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 2008 snapshot that was developed by growing the 2006 inventory to 2008 and by updating the mobile source estimates using the EMFAC2007 and OFFROAD2007 models.

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 2-2.

Figure 2-1 shows the national 8-hour ozone design values for the top 15 urban areas in the nation, based on data for 2005 to 2007. The design values in all these areas exceed the national 8-hour standard of 0.075 ppm. Six 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 2-2 shows the top $PM_{2.5}$ areas in the nation and their design values for 2005 to 2007. 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, area-wide, 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), PM_{10}, $PM_{2.5}$, 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.

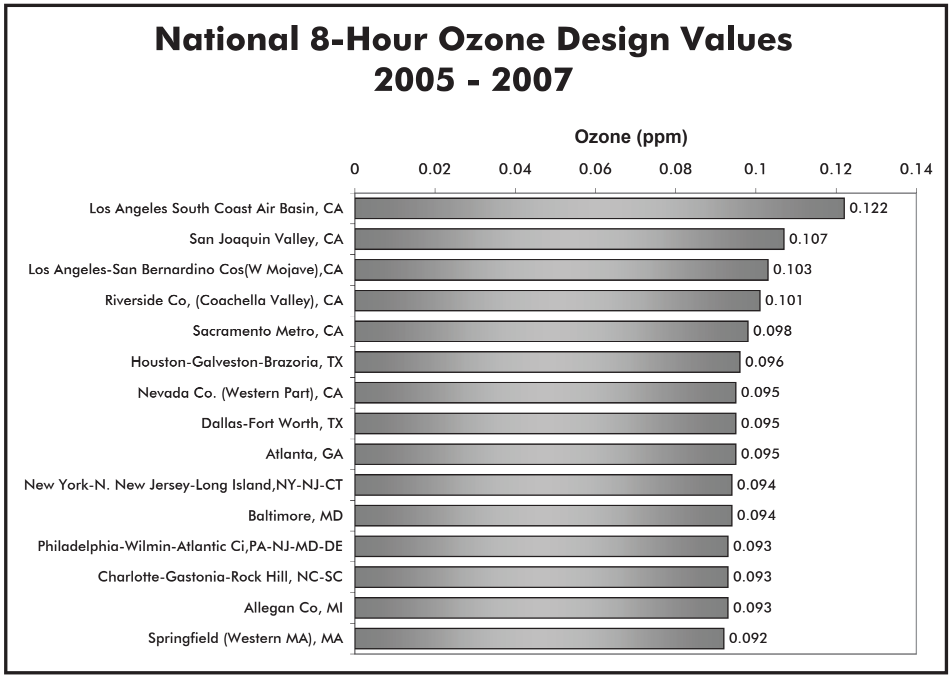

Figure 2-1

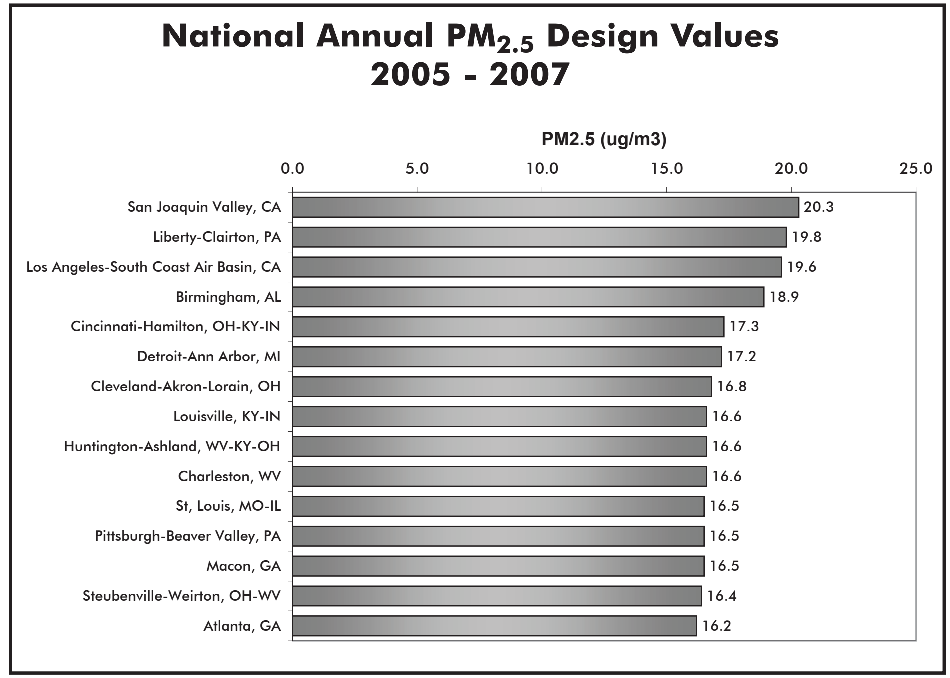

Figure 2-2

2008 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	**427**	**317**	**368**	**109**	**161**	**95**	**91**
Fuel Combustion	32	245	262	39	34	31	14
Waste Disposal	53	4	3	1	1	1	58
Cleaning And Surface Coatings	142	0	0	0	1	1	0
Petroleum Production And Marketing	135	12	8	40	4	3	2
Industrial Processes	65	56	94	30	121	58	17
Area-Wide Sources	**652**	**1968**	**95**	**6**	**1791**	**448**	**610**
Solvent Evaporation	408	0	0	0	0	0	34
Miscellaneous Processes	243	1968	95	6	1791	448	575
Mobile Sources	**1135**	**9042**	**2747**	**166**	**160**	**133**	**55**
Light Duty Passenger Vehicles	231	2207	189	2	16	9	25
Light and Medium Duty Trucks	231	2568	300	2	19	13	27
Heavy Duty Trucks	119	796	1020	1	40	34	2
Other Onroad	51	529	75	0	2	2	1
Aircraft and Trains	47	313	198	5	13	13	-
Ocean Going Vessels & Commercial Harbor Craft	14	40	315	154	23	22	-
Pleasure Crafts	137	740	40	0	9	7	-
Recreational Vehicles	69	192	2	1	1	1	-
Off-road Equipment	190	1546	503	0	30	27	-
Other Off-road	45	113	104	0	6	6	0
Total Statewide - All Sources**	***2213***	***11327***	***3209***	***281***	***2112***	***677***	***756***

* 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 PM_{10}.

Table 2-1

2008 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)	**427**	**317**	**368**	**109**	**161**	**95**	**91**
Fuel Combustion (major category total)	32	245	262	39	34	31	14
- Electric Utilities	3	36	26	4	6	6	10
- Cogeneration	4	35	22	2	4	3	1
- Oil And Gas Production (Combustion)	9	19	21	2	2	2	0
- Petroleum Refining (Combustion)	3	14	25	12	3	3	1
- Manufacturing And Industrial	3	52	65	14	5	5	1
- Food And Agricultural Processing	4	43	33	1	2	2	0
- Service And Commercial	5	38	53	3	6	6	0
- Other (Fuel Combustion)	2	8	17	1	5	4	0
Waste Disposal (major category total)	53	4	3	1	1	1	58
- Sewage Treatment	1	0	0	0	0	0	2
- Landfills	9	2	1	1	1	0	11
- Incinerators	2	3	2	0	0	0	0
- Soil Remediation	0	0	0	0	0	0	0
- Other (Waste Disposal)	41	0	0	0	0	0	45
Cleaning And Surface Coatings (major category total)	142	0	0	0	1	1	0
- Laundering	1	0	0	0	0	0	0
- Degreasing	34	0	0	0	0	0	0
- Coatings And Related Process Solvents (sub-category total)	65	0	0	0	1	1	0
- Auto Marine, & Aircraft	*23*	*0*	*0*	*0*	*0*	*0*	*0*
- Paper & Fabric	*3*	*0*	*0*	*0*	*0*	*0*	*0*
- Metal, Wood, & Plastic	*23*	*0*	*0*	*0*	*0*	*0*	*0*
- Other	*16*	*0*	*0*	*0*	*1*	*1*	*0*

* Includes directly emitted particulate matter only.

Table 2-2

2008 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)						
Stationary Sources (division total) *(continued)*							
Cleaning And Surface Coatings (major category) *(continued)*							
- Printing	16	0	0	0	0	0	0
- Adhesives And Sealants	20	0	0	0	0	0	0
- Other (Cleaning And Surface Coatings)	6	0	0	0	0	0	0
Petroleum Production And Marketing (major category total)	135	12	8	40	4	3	2
- Oil And Gas Production	42	2	3	0	0	0	0
- Petroleum Refining	12	10	5	39	4	3	2
- Petroleum Marketing (sub-category total)	80	0	0	0	0	0	0
- Fuel Distribution Losses	*6*	*0*	*0*	*0*	*0*	*0*	*0*
- Fuel Storage Losses	*2*	*0*	*0*	*0*	*0*	*0*	*0*
- Vehicle Refueling	*40*	*0*	*0*	*0*	*0*	*0*	*0*
- Other	*32*	*0*	*0*	*0*	*0*	*0*	*0*
- Other (Petroleum Production And Marketing)	0	0	0	0	0	0	0
Industrial Processes (major category total)	65	56	94	30	121	58	17
- Chemical	22	1	2	4	4	4	1
- Food And Agriculture	20	2	9	1	16	7	0
- Mineral Processes	5	42	65	21	67	24	1
- Metal Processes	0	1	1	0	1	1	0
- Wood And Paper	4	2	2	0	14	9	0
- Glass And Related Products	0	1	10	3	2	1	1
- Electronics	0	0	0	0	0	0	0
- Other (Industrial Processes)	14	6	5	1	17	12	15

* Includes directly emitted particulate matter only.

Table 2-2 (continued)

2008 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)	**652**	**1968**	**95**	**6**	**1791**	**448**	**610**
Solvent Evaporation (major category total)	408	0	0	0	0	0	34
- Consumer Products	240	0	0	0	0	0	0
- Architectural Coatings And Related Process Solvent (sub-category total)	86	0	0	0	0	0	0
- Architectural Coating	*73*	*0*	*0*	*0*	*0*	*0*	*0*
- Thinning & Cleanup Solvents	*13*	*0*	*0*	*0*	*0*	*0*	*0*
- Pesticides/Fertilizers (sub-category total)	51	0	0	0	0	0	34
- Farm Use	*49*	*0*	*0*	*0*	*0*	*0*	*0*
- Commercial Use	*2*	*0*	*0*	*0*	*0*	*0*	*0*
- Asphalt Paving / Roofing	32	0	0	0	0	0	0
- Other (Solvent Evaporation)	-	-	-	-	-	-	-
Miscellaneous Processes (major category total)	243	1968	95	6	1791	448	575
- Residential Fuel Combustion (sub-category total)	53	779	69	4	113	109	6
- Wood Combustion	*50*	*752*	*10*	*1*	*108*	*104*	*6*
- Cooking And Space Heating	*3*	*23*	*49*	*2*	*5*	*5*	*0*
- Other	*0*	*4*	*10*	*0*	*1*	*1*	*0*
- Farming Operations (sub-category total)	116	0	0	0	163	40	505
- Tilling,Harvesting, & Growing	*0*	*0*	*0*	*0*	*130*	*19*	*0*
- Livestock	*116*	*0*	*0*	*0*	*33*	*20*	*505*

* Includes directly emitted particulate matter only.

Table 2-2 (continued)

2008 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)	0	0	0	0	209	21	0
- Building	*0*	*0*	*0*	*0*	*120*	*12*	*0*
- Road Construction Dust	*0*	*0*	*0*	*0*	*90*	*9*	*0*
- Paved Road Dust	0	0	0	0	395	59	0
- Unpaved Road Dust	0	0	0	0	479	48	0
- Fugitive Windblown Dust (sub-category total)	0	0	0	0	287	45	0
- Farm Lands	*0*	*0*	*0*	*0*	*161*	*28*	*0*
- Pasture Lands	*0*	*0*	*0*	*0*	*13*	*2*	*0*
- Unpaved Roads	*0*	*0*	*0*	*0*	*113*	*15*	*0*
- Fires	1	10	0	0	1	1	0
- Managed Burning And Disposal (sub-category total)	67	1177	26	2	110	100	4
- Agricultural Burning	*22*	*233*	*13*	*1*	*29*	*27*	*3*
- Non-Agricultural Burning	*44*	*930*	*12*	*2*	*79*	*72*	*1*
- Other	*1*	*14*	*0*	*0*	*2*	*1*	*0*
- Cooking	7	0	0	0	32	24	0
- Other (Miscellaneous Processes)	0	1	0	0	1	1	61

* 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)

2008 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)	**1135**	**9042**	**2747**	**166**	**160**	**133**	**55**
On-Road Motor Vehicles (major category total)	632	6099	1585	5	77	58	55
- Light Duty Passenger (sub-category total)	231	2207	189	2	16	9	25
- Non-Evaporative	*122*	*2206*	*187*	*2*	*16*	*9*	*25*
- Evaporative	*109*	*0*	*0*	*0*	*0*	*0*	*0*
- Diesel	*0*	*1*	*2*	*0*	*0*	*0*	*0*
- Light Duty Trucks(<3750 lbs.) (sub-category total)	79	812	74	1	4	2	5
- Non-Evaporative	*43*	*809*	*66*	*0*	*4*	*2*	*5*
- Evaporative	*36*	*0*	*0*	*0*	*0*	*0*	*0*
- Diesel	*0*	*3*	*8*	*0*	*0*	*0*	*0*
- Light Duty Trucks (>3750 lbs) (sub-category total)	104	1160	146	1	11	7	12
- Non-Evaporative	*55*	*1160*	*146*	*1*	*11*	*7*	*12*
- Evaporative	*48*	*0*	*0*	*0*	*0*	*0*	*0*
- Diesel	*0*	*0*	*1*	*0*	*0*	*0*	*0*
- Medium Duty Trucks (sub-category total)	49	596	80	1	5	3	10
- Non-Evaporative	*31*	*595*	*79*	*1*	*5*	*3*	*10*
- Evaporative	*17*	*0*	*0*	*0*	*0*	*0*	*0*
- Diesel	*0*	*0*	*1*	*0*	*0*	*0*	*0*
- Light Heavy Duty Gas Trucks (<10000 lbs) (sub-category total)	24	197	33	0	1	0	2
- Non-Evaporative	*15*	*197*	*33*	*0*	*1*	*0*	*2*
- Evaporative	*9*	*0*	*0*	*0*	*0*	*0*	*0*
- Light Heavy Duty Gas Trucks (>10000 lbs) (sub-category total)	8	64	9	0	0	0	0
- Non-Evaporative	*5*	*64*	*9*	*0*	*0*	*0*	*0*
- Evaporative	*4*	*0*	*0*	*0*	*0*	*0*	*0*
- Medium Heavy Duty Gas Trucks (sub-category total)	16	147	16	0	0	0	0
- Non-Evaporative	*12*	*147*	*16*	*0*	*0*	*0*	*0*
- Evaporative	*4*	*0*	*0*	*0*	*0*	*0*	*0*

* Includes directly emitted particulate matter only.

Table 2-2 (continued)

2008 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)	9	127	18	0	0	0	0
- Non-Evaporative	*8*	*127*	*18*	*0*	*0*	*0*	*0*
- Evaporative	*1*	*0*	*0*	*0*	*0*	*0*	*0*
- Light Heavy Duty Gas Trucks (<10000 lbs)	1	5	28	0	0	0	0
- Light Heavy Duty Gas Trucks (>10000 lbs)	1	4	22	0	0	0	0
- Medium Heavy Duty Diesel Trucks	3	28	137	0	4	3	0
- Heavy Heavy Duty Diesel Trucks	57	224	757	1	34	30	0
- Motorcycles (Mcy) (sub-category total)	44	413	11	0	0	0	0
- Non-Evaporative	*35*	*413*	*11*	*0*	*0*	*0*	*0*
- Evaporative	*9*	*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	13	14	0	1	0	0
- Non-Evaporative	*1*	*10*	*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	21	10	0	0	0	0
- Non-Evaporative	*1*	*19*	*3*	*0*	*0*	*0*	*0*
- Evaporative	*0*	*0*	*0*	*0*	*0*	*0*	*0*
- Diesel	*0*	*1*	*6*	*0*	*0*	*0*	*0*
- Motor Homes (sub-category total)	2	66	10	0	0	0	0
- Non-Evaporative	*2*	*65*	*6*	*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)

2008 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)	502	2943	1162	160	82	75	0
- Aircraft	35	278	57	4	9	9	0
- Trains	12	35	141	1	4	4	0
- Ocean Going Vessels (sub-category total)	10	20	250	154	20	20	0
- Residual Oil	*8*	*16*	*204*	*146*	*19*	*18*	*0*
- Diesel	*1*	*3*	*46*	*9*	*1*	*1*	*0*
- Commercial Harbor Craft	5	20	65	0	3	3	*0*
- Pleasure Craft (sub-category total)	137	740	40	0	9	7	*0*
- Non-Evaporative	*95*	*739*	*37*	*0*	*9*	*7*	*0*
- Evaporative	*42*	*0*	*0*	*0*	*0*	*0*	*0*
- Diesel	*1*	*1*	*2*	*0*	*0*	*0*	*0*
- Off-Road Recreational Vehicles (sub-category total)	69	192	2	1	1	1	0
- All-Terrain Vehicles	*17*	*49*	*1*	*0*	*0*	*0*	*0*
- Motorcycles	*41*	*67*	*0*	*0*	*0*	*0*	*0*
- Snowmobiles	*8*	*22*	*0*	*0*	*0*	*0*	*0*
- Golf Carts, Specialty Carts & Minibikes	*3*	*53*	*1*	*0*	*0*	*0*	*0*
- Off-Road Equipment (sub-category total)	190	1546	503	0	30	27	0
- Lawn And Garden Equipment	*90*	*564*	*13*	*0*	*2*	*1*	*0*
- Non-Evaporative	*47*	*561*	*7*	*0*	*1*	*1*	*0*
- Evaporative	*42*	*0*	*0*	*0*	*0*	*0*	*0*
- Diesel	*1*	*3*	*6*	*0*	*0*	*0*	*0*
- Commercial & Industrial Equipment	*99*	*969*	*489*	*0*	*28*	*26*	*0*
- Non-Evaporative	*22*	*624*	*25*	*0*	*2*	*2*	*0*
- Evaporative	*11*	*0*	*0*	*0*	*0*	*0*	*0*
- Diesel	*65*	*253*	*448*	*0*	*26*	*24*	*0*
- Natural Gas	*0*	*91*	*17*	*0*	*0*	*0*	*0*
- Farm Equipment (sub-category total)	21	113	104	0	6	6	0
- Non-Evaporative	*2*	*63*	*2*	*0*	*0*	*0*	*0*
- Evaporative	*3*	*0*	*0*	*0*	*0*	*0*	*0*
- Diesel	*16*	*50*	*102*	*0*	*6*	*6*	*0*
- Fuel Storage and Handling	24	0	0	0	0	0	0
Total Statewide - All Sources**	***2213***	***11327***	***3209***	***281***	***2112***	***677***	***756***

* 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 PM_{10}.

Table 2-2 (continued)

Ozone

2008 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 85 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.

ROG Sources - Statewide

ROG are VOCs 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, farming operations, and other evaporative emissions.

NO_X Emissions (annual average)		
Emissions Source	**tons/day**	**Percent**
Stationary Sources	368	11%
Area-wide Sources	95	3%
On-Road Mobile	1585	49%
Gasoline Vehicles	627	20%
Diesel Vehicles	957	30%
Other Mobile	1162	36%
Gasoline Vehicles	278	9%
Diesel Vehicles	810	25%
Other	74	2%
Total Statewide	***3209***	***100%***

Table 2-3

ROG Emissions (annual average)		
Emissions Source	**tons/day**	**Percent**
Stationary Sources	427	19%
Area-wide Sources	652	29%
On-Road Mobile	632	29%
Gasoline Vehicles	570	26%
Diesel Vehicles	62	3%
Other Mobile	502	23%
Gasoline Vehicles	367	17%
Diesel Vehicles	100	5%
Other	36	2%
Total Statewide	***2213***	***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 Quarry	Apple Valley	4955
Mojave Desert	TXI Riverside Cement Company	Oro Grande	4446
Mojave Desert	California Portland Cement	Mojave	3126
Mojave Desert	Mitsubishi Cement	Lucerne Valley	2789
San Francisco Bay Area	Valero Refining Company - California	Benicia	2253
Mojave Desert	Searles Valley Minerals	Trona	1982
San Francisco Bay Area	Tesoro Refining And Marketing	Martinez	1635
San Francisco Bay Area	Hanson Permanente Cement	Cupertino	1364
San Francisco Bay Area	Shell Martinez Refinery	Martinez	1279
Mojave Desert	PG&E Topock Compressor Station	Needles	1261

Table 2-5

Largest Stationary Sources of ROG Statewide

Air Basin	Facility Name	City	Tons/Year
San Francisco Bay Area	Chevron Products Company	Richmond	1152
San Francisco Bay Area	Shell Martinez Refinery	Martinez	991
San Francisco Bay Area	Tesoro Refining And Marketing	Martinez	969
San Francisco Bay Area	New United Motor Manufacturing	Fremont	661
South Coast	ExxonMobil Oil Corporation	Torrance	626
South Coast	Chevron Products	El Segundo	588
South Coast	BP West Coast Products Carson Refinery	Carson	526
San Joaquin Valley	Equilon Enterprises	Bakersfield	395
San Joaquin Valley	E&J Gallo Winery	Fresno	381
San Diego	National Steel & Shipbuilding General Dynamics	San Diego	298

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

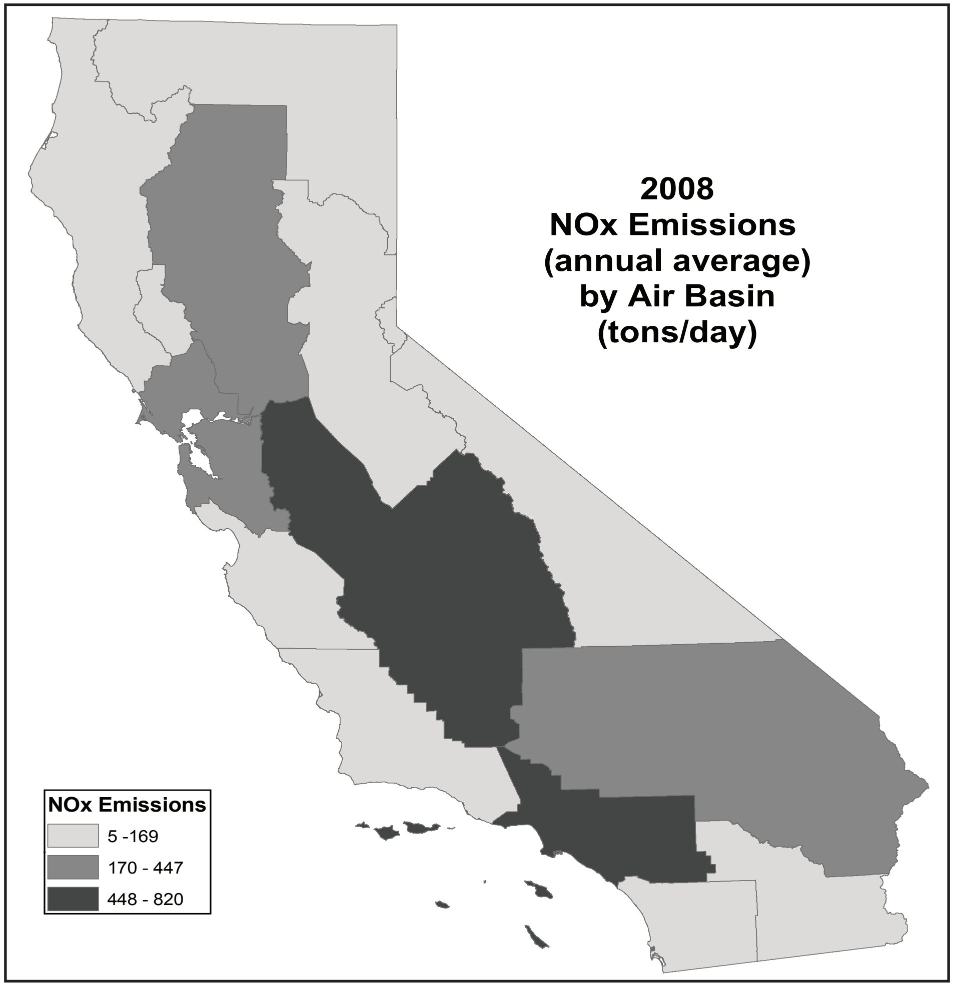

Figure 2-3

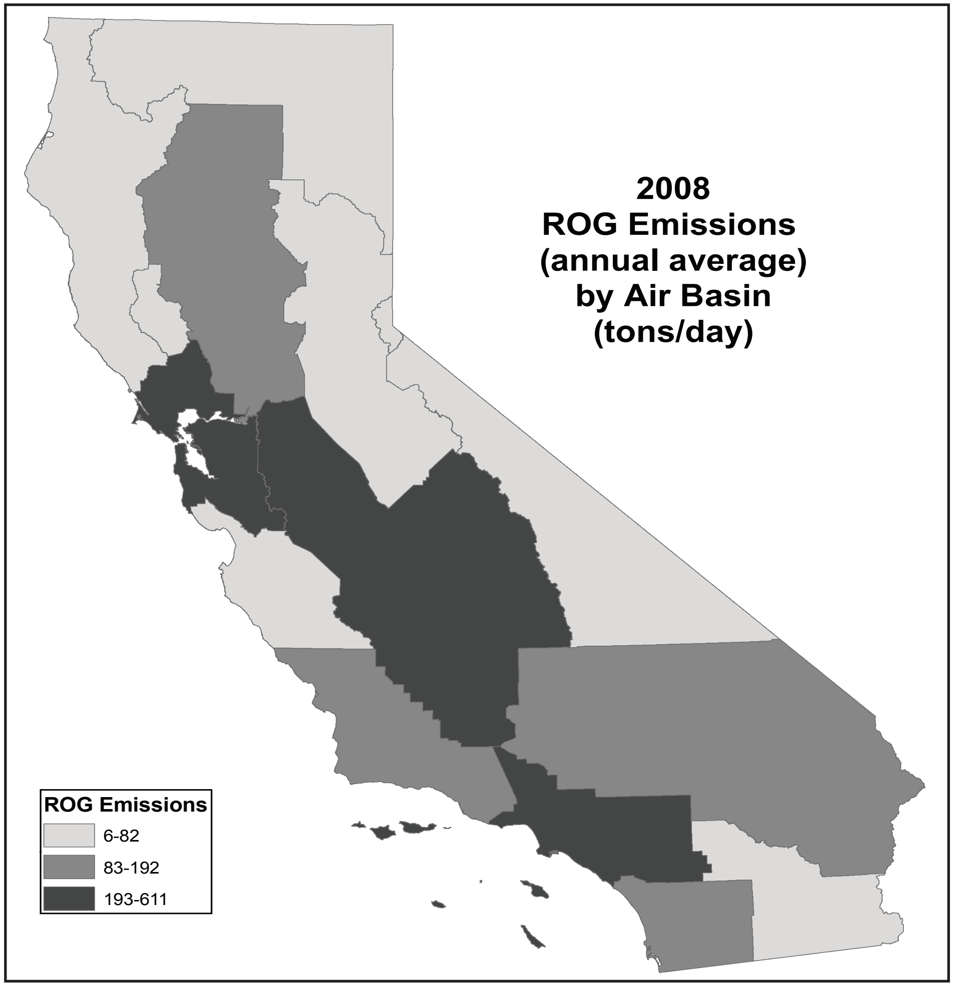

Figure 2-4

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Ozone - 2007 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 11 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. 2007 air quality data for California's five largest air basins can be found in Chapter 4, along with preliminary 2008 ozone data.

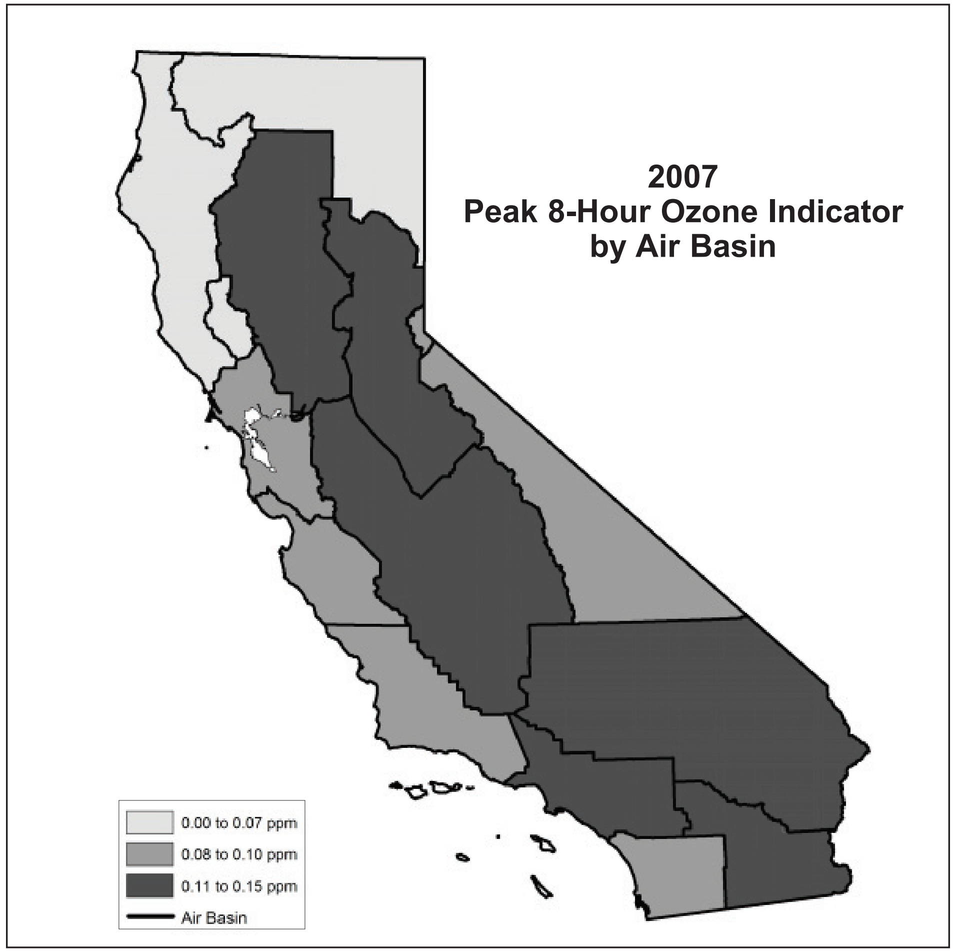

Figure 2-5

Ozone - 2007 Air Quality Tables

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

AIR BASIN	2007 Maximum Peak Indicator in parts per million		Number of Days in 2007 above the Standard		
			State		National
	1-Hour	8-Hour	1-Hour	8-Hour	8-Hour
Great Basin Valleys Air Basin	0.097	0.095	3	35	18
Lake County Air Basin	0.074	0.067	0	0	0
Lake Tahoe Air Basin	0.080	0.076	0	5	0
Mojave Desert Air Basin	0.135	0.120	50	124	98
Mountain Counties Air Basin	0.126	0.114	19	88	57
North Central Coast Air Basin	0.097	0.086	1	17	3
North Coast Air Basin	0.076	0.067	0	0	0
Northeast Plateau Air Basin	0.077	0.073	0	0	0
Sacramento Valley Air Basin	0.132	0.118	15	61	34
Salton Sea Air Basin	0.130	0.117	39	99	68
San Diego Air Basin	0.116	0.101	21	50	27
San Francisco Bay Area Air Basin	0.122	0.095	4	9	2
San Joaquin Valley Air Basin	0.142	0.124	69	138	110
South Central Coast Air Basin	0.113	0.101	9	76	35
South Coast Air Basin	0.159	0.140	96	127	108

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 Air Basin	0.122	108	63%
San Joaquin Valley	0.107	110	43%
Sacramento Metro Area	0.098	38	31%
Ventura	0.088	21	17%
San Diego	0.089	27	19%
San Francisco Bay Area	0.077	2	3%
Western Nevada	0.095	37	27%
Central Mountain Counties	0.090	6	20%
Southern Mountain Counties	0.085	35	13%
Eastern Kern	0.085	6	13%
Coachella Valley	0.101	63	35%
Antelope Valley and Western Mojave Desert	0.103	96	37%
Imperial	0.087	27	16%
Butte County	0.084	12	12%
Sutter Buttes	0.081	7	8%

* Based on areas designated nonattainment for the 0.08 ppm standard in 2004. EPA will be revising designations in 2010, based on the new 0.075 ppm standard.

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

Northeast Plateau Air Basin
- Yreka-Foothill Drive

Table 2-9

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
- El Centro-9th Street
- Westmorland-W 1st Street
- Calexico-Ethel Street

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

San Francisco Bay Area Air Basin
- Livermore-793 Rincon Avenue
- San Martin-Murphy Avenue
- Bethel Island Road
- Concord-2975 Treat Blvd
- Gilroy-9th Street

San Joaquin Valley Air Basin
- Arvin-Bear Mountain Blvd
- Sequoia and Kings Canyon Nat'l Park
- Edison
- Fresno-1st Street
- Bakersfield-5558 California Avenue
- Oildale-3311 Manor Street

South Central Coast Air Basin
- Simi Valley-Cochran Street
- Carrizo Plains School-9640 Carrizo
- Ojai-Ojai Avenue
- Piru-3301 Pacific Avenue
- Red Hills

South Coast Air Basin
- Crestline
- San Bernardino-4th Street
- Fontana-Arrow Highway
- Redlands-Dearborn
- Santa Clarita

Sites with 8-hour peak indicator values above the level of the State ozone standard during 2007. 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 five sites are listed, there were multiple sites with the same maximum concentration.

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, 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 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 statistics for PM_{10} 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 PM_{10} standard uses standard conditions for data reporting.

Directly Emitted Particulate Matter (PM_{10})
2008 Statewide Emission Inventory - Directly Emitted PM_{10} by Category

Area-wide sources account for about 85 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.

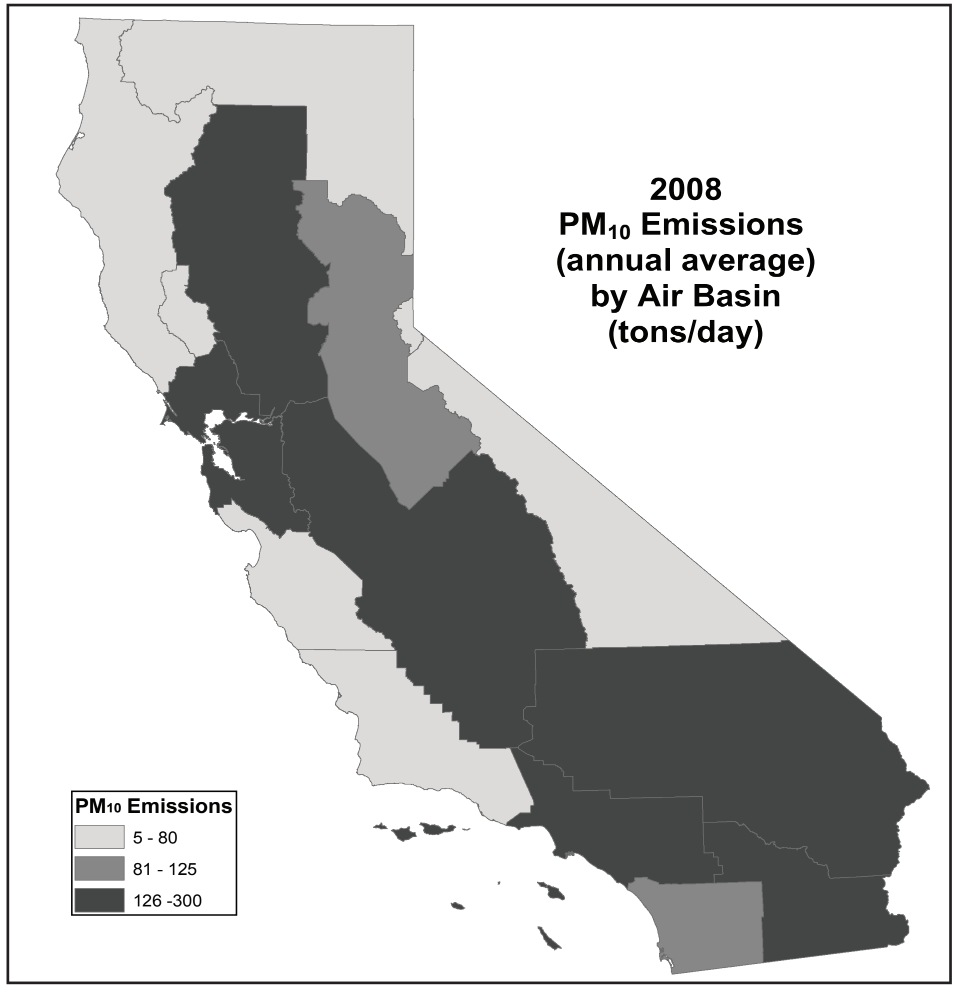

Figure 2-6

PM_{10} Emissions (annual average)		
Emissions Source	**tons/day**	**Percent**
Stationary Sources	161	8%
Area-wide Sources	1791	85%
On-Road Mobile	77	4%
Gasoline Vehicles	37	2%
Diesel Vehicles	40	2%
Other Mobile	82	4%
Gasoline Vehicles	33	2%
Diesel Vehicles	41	2%
Other	9	0%
Total Statewide	***2112***	***100%***

Table 2-10

Largest Stationary Sources Statewide

Largest Stationary Sources of Directly Emitted PM_{10} Statewide

Air Basin	Facility Name	City	Tons/Year
Mojave Desert	Service Rock Products	Palmdale	3054
Mojave Desert	U.S. Borax	Boron	1156
Mojave Desert	Mitsubishi Cement	Lucerne Valley	754
Mojave Desert	TXI Riverside Cement Company	Oro Grande	728
Mojave Desert	Cemex Quarry	Apple Valley	721
Mountain Counties	SierraPine Ltd Ampine Division	Martell	518
Mojave Desert	National Cement	Lebec	462
Mojave Desert	Granite Construction - Littlerock Facility	Palmdale	432
Mojave Desert	Searles Valley Minerals	Trona	356
San Francisco Bay Area	Shell Martinez Refinery	Martinez	355

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 ($PM_{2.5}$)

2008 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 *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.

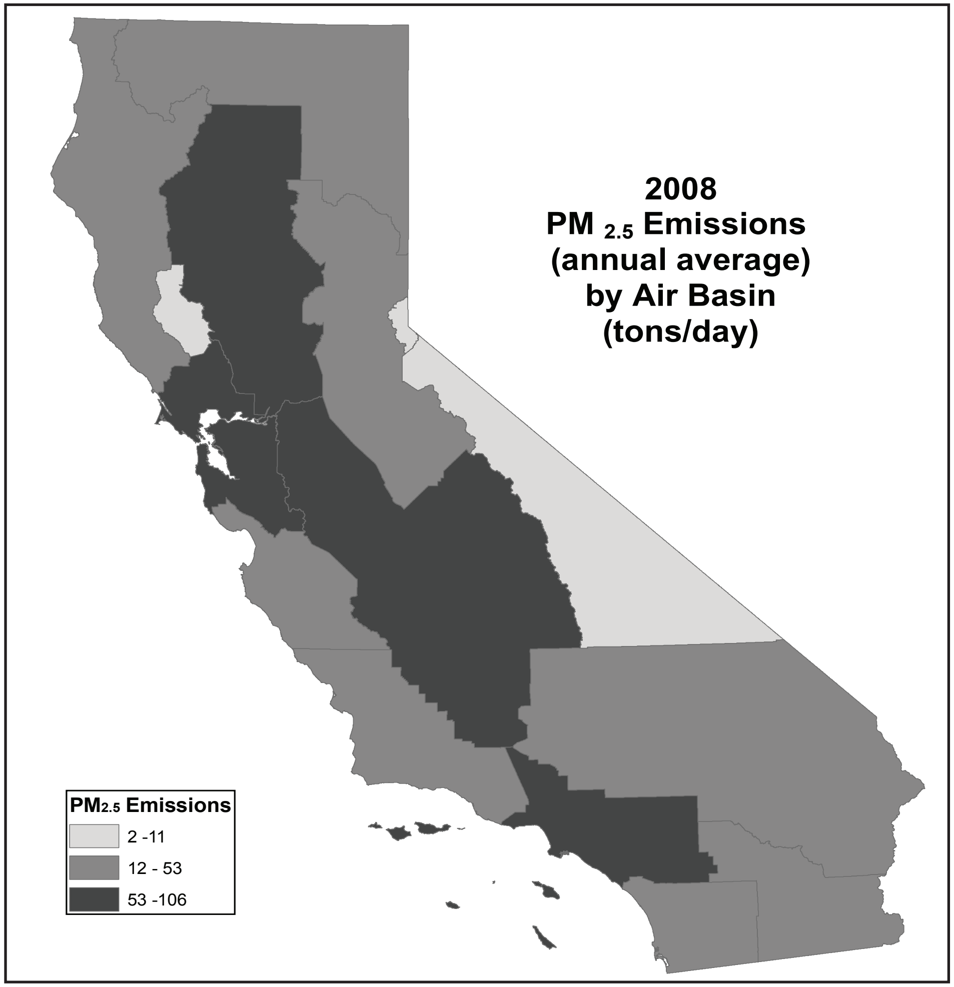

Figure 2-7

$PM_{2.5}$ Emissions (annual average)		
Emissions Source	**tons/day**	**Percent**
Stationary Sources	95	14%
Area-wide Sources	448	66%
On-Road Mobile	58	9%
Gasoline Vehicles	23	3%
Diesel Vehicles	35	5%
Other Mobile	75	11%
Gasoline Vehicles	29	4%
Diesel Vehicles	38	6%
Other	9	1%
Total Statewide	***677***	***100%***

Table 2-12

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	Lucerne Valley	596
Mojave Desert	Service Rock Products	Palmdale	477
Mountain Counties	SierraPine Ltd Ampine Division	Martell	414
Mojave Desert	TXI Riverside Cement Company	Oro Grande	362
San Francisco Bay Area	Shell Martinez Refinery	Martinez	343
Mojave Desert	Cemex Quarry	Apple Valley	338
South Coast	ExxonMobil Oil Corporation	Torrance	329
Mojave Desert	National Cement	Lebec	298
South Coast	BP West Coast Products Carson Refinery	Carson	282
South Coast	Tesoro Refining And Marketing	Wilmington	257

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

PM_{10} - 2007 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 2007 occurred in the Salton Sea, South Coast, San Diego, Mojave Desert, South Central Coast, Great Basin Valleys, and Northeast Plateau air basins. The 2007 data are summarized in Table 2-14. The highest 24-hour concentrations generally occurred in the desert areas where wind-blown dust contributes to local PM_{10} problems. However, the 2007 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 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.

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.)

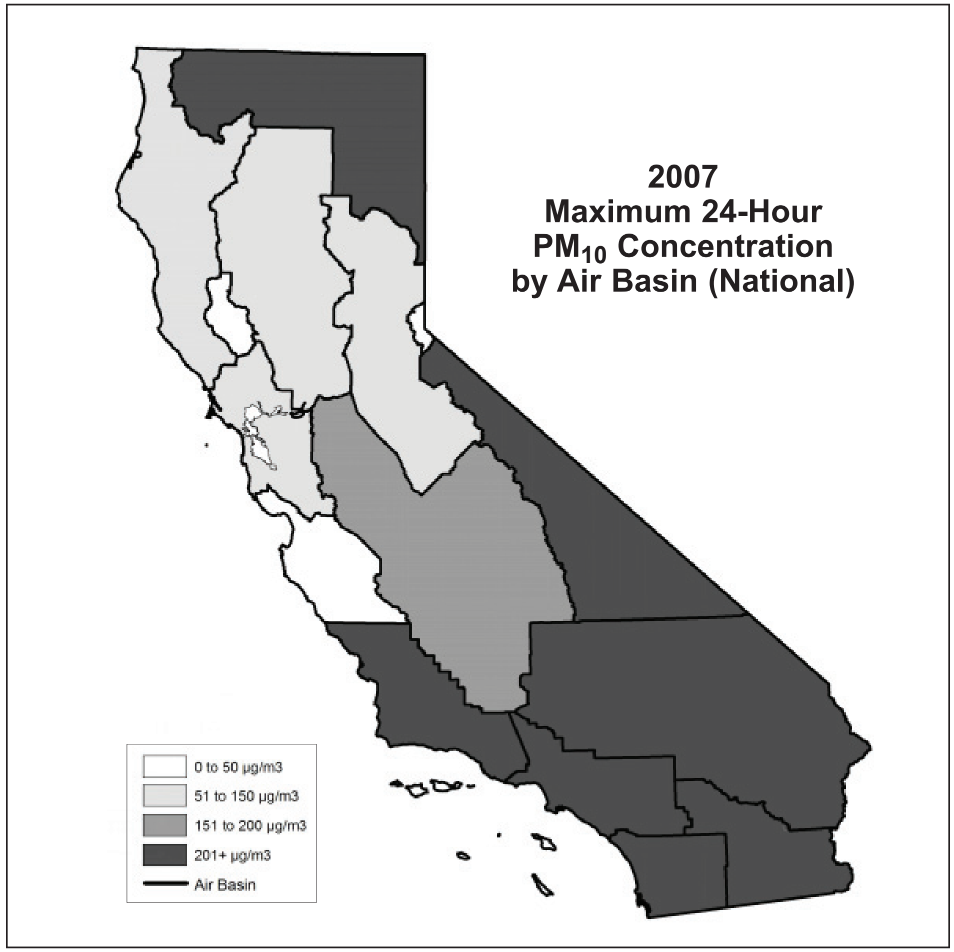

Figure 2-8

PM_{10} - 2007 Air Quality Tables

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

AIR BASIN	2007 Maximum 24-Hour Concentration in micrograms/cubic meter		2007 Maximum Annual Average of Quarters in micrograms/cubic meter
	State	National	State
Great Basin Valleys Air Basin	8338.0	10020.0	14.6
Lake County Air Basin	19.0	*	8.9
Lake Tahoe Air Basin	55.6	*	*
Mojave Desert Air Basin	339.0	358.0	36.0
Mountain Counties Air Basin	116.0	127.0	16.3
North Central Coast Air Basin	51.0	49.0	25.4
North Coast Air Basin	53.8	51.2	20.6
Northeast Plateau Air Basin	189.0	205.0	4.6
Sacramento Valley Air Basin	119.0	119.0	28.1
Salton Sea Air Basin	296.0	291.0	65.5
San Diego Air Basin	392.0	394.0	58.5
San Francisco Bay Area Air Basin	77.8	72.9	25.6
San Joaquin Valley Air Basin	135.0	172.1	48.5
South Central Coast Air Basin	399.7	320.3	33.9
South Coast Air Basin	1155.0	1212.0	72.2

* 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

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

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

Lake Tahoe Air Basin
- South Lake Tahoe-Sandy Way

Mojave Desert Air Basin
- Victorville-14306 Park Avenue
- Lucerne Valley-Middle School
- Barstow
- Lancaster-43301 Division Street
- Hesperia-Olive Street

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

North Central Coast Air Basin
- Davenport

North Coast Air Basin
- Eureka-I Street
- Weaverville-Courthouse

Northeast Plateau Air Basin
- Yreka-Foothill Drive

Table 2-15

Sacramento Valley Air Basin
- Woodland-Gibson Road
- Paradise-Fire Station #1
- Sacramento-3801 Airport Road
- Sacramento-Del Paso Manor
- Chico-Manzanita Avenue

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

San Diego Air Basin
- Otay Mesa-Paseo International
- San Diego-1110 Beardsley Street
- Escondido-E Valley Parkway
- San Diego-Overland Avenue
- El Cajon-Redwood Avenue

San Francisco Bay Area Air Basin
- San Jose-Tully Road
- Livermore-793 Rincon Avenue
- San Francisco-Arkansas Street
- San Jose-Jackson Street
- Fremont-Chapel Way

San Joaquin Valley Air Basin
- Bakersfield-Golden State Highway
- Corcoran-Patterson Avenue
- Bakersfield-5558 California Avenue
- Clovis-N Villa Avenue
- Hanford-NWS/NOAA
- Oildale-3311 Manor Street

South Central Coast Air Basin
- Santa Barbara-700 East Canon Perdido
- Las Flores Canyon #1
- El Rio-Rio Mesa School #2
- El Capitan Beach
- Nipomo-Hillview Road

South Coast Air Basin
- Perris
- Riverside-Rubidoux
- Anaheim-Pampas Lane
- Norco-Norconian
- Ontario-1408 Francis Street

Sites with 24-hour PM_{10} concentrations above the level of the State PM_{10} standard during 2007. 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 five sites are listed, there were multiple sites with the same maximum concentration.

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$PM_{2.5}$ - 2007 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 2007 data from California's $PM_{2.5}$ network are summarized in Table 2-17. Sites in the San Diego 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 2007 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.)

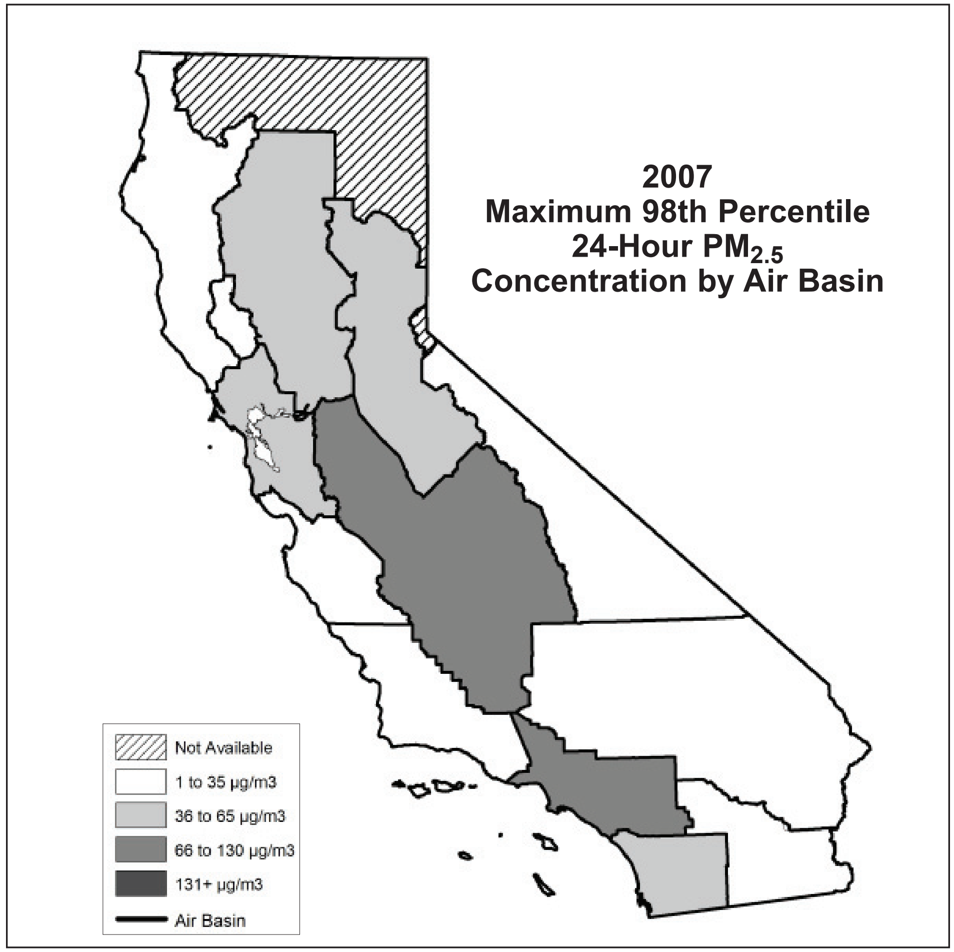

Figure 2-9

$PM_{2.5}$ - 2007 Air Quality Tables

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

AIR BASIN	2007 Maximum 24-Hr Concentration in micrograms/cubic meter		98th Percentile 24-Hr Conc. ($\mu g/m^3$)*	2007 Average of Quarterly Means in micrograms/cubic meter*	
	State	National		State	National
Great Basin Valleys	57.0	57.0	35.0	5.8	5.8
Lake County	9.5	9.5	9.1	3.3	3.3
Lake Tahoe	Incomplete Data	Incomplete Data	Incomplete Data	Incomplete Data	Incomplete Data
Mojave Desert	28.0	28.0	20.0	9.7	9.7
Mountain Counties	134.0	72.0	41.0	14.2	13.0
North Central Coast	20.9	20.9	19.4	7.0	7.0
North Coast	33.8	33.8	27.2	7.6	7.6
Northeast Plateau	Incomplete Data	Incomplete Data	Incomplete Data	Incomplete Data	Incomplete Data
Sacramento Valley	83.7	61.0	53.0	14.4	12.3
Salton Sea	95.0	52.7	29.5	23.2	8.6
San Diego	151.0	126.2	37.7	13.3	13.3
San Francisco Bay Area	57.5	57.5	39.2	13.3	10.7
San Joaquin Valley	154.0	104.0	73.0	25.2	22.0
South Central Coast	108.0	48.8	31.8	13.4	11.6
South Coast	82.8	82.8	70.7	19.8	20.9

* 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 2-16

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, 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). This is also true in the San Francisco Bay Area and Sacramento regions. 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

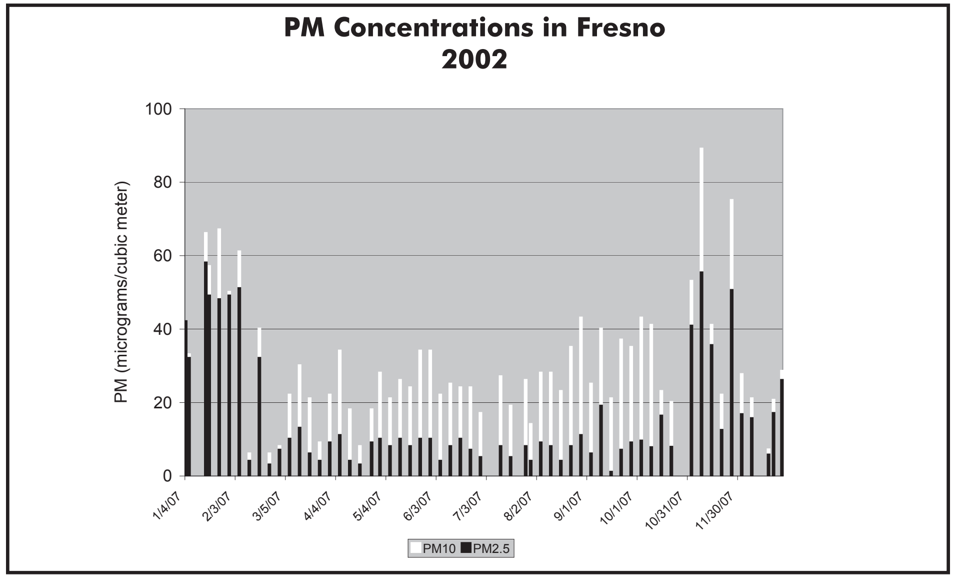

Figure 2-10

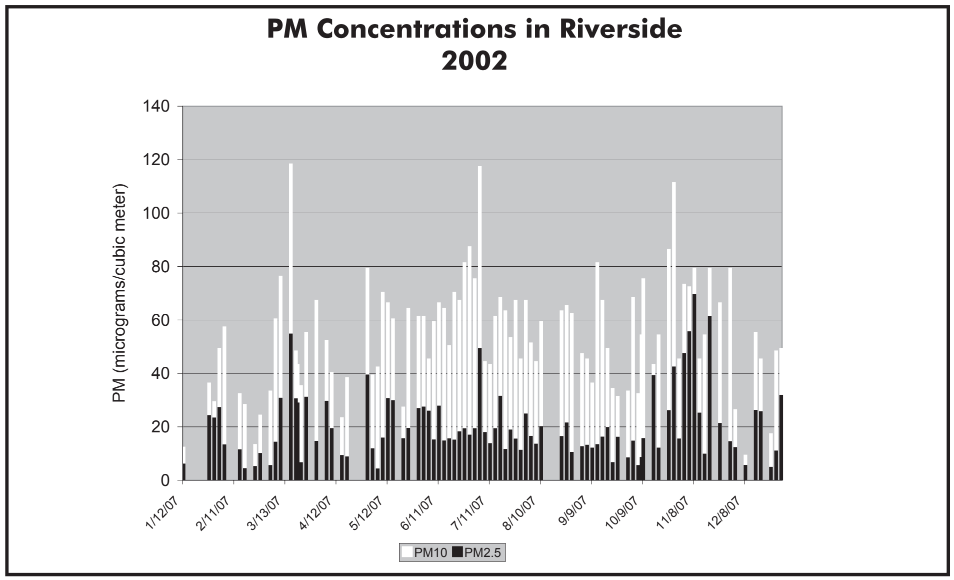

Figure 2-11

Regional PM_{10}/$PM_{2.5}$ Air Quality Study, Children's Health Study, 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 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) (2004-2006)	
Air Basin	Secondary $PM_{2.5}$ (%)
Great Basin Valleys	30
Lake County	20
Lake Tahoe	20
Mojave Desert	30
Mountain Counties	10
North Central Coast	30
North Coast	20
Northeast Plateau	20
Sacramento Valley	30
Salton Sea	30
San Diego	50
San Francisco Bay Area	40
San Joaquin Valley	50
South Central Coast	50
South Coast	60

Table 2-17

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 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 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.

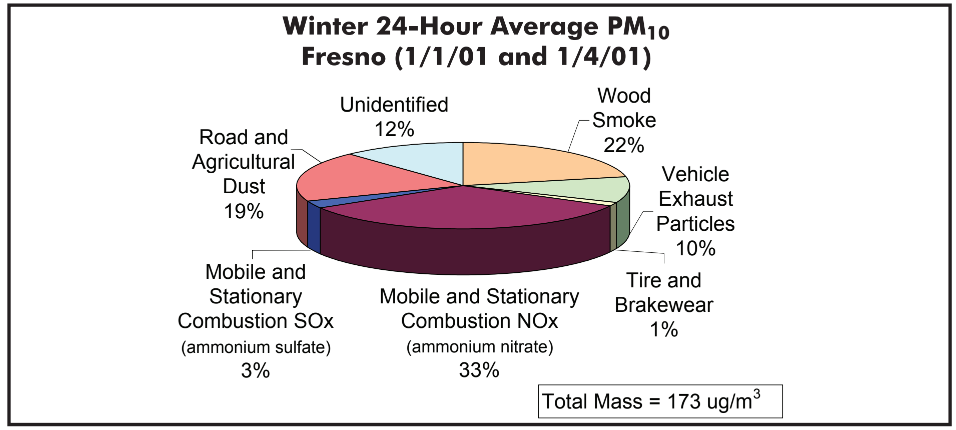

Figure 2-12

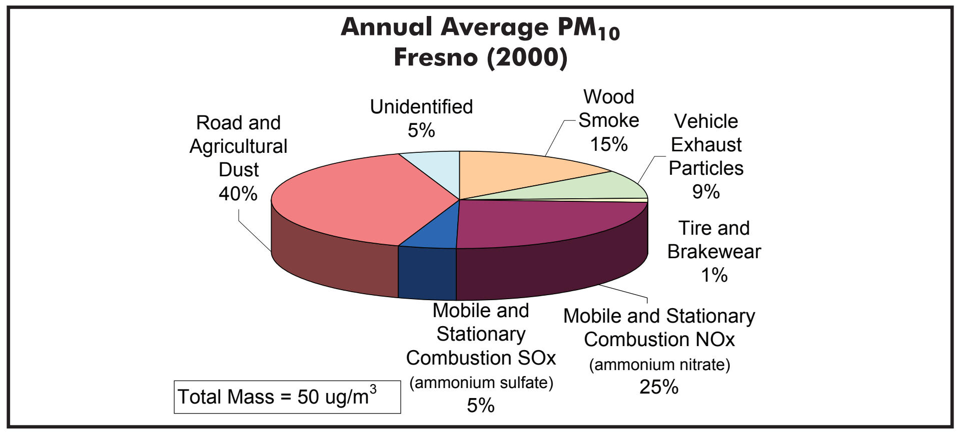

Figure 2-13

San Francisco Bay Area Air Basin

Figures 2-14 and 2-15 illustrate source contributions to ambient PM_{10} and $PM_{2.5}$ 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 $PM_{2.5}$.

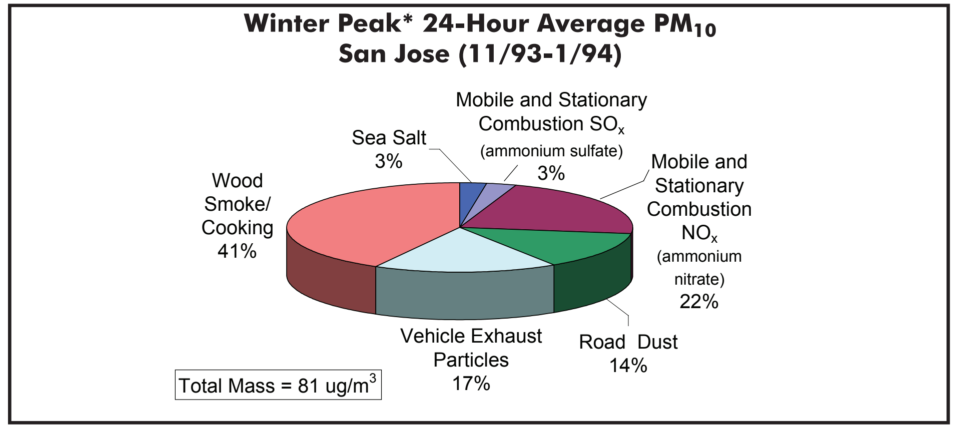

Figure 2-14

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

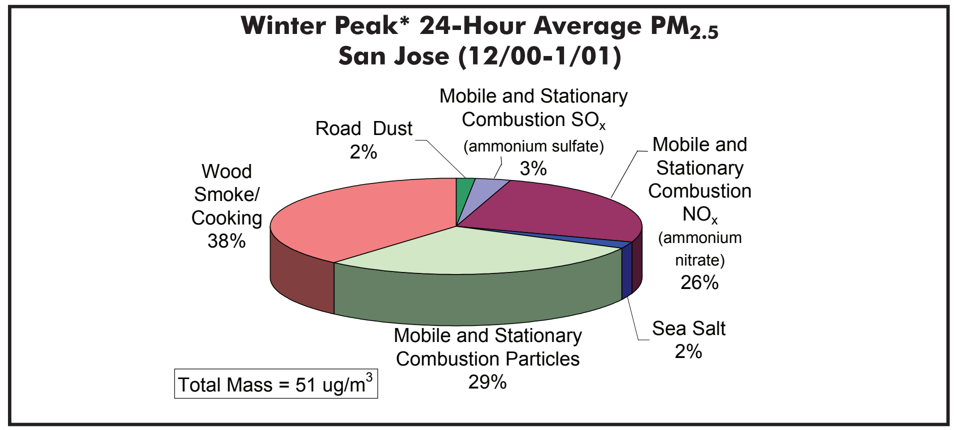

Figure 2-15

* 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 and wood smoke from residential wood combustion also contribute significantly to the ambient PM concentrations in the winter. While road and other dust is a significant component of ambient PM_{10}, its contribution to $PM_{2.5}$ is minor.

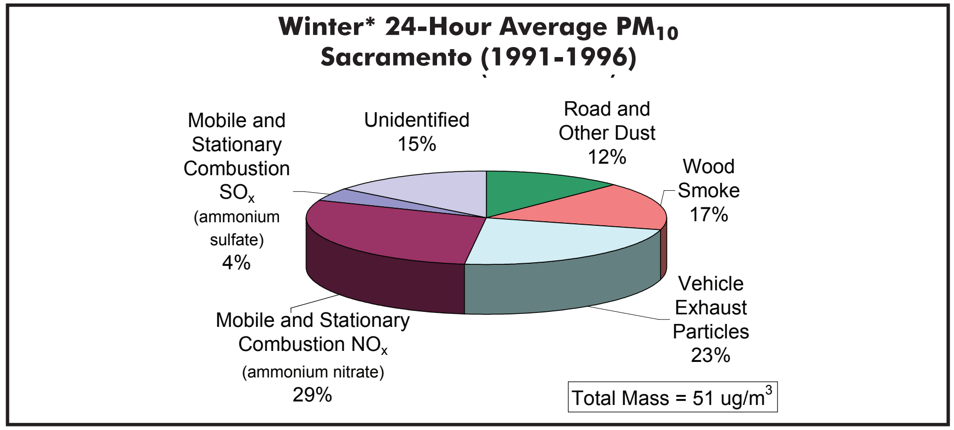

Figure 2-16

* Average of days with PM_{10} > 40 ug/m3

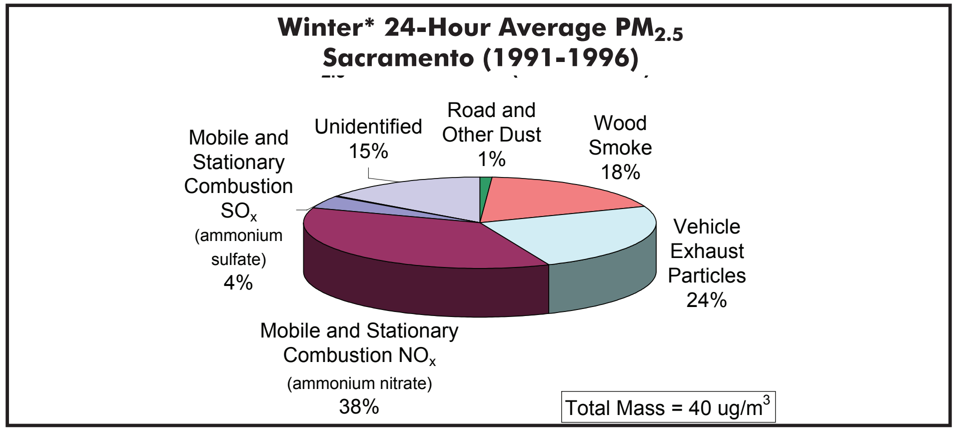

Figure 2-17

* Average of days with PM_{10} > 40 ug/m3

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}. 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.

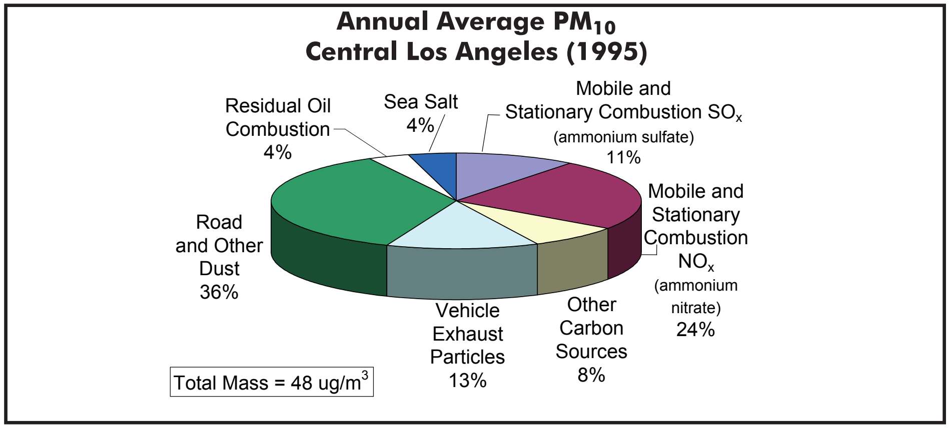

Figure 2-18

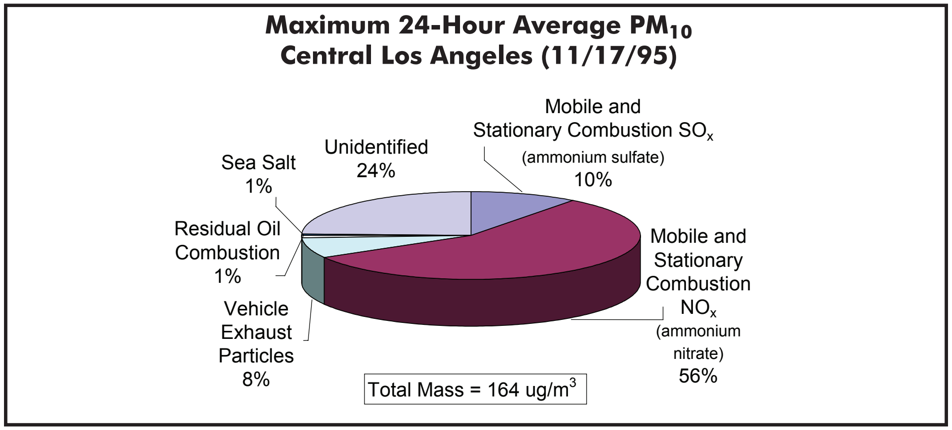

Figure 2-19

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}. Ammonium nitrate is a significant contributor to PM_{10} in the South Coast. Ammonia in the presence of NO_x from mobile and stationary combustion sources binds to form ammonium nitrate. Vehicle exhaust particles and emissions from other carbon sources also contribute to both annual and episodic ambient PM_{10} levels.

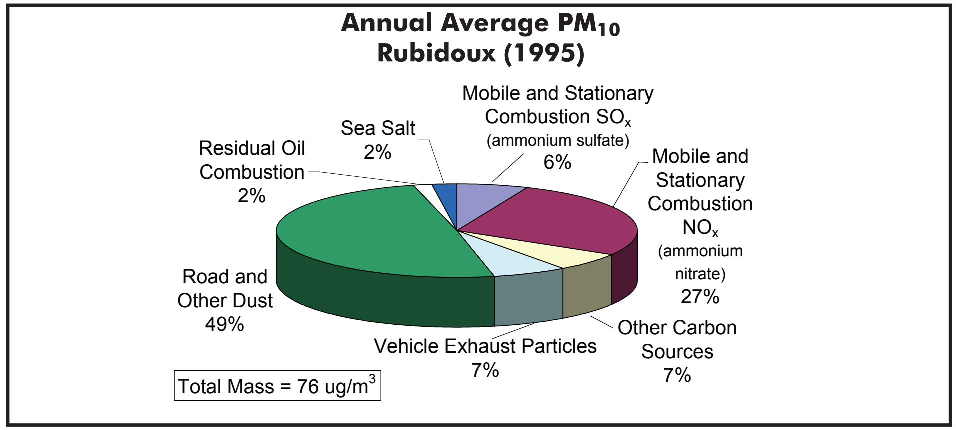

Figure 2-20

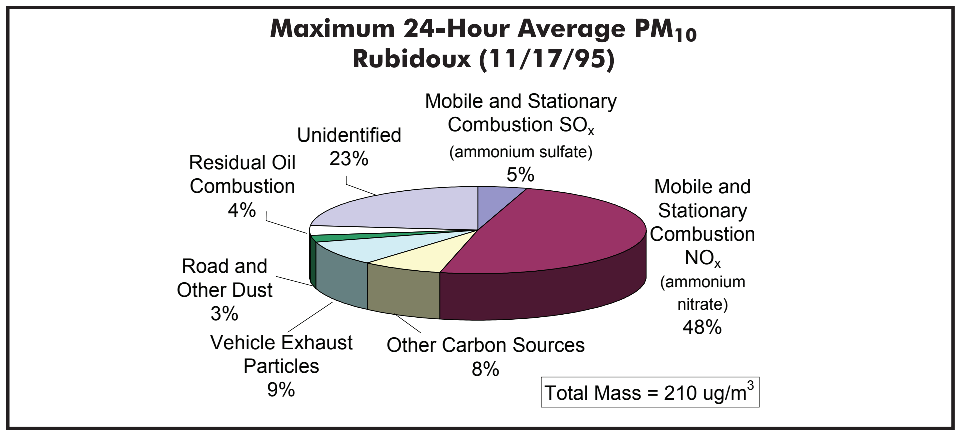

Figure 2-21

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

2008 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 80 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.

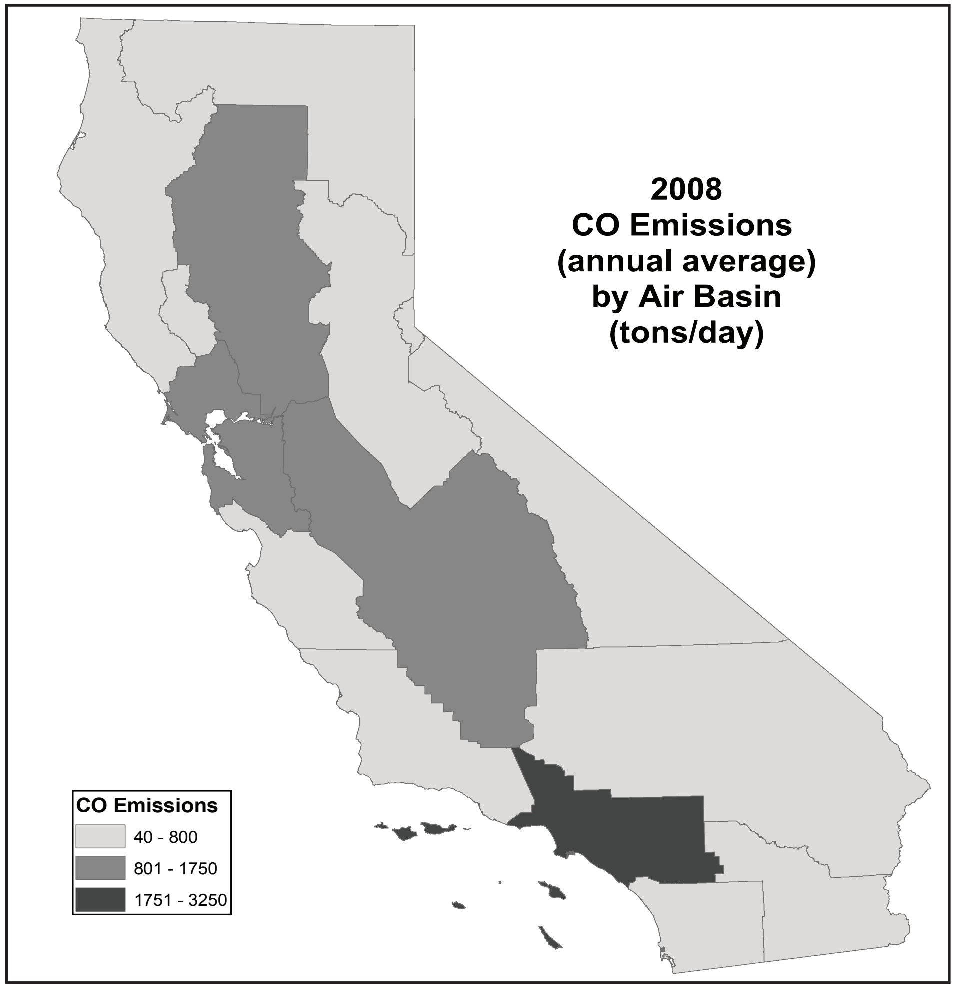

Figure 2-22

CO Emissions (annual average)		
Emissions Source	**tons/day**	**Percent**
Stationary Sources	317	3%
Area-wide Sources	1968	17%
On-Road Mobile	6099	54%
Gasoline Vehicles	5831	51%
Diesel Vehicles	267	2%
Other Mobile	2943	26%
Gasoline Vehicles	2208	19%
Diesel Vehicles	366	3%
Other	369	3%
Total Statewide	***11327***	***100%***

Table 2-18

Carbon Monoxide - 2007 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.

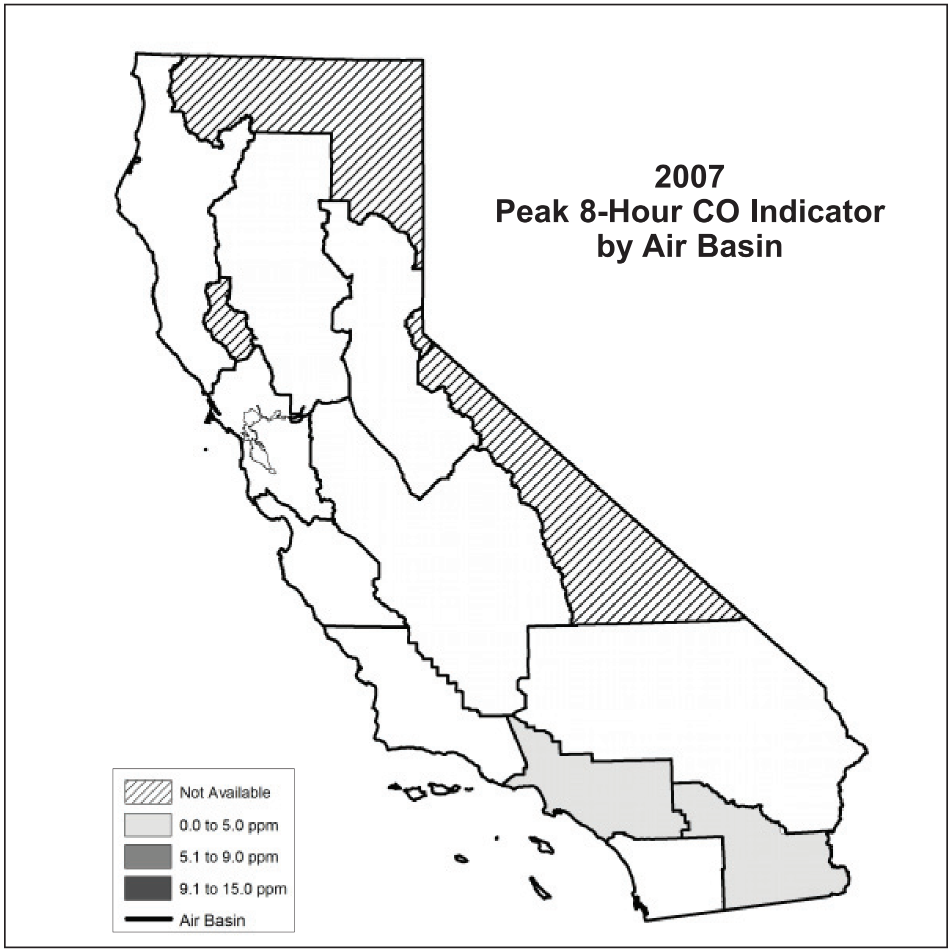

Figure 2-23

Carbon Monoxide - 2007 Air Quality Tables

Maximum Peak 8-Hour Indicator by Air Basin

AIR BASIN	2007 Maximum Peak 8-Hour Indicator in parts per million	Number of Days in 2007 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	1.6	0	0
Mountain Counties	0.5	0	0
North Central Coast	1.0	0	0
North Coast	1.6	0	0
Northeast Plateau	No Data	No Data	No Data
Sacramento Valley	4.2	0	0
Salton Sea	7.3	0	0
San Diego	4.3	0	0
San Francisco Bay Area	3.4	0	0
San Joaquin Valley	3.4	0	0
South Central Coast	1.7	0	0
South Coast	6.0	0	0

Table 2-19

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

2008 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.

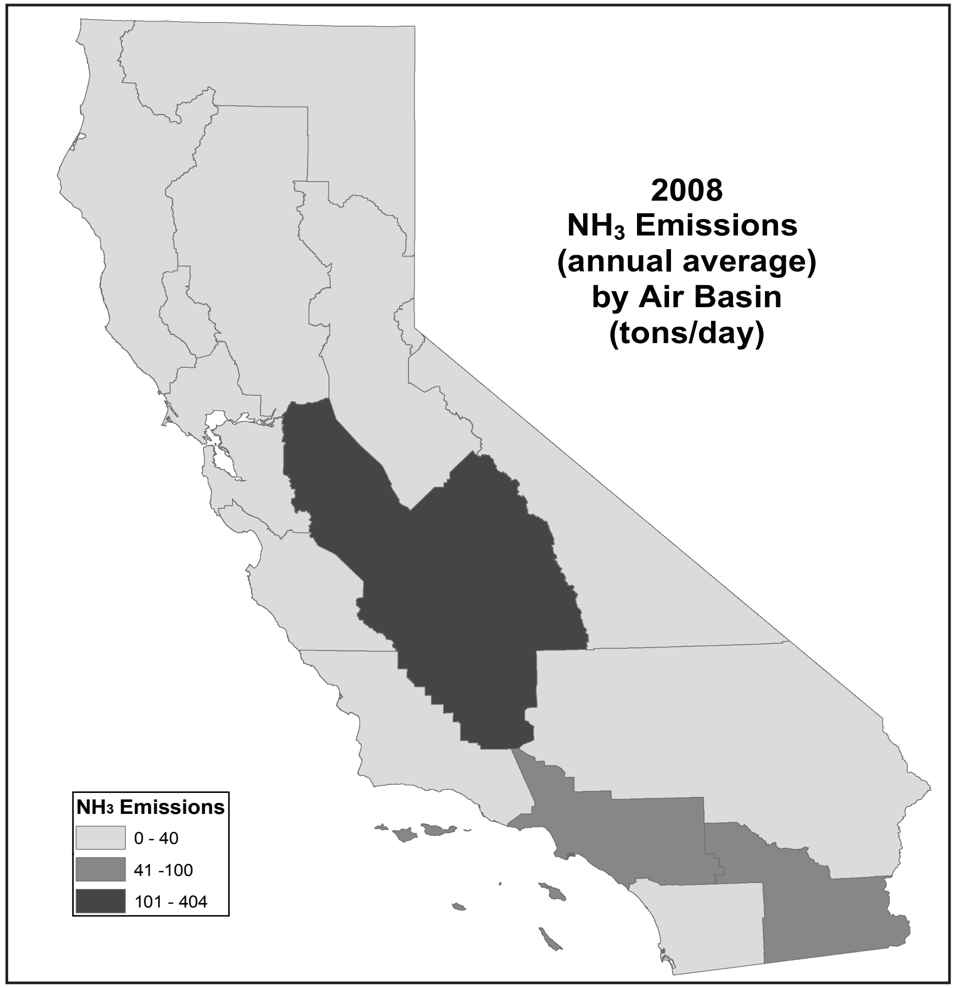

Figure 2-24

NH_3 Emissions (annual average)		
Emissions Source	**tons/day**	**Percent**
Stationary Sources	91	12%
Area-wide Sources	610	81%
On-Road Mobile	55	7%
Gasoline Vehicles	55	7%
Diesel Vehicles	1	0%
Other Mobile	0	0%
Gasoline Vehicles	0	0%
Diesel Vehicles	0	0%
Other	0	0%
Total Statewide	***756***	***100%***

* No data available

Table 2-20

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