Area	75.3	75.3	42.8	12.4	9.3
San Joaquin Valley	88.1	87.0	64.7	21.6	19.3
South Central Coast	119.5	31.7	27.6	10.3	10.3
South Coast	72.2	72.2	54.4	16.6	20.8

* 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 2-17

National Nonattainment Areas: Annual and 24-Hour Average Design Value by Area

Area	2004-2006 Annual Design Value	2004-2006 24-Hr Avg Design Value	Percent above Annual Standard
San Joaquin Valley	18.9	64.0	26%
South Coast	20.6	57.0	37%

Table 2-18

PM₁₀ 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 PM₁₀ and PM_{2.5} concentrations in the fall and winter months (refer to Figure 2-10). In the winter, PM₁₀ 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 PM₁₀ 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, PM₁₀ 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 PM₁₀ levels, with soil dust as the major contributor to ambient PM₁₀.

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 PM₁₀ monitoring networks, California Regional PM₁₀/PM_{2.5} Air Quality Study, Children's Health Study,

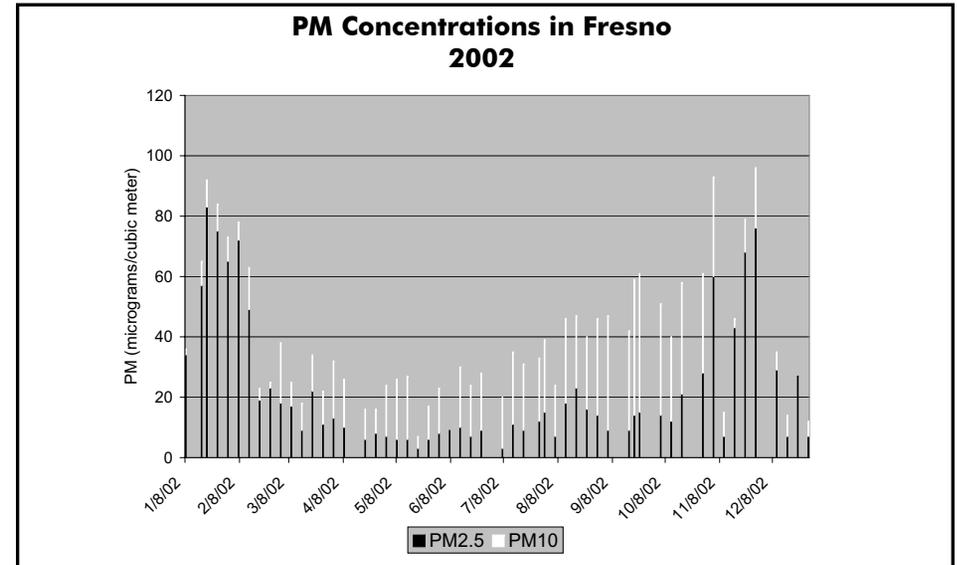


Figure 2-12

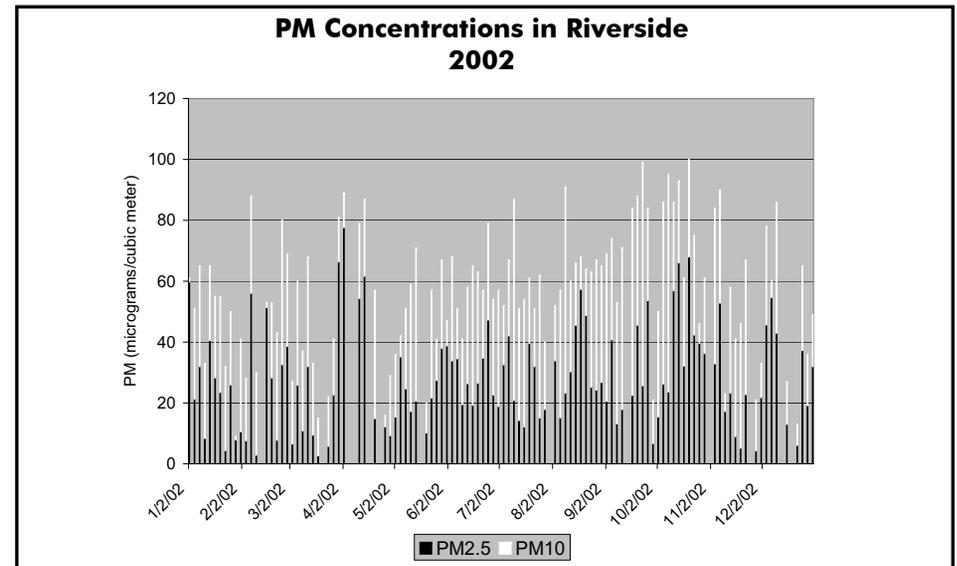


Figure 2-13

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 NO_x, 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 combus-

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 2-19

tion 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.

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 PM₁₀

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 PM₁₀/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 PM₁₀, formed from NO_x 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 PM₁₀ levels. On an annual average basis, elevated concentrations of PM₁₀ were associated with high levels of road and agricultural dust. Secondary ammonium nitrate, wood smoke, and vehicle exhaust particles also contributed significantly to annual PM₁₀ concentrations.

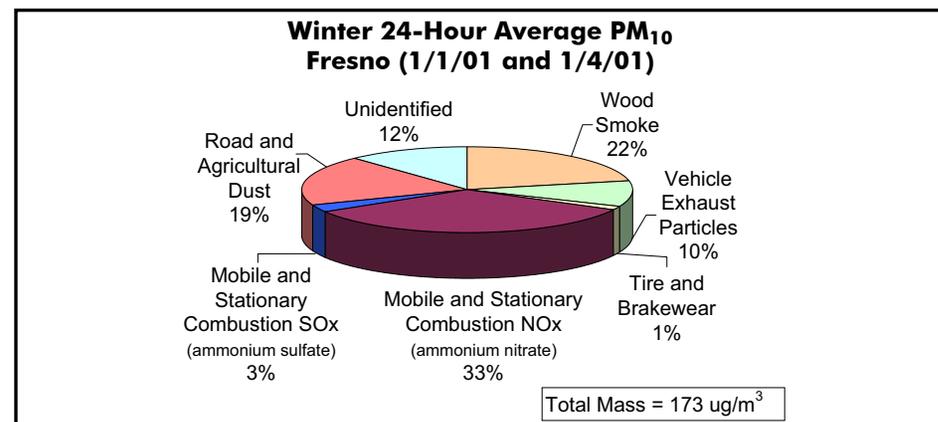


Figure 2-14

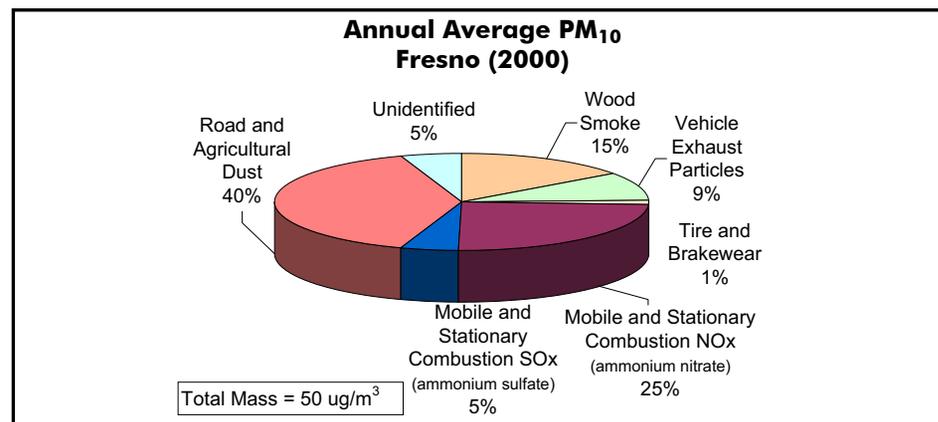


Figure 2-15

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 $\text{PM}_{2.5}$. Road dust is a significant contributor to PM_{10} , but not $\text{PM}_{2.5}$.

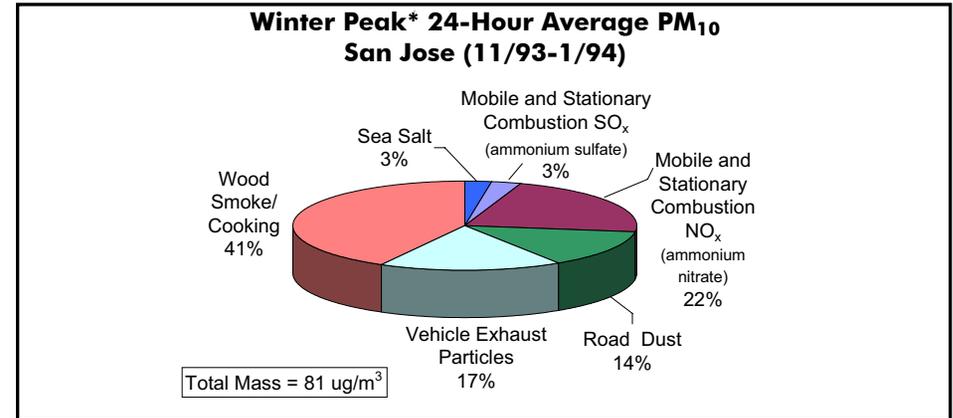


Figure 2-16

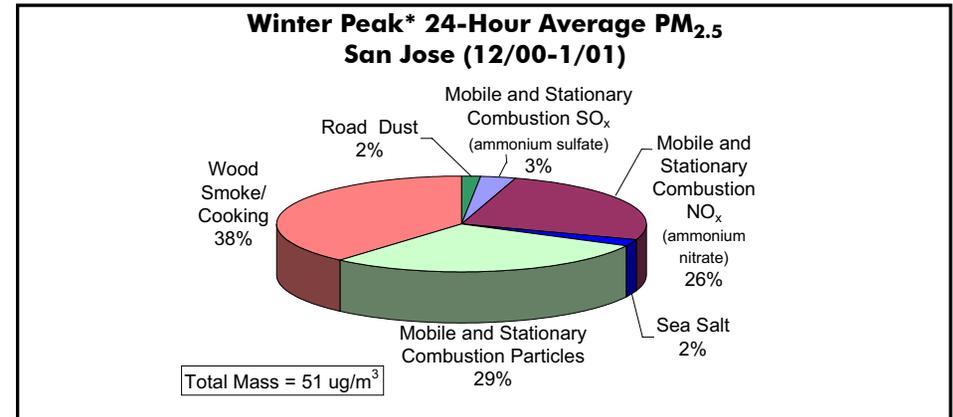
* Average of days with $\text{PM}_{10} > 50 \mu\text{g}/\text{m}^3$ 

Figure 2-17

* Average of days with $\text{PM}_{2.5} > 40 \mu\text{g}/\text{m}^3$

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.

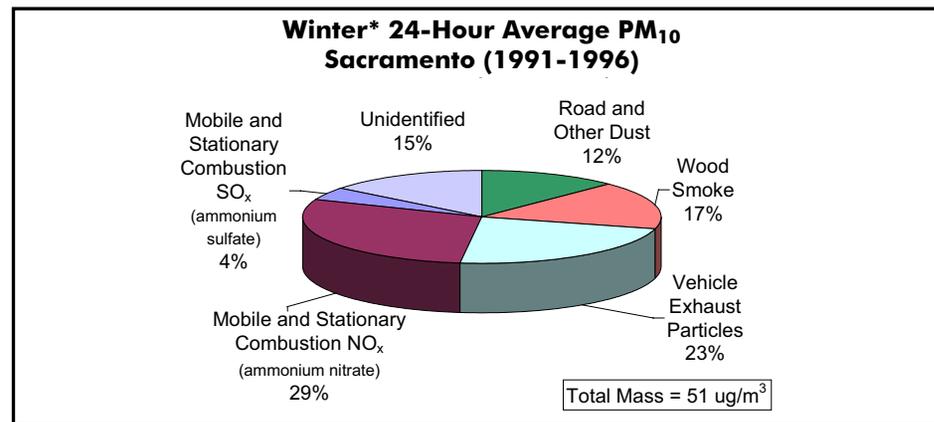


Figure 2-18

* Average of days with $PM_{10} > 40 \mu g/m^3$

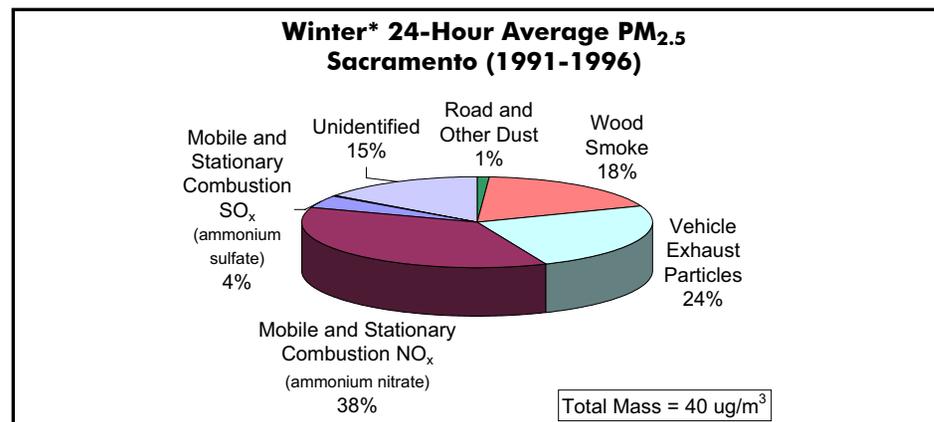


Figure 2-19

* Average of days with $PM_{10} > 40 \mu g/m^3$

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 PM₁₀ Technical Enhancement Program (SCAQMD, 1996).

On an annual basis, in Central Los Angeles, dust from roads and construction is the major contributor to ambient PM₁₀. 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 PM₁₀ levels.

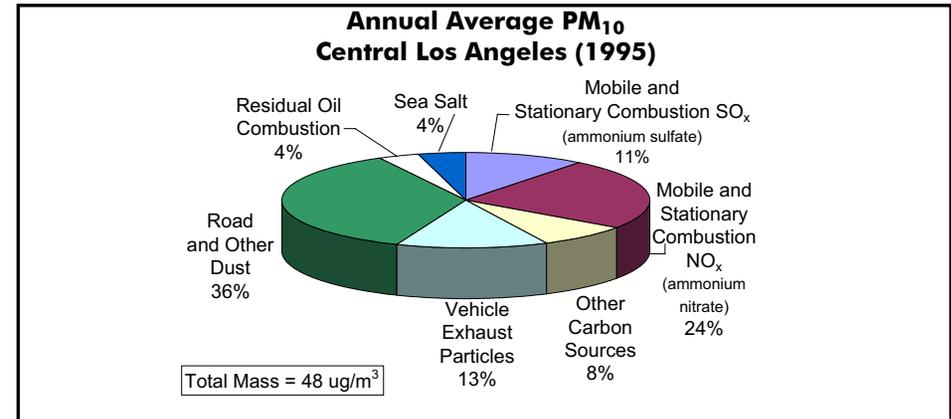


Figure 2-20

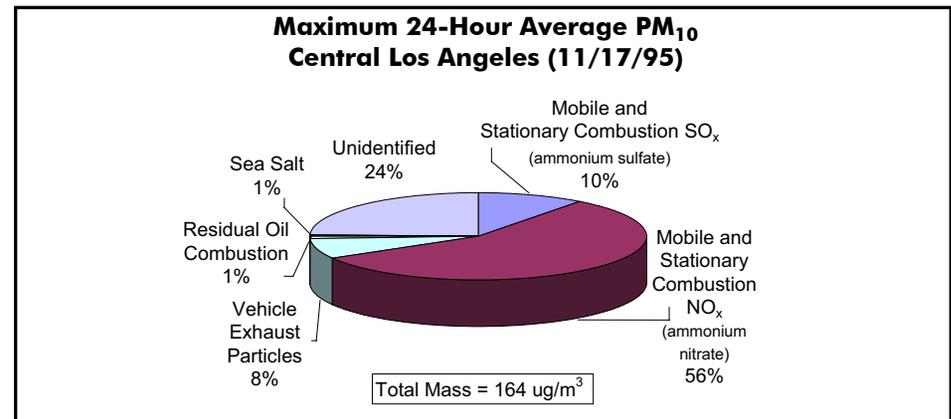


Figure 2-21

South Coast Air Basin (cont'd)

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.

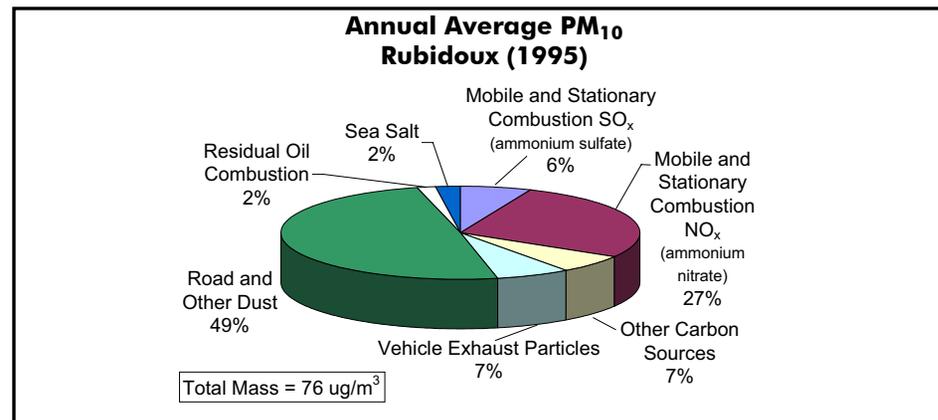


Figure 2-22

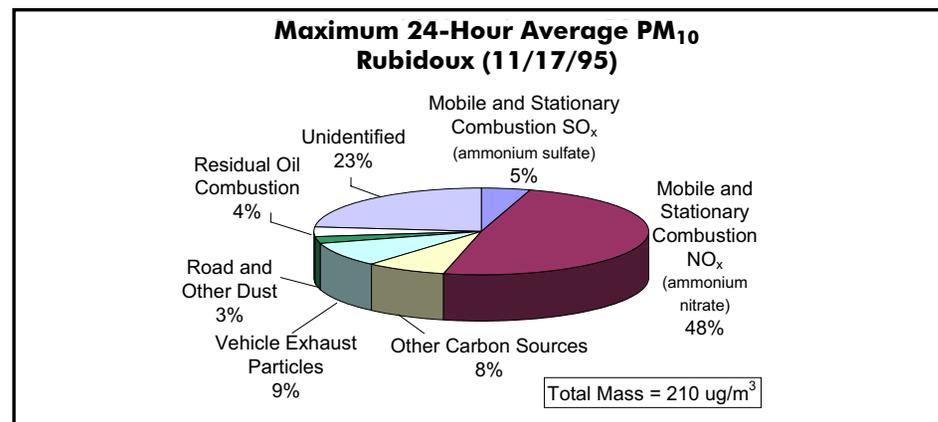


Figure 2-23

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 PM₁₀ 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 PM₁₀ Plan: San Joaquin Valley Plan to Attain Federal Standards for Particulate Matter 10 Microns and Smaller*. Appendix N.

Carbon Monoxide

2006 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 82 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. The emissions data remain the same as presented in the previous edition and will be updated in the 2009 Almanac.

CO Emissions (annual average)		
Emissions Source	tons/day	Percent
Stationary Sources	346	3%
Area-wide Sources	1974	16%
On-Road Mobile	7189	58%
Gasoline Vehicles	6883	55%
Diesel Vehicles	306	2%
Other Mobile	2946	24%
Gasoline Vehicles	2225	18%
Diesel Vehicles	358	3%
Other	363	3%
Total Statewide	12456	100%

Table 2-20

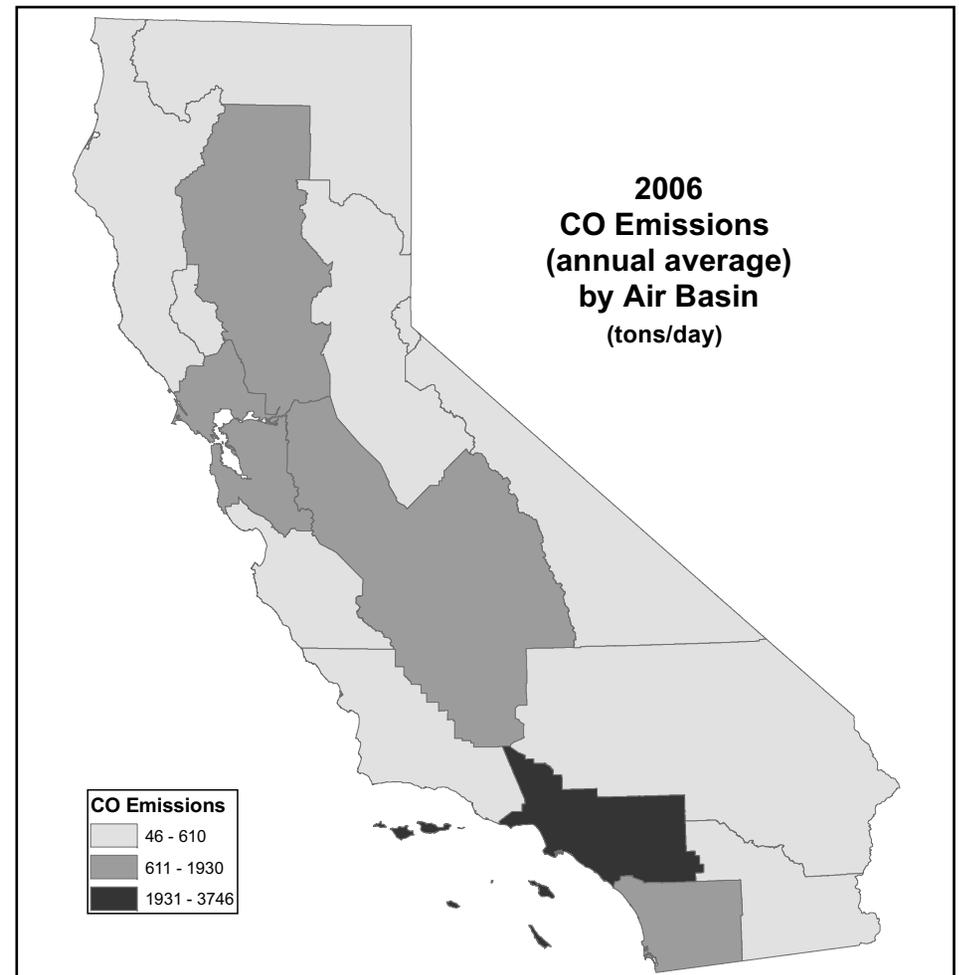


Figure 2-24

Carbon Monoxide - 2006 Air Quality

The State and national CO standards are now attained statewide in 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.

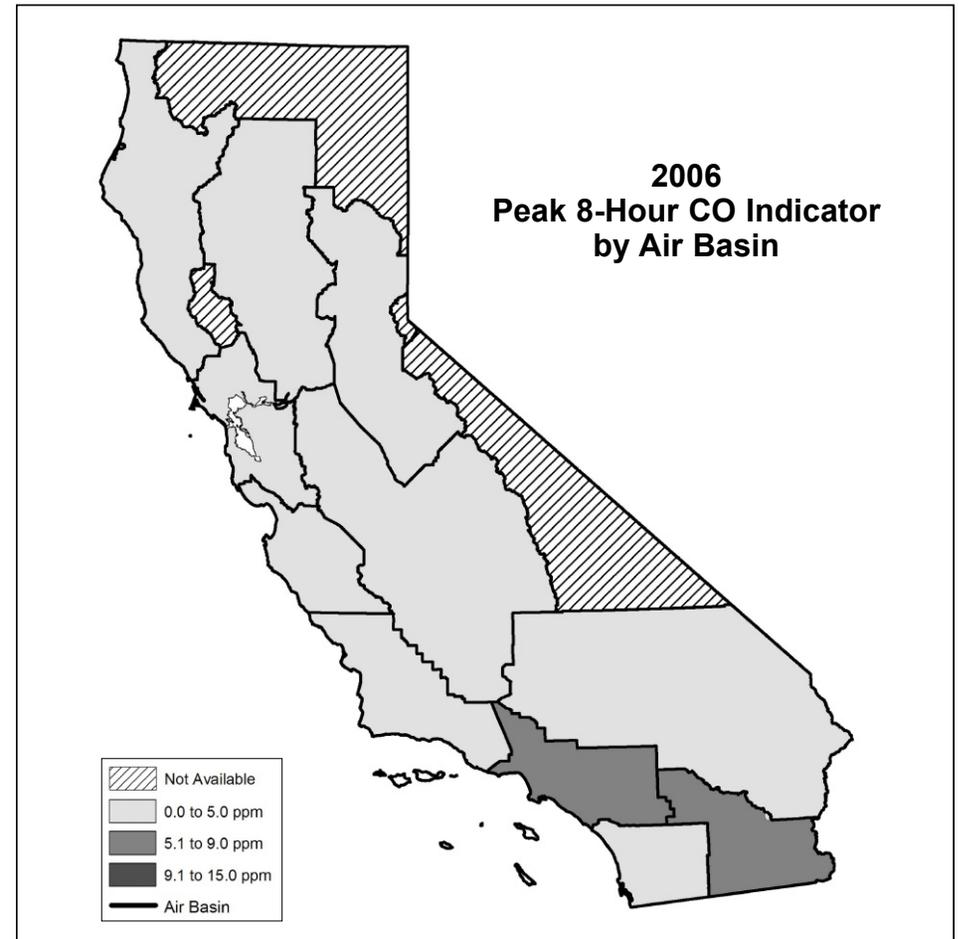


Figure 2-25

Carbon Monoxide - 2006 Air Quality Tables

Maximum Peak 8-Hour Indicator by Air Basin

AIR BASIN	2006 Maximum Peak 8-Hour Indicator in parts per million	Number of Days in 2006 above 8-Hour Standard	
		State	National
Great Basin Valleys	No Data	No Data	No Data
Lake County	No Data	No Data	No Data
Lake Tahoe	No Data	No Data	No Data
Mojave Desert	1.8	0	0
Mountain Counties	0.5	0	0
North Central Coast	1.1	0	0
North Coast	1.7	0	0
Northeast Plateau	No Data	No Data	No Data
Sacramento Valley	4.2	0	0
Salton Sea	8.0	1	1
San Diego	3.8	0	0
San Francisco Bay Area	3.5	0	0
San Joaquin Valley	3.4	0	0
South Central Coast	1.9	0	0
South Coast	6.4	0	0

Table 2-21

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

**No Sites had Peak 8-Hour Indicator
Values above the State CO Standard**

Ammonia

2006 Statewide Emission Inventory - Ammonia by Category

Area-wide sources account for 81 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, the manufacture of a variety of products, and waste disposal.

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. The emissions data remain the same as presented in the previous edition and will be updated in the 2009 Almanac.

NH ₃ Emissions (annual average)		
Emissions Source	tons/day	Percent
Stationary Sources	78	11%
Area-wide Sources	599	81%
On-Road Mobile	61	8%
Gasoline Vehicles	60	8%
Diesel Vehicles	1	<1%
Other Mobile*	0	0%
Gasoline Vehicles	0	0%
Diesel Vehicles	0	0%
Other	0	0%
Total Statewide	738	100%

* No data available

Table 2-22

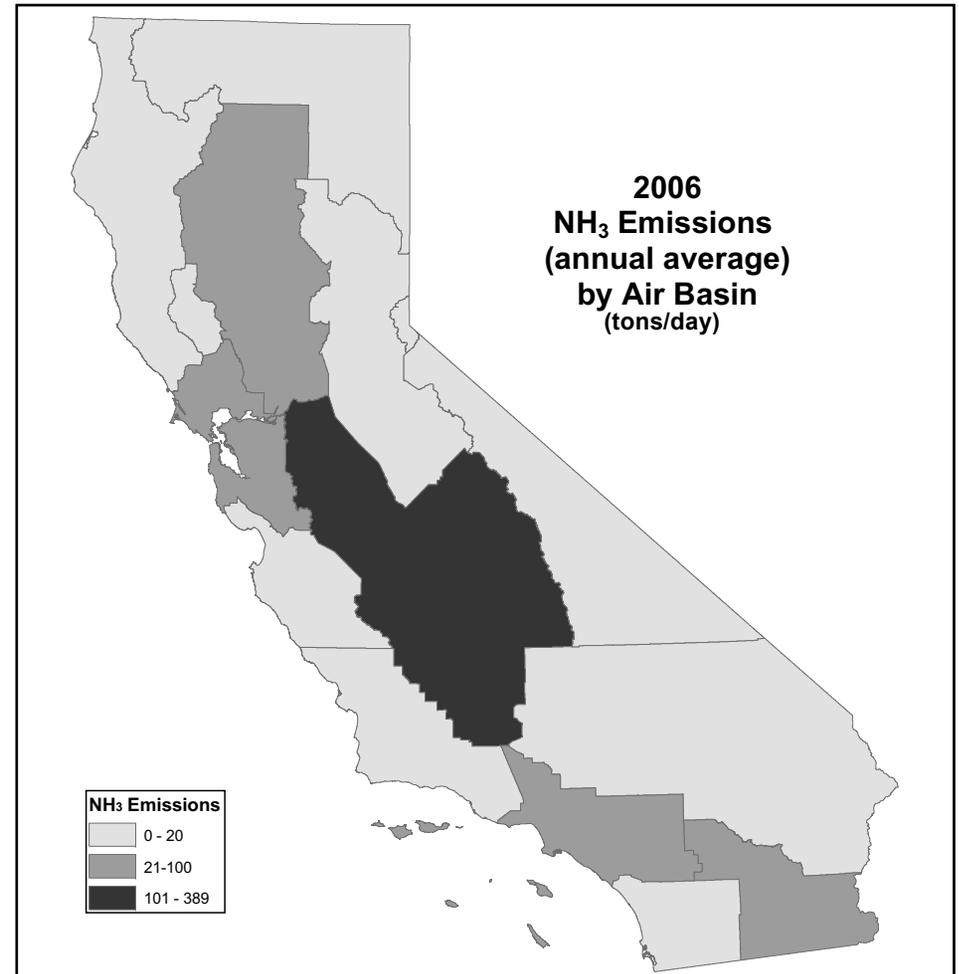


Figure 2-26

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