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.

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), 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.

State and local agencies have implemented many control measures during the last three decades to improve air quality. As a result, there has been a steady decline in both emissions and pollutant concentrations. However, two pollutants, ozone and PM, still pose air quality problems. With the City of Calexico in Imperial County now attaining both the national and State CO standards, the entire state is in attainment for CO. Although progress continues to be made, it is still a challenge to reduce emissions sufficiently to attain State andnational ozone and PM standards statewide.

Figure 2-1 shows the national 8-hour ozone design values for the top 15 urban areas in the nation, based on data for 2003 to 2005. The design values in all these areas exceed the national 8-hour standard

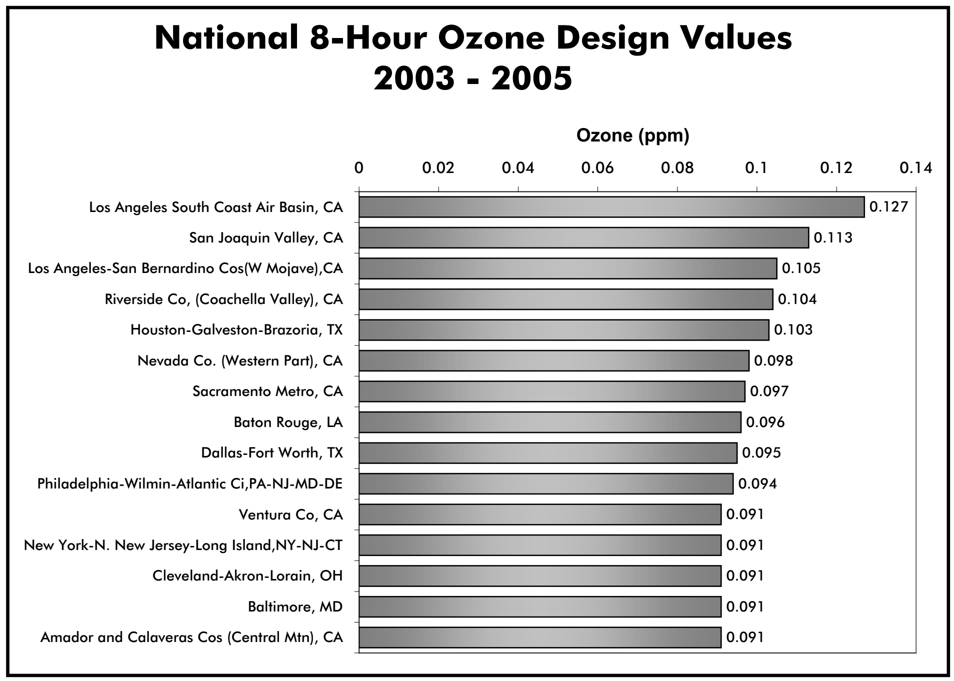

Figure 2-1

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 the severity of the ozone air quality problem in California.

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 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, significant progress has being made, because of the nature of the PM problem, it will be many years before the standards are attained.

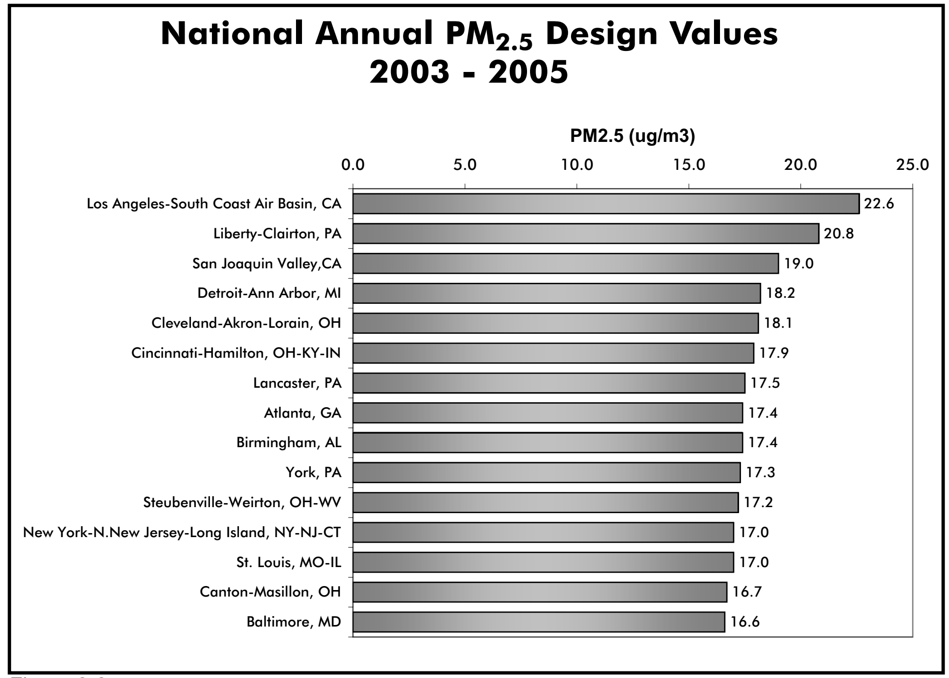

Figure 2-2

2006 Statewide Emission Inventory
Summary

Division Major Category	ROG	CO	NO_x	SO_x	PM_{10} *	$PM_{2.5}$ *	NH_3
	Emissions (tons/day, annual average)						
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 PM_{10}.
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
- Auto Marine, & Aircraft	*24*	*0*	*0*	*0*	*0*	*0*	*0*
- Paper & Fabric	*3*	*0*	*0*	*0*	*0*	*0*	*0*
- Metal, Wood, & Plastic	*24*	*0*	*0*	*0*	*0*	*0*	*0*
- Other	*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	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	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	ROG	CO	NO_x	SO_x	PM_{10} *	$PM_{2.5}$ *	NH_3
	Emissions (tons/day, annual average)						
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	-	-	-	-	-	-
- Architectural Coating	*76*	*0*	*0*	*0*	*0*	*0*	*0*
- Thinning & Cleanup Solvents	*16*	*0*	*0*	*0*	*0*	*0*	*0*
- Pesticides/Fertilizers (sub-category total)	53	-	-	-	-	-	35
- Farm Use	*51*	*0*	*0*	*0*	*0*	*0*	*0*
- Commercial Use	*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
- Wood Combustion	*50*	*763*	*10*	*1*	*108*	*104*	*6*
- Cooking And Space Heating	*3*	*25*	*52*	*2*	*5*	*5*	*0*
- Other	*0*	*4*	*10*	*0*	*1*	*1*	*0*
- Farming Operations (sub-category total)	116	-	-	-	161	40	495
- Tilling,Harvesting, & Growing	*0*	*0*	*0*	*0*	*126*	*19*	*0*
- Livestock	*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	ROG	CO	NO_x	SO_x	PM_{10} *	$PM_{2.5}$ *	NH_3
	Emissions (tons/day, annual average)						
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 PM_{10}.

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, 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 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.

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	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 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

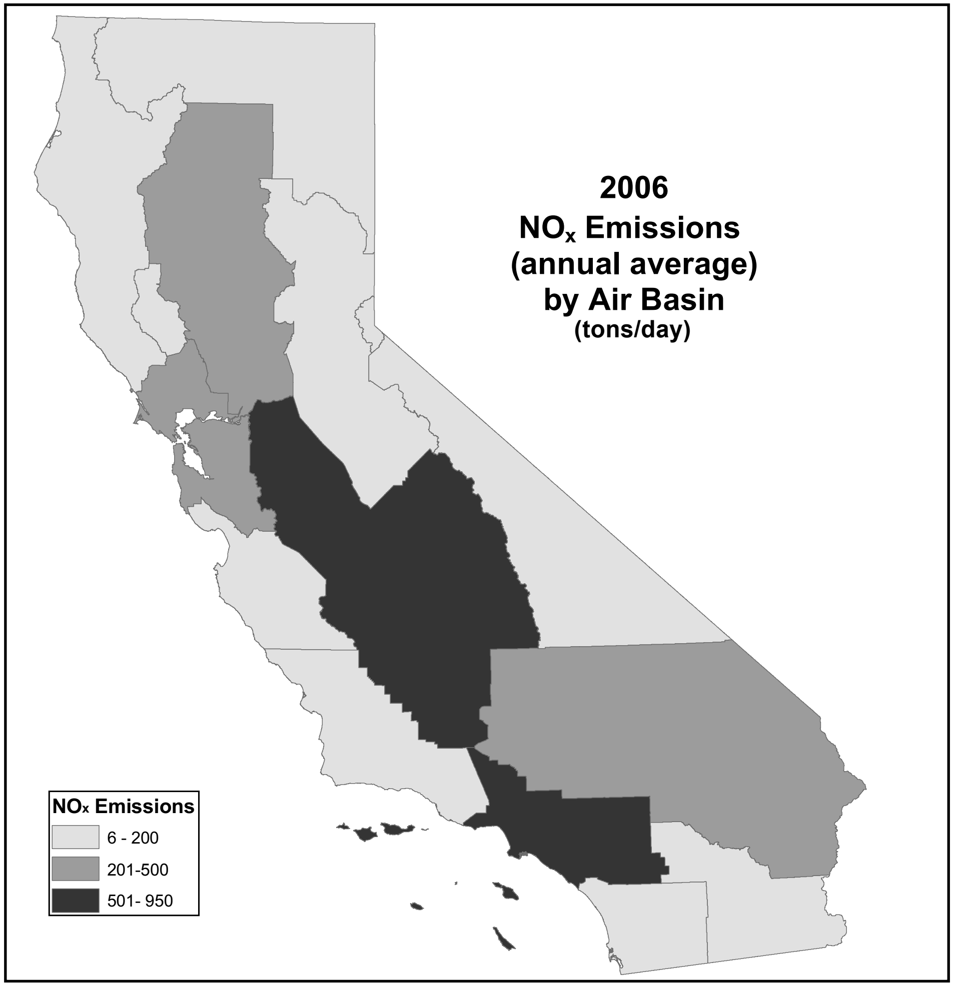

Figure 2-3

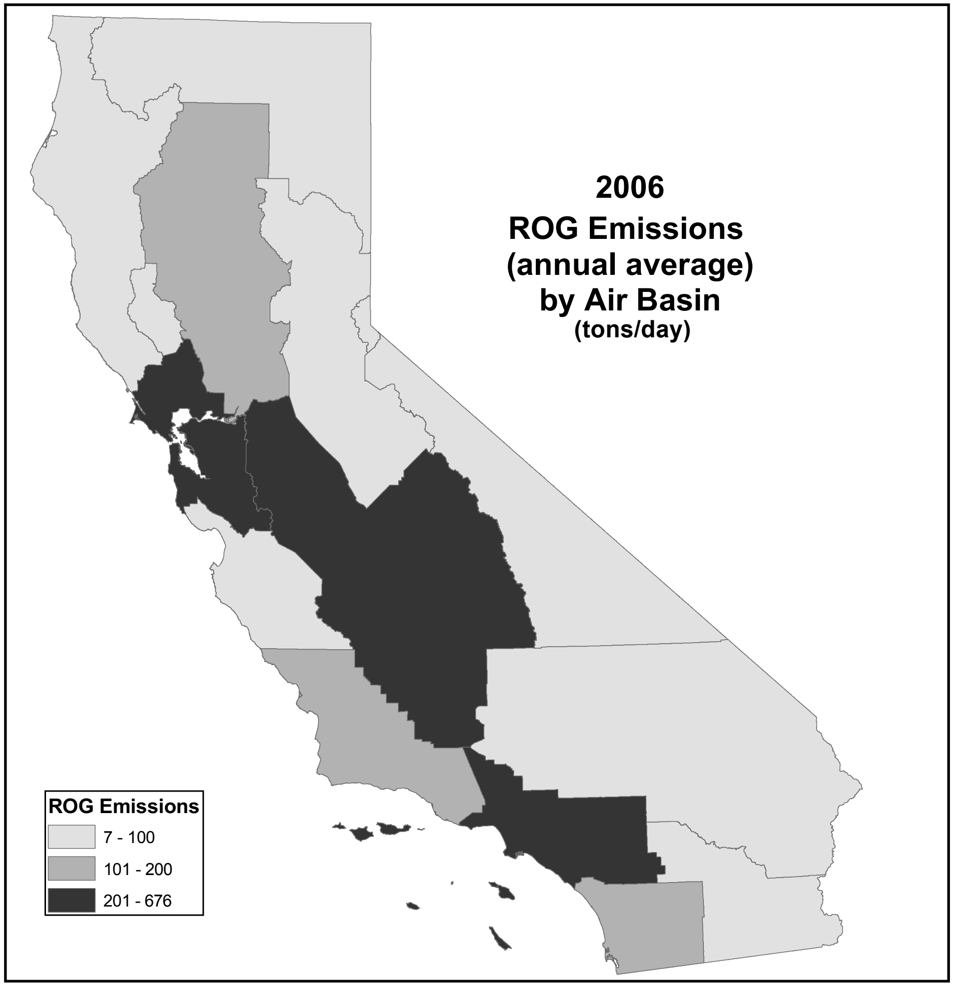

Figure 2-4

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Ozone - 2005 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. 2005 air quality data for California's five largest air basins can be found in Chapter 4, along with preliminary 2006 ozone data.

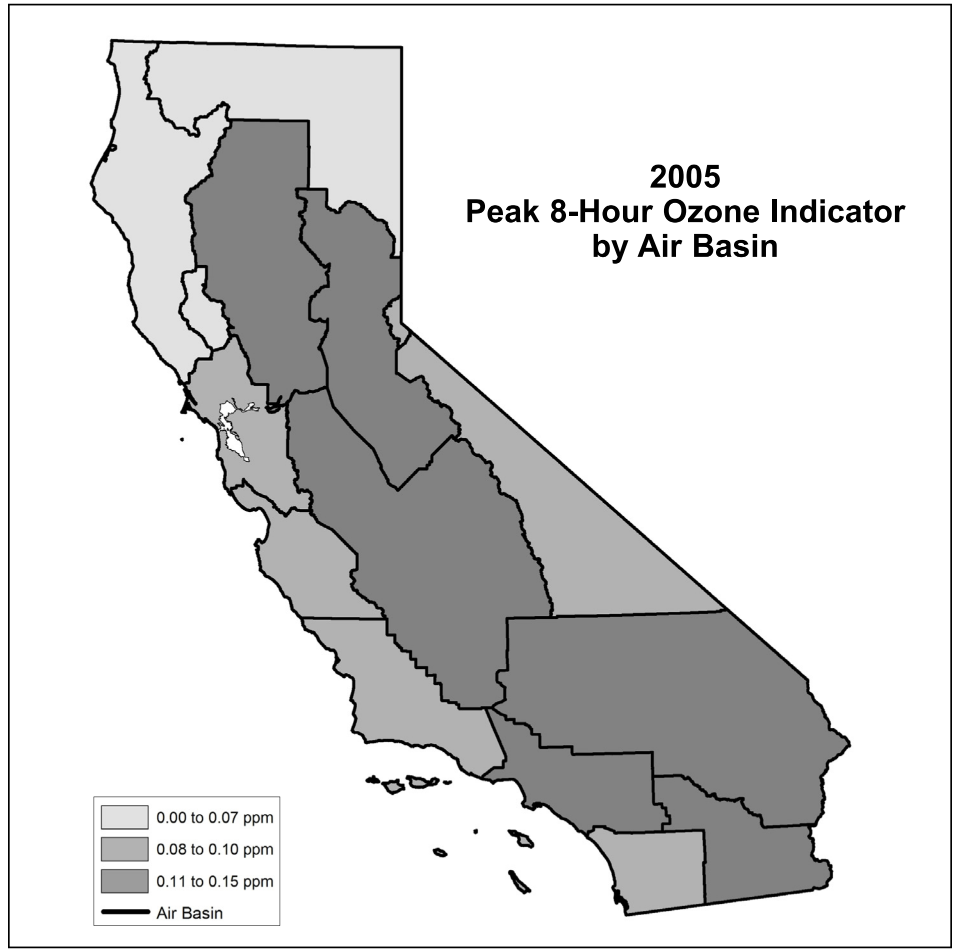

Figure 2-5

Ozone - 2005 Air Quality Tables

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

AIR BASIN	2005 Peak Indicator in parts per million (State)		Number of Days in 2005 above the Standard		
			State		National
	1-Hour	8-Hour	1-Hour	8-Hour	8-Hour
Great Basin Valleys	0.092	0.089	1	47	4
Lake County	0.076	0.067	0	0	0
Lake Tahoe	0.084	0.079	0	2	0
Mojave Desert	0.138	0.120	66	128	55
Mountain Counties	0.130	0.116	41	85	38
North Central Coast	0.097	0.084	2	7	1
North Coast	0.077	0.065	0	0	0
Northeast Plateau	0.078	0.074	0	0	0
Sacramento Valley	0.131	0.116	33	62	25
Salton Sea	0.131	0.120	54	102	43
San Diego	0.113	0.089	16	51	5
San Francisco Bay Area	0.122	0.094	9	9	1
San Joaquin Valley	0.144	0.124	83	124	72
South Central Coast	0.116	0.102	17	67	12
South Coast	0.174	0.152	99	138	83

Table 2-7

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
- Mojave-923 Poole Street

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

North Central Coast Air Basin
- Pinnacles National Monument
- Hollister-Fairview Road
- Scotts Valley-Scotts Valley Drive
- Carmel Valley-Ford Road

Northeast Plateau Air Basin
- Yreka-Foothill Drive

Table 2-8

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-East
- Calexico-Ethel Street

San Diego Air Basin
- Alpine-Victoria Drive
- Camp Pendleton
- Escondido-East Valley Parkway
- San Diego-Overland Avenue
- Del Mar-Mira Costa College

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

San Joaquin Valley Air Basin
- Arvin-Bear Mountain Blvd
- Sequoia and Kings Canyon Nat'l Park
- Parlier
- Merced-S Coffee Avenue
- Fresno-1st Street
- Fresno-Sierra Skypark #2

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

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

Sites with 8-hour peak indicator values above the level of the State ozone standard during 2005. 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 (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 ($PM_{2.5\text{-}10}$), 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})

2006 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.

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 2-9

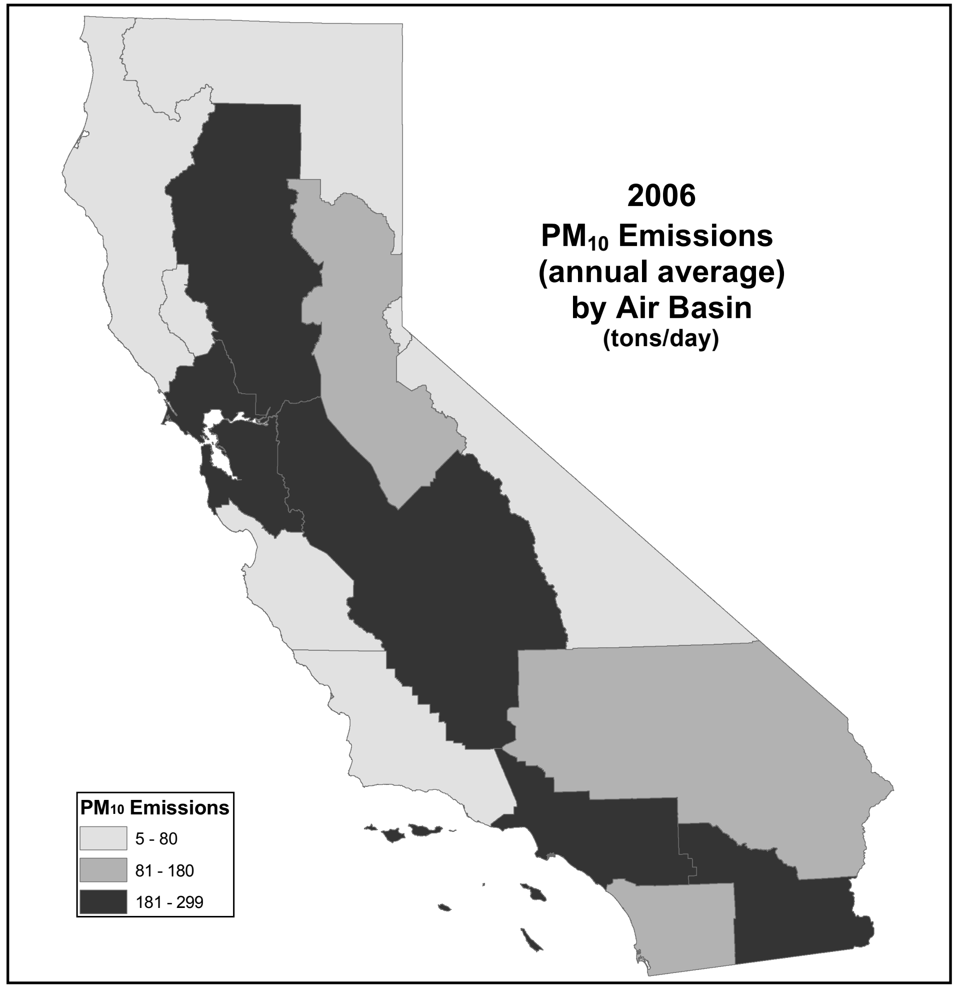

Figure 2-6

Largest Stationary Sources Statewide

Largest Stationary Sources of Directly Emitted PM_{10} Statewide

Air Basin	Facility Name	City	Tons/Year
Mojave Desert	Mitsubishi Cement 2000	Lucerne Valley	1468
Mojave Desert	TXI Riverside Cement Company	Oro Grande	755
Mojave Desert	Antelope Valley Aggregate	Littlerock	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	Littlerock	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 2-10

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 *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.

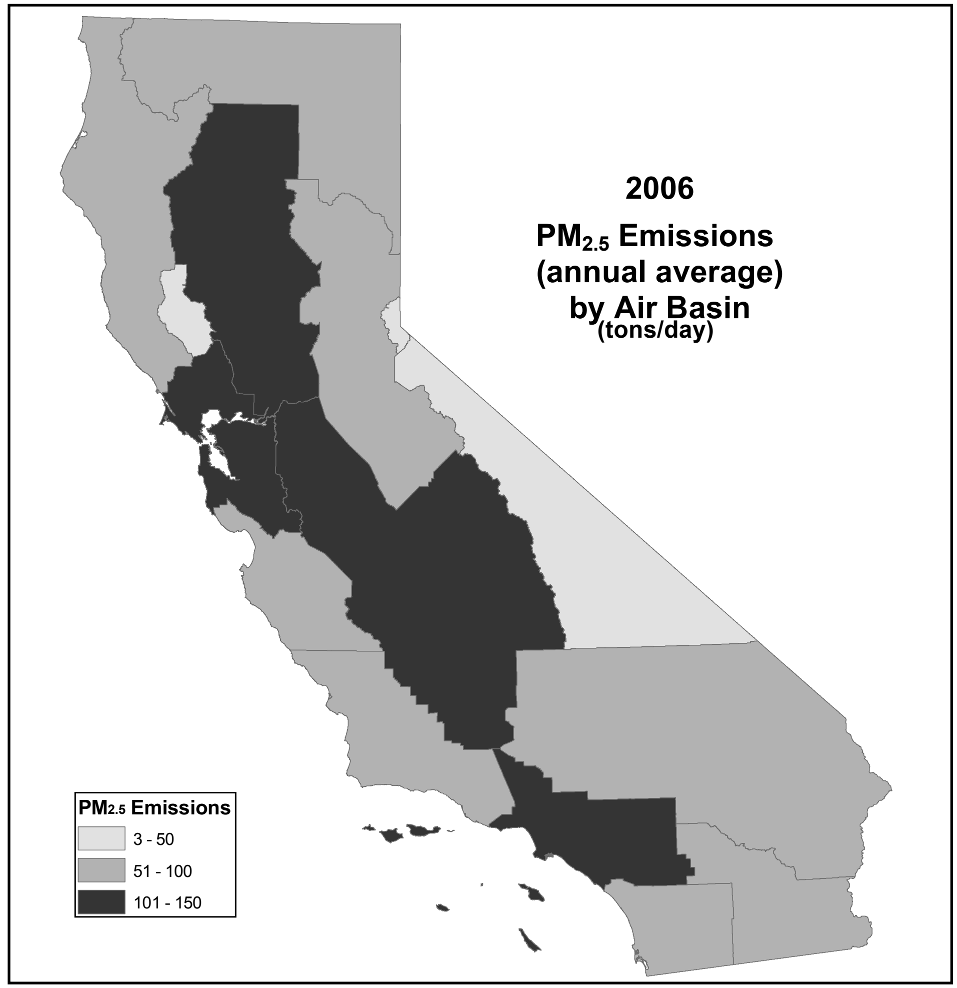

Figure 2-7

$PM_{2.5}$ Emissions (annual average)		
Emissions Source	**tons/day**	**Percent**
Stationary Sources	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 2-11

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 2-12

PM_{10} - 2005 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 2005 occurred in the Salton Sea, South Coast, San Diego, San Joaquin Valley, and Great Basin Valleys air basins. The 2005 data are summarized in Table 2-13. The highest 24-hour concentrations generally occurred in the desert areas where wind-blown dust contributes to local PM_{10} problems. However, the 2005 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.)

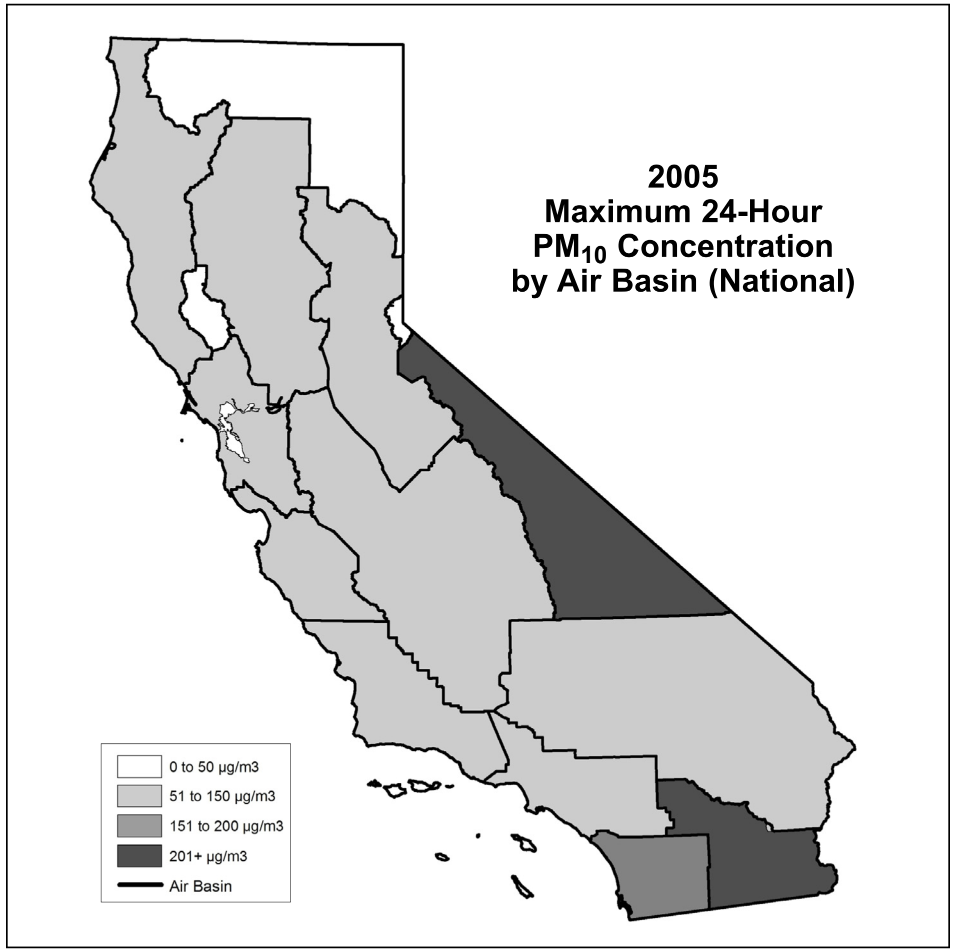

Figure 2-8

PM_{10} - 2005 Air Quality Tables

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

AIR BASIN	2005 Maximum 24-Hour Concentration in micrograms/cubic meter		2005 Maximum Annual Average of Quarters in micrograms/cubic meter	
	State	National**	State	National
Great Basin Valleys	1720	3988	30.1	83.5
Lake County	20	*	9.7	*
Lake Tahoe	33	38	14.8	17.5
Mojave Desert	70	131	26.1	28.9
Mountain Counties	73	127	18.0	29.9
North Central Coast	69	66	24.3	23.6
North Coast	71	67	18.6	18.0
Northeast Plateau	28	29	13.3	13.9
Sacramento Valley	109	110	30.4	27.2
Salton Sea	220	211	52.7	53.2
San Diego	154	155	28.6	49.8
San Francisco Bay Area	81	78	24.2	23.5
San Joaquin Valley	137	131	44.5	44.3
South Central Coast	87	83	25.6	27.7
South Coast	131	131	50.4	51.8

* 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.
NOTE: According to the Exceptional Events log, no exceptional events were recorded in 2005.

Table 2-13

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

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

Mojave Desert Air Basin
- Barstow
- Lucerne Valley-Middle School
- Victorville-14306 Park Avenue
- Hesperia-Olive Street
- Twentynine Palms-Adobe Road #2

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

North Central Coast Air Basin
- Davenport
- Moss Landing-Sandholt Road

North Coast Air Basin
- Eureka-I Street

Sacramento Valley Air Basin
- North Highlands-Blackfoot Way
- Sacramento-3801 Airport Road
- Colusa-Sunrise Blvd
- Sacramento-Del Paso Manor
- Chico-Manzanita Avenue

Salton Sea Air Basin
- Calexico-Grant Street
- Calexico-Ethel Street
- Indio-Jackson Street
- El Centro-9th Street
- Niland-English Road

San Diego Air Basin
- Otay Mesa-Paseo International
- San Diego-12th Avenue
- San Diego-1110 Beardsley Street
- Chula Vista

San Francisco Bay Area Air Basin
- Redwood City
- San Jose-Tully Road
- Bethel Island Road
- Pittsburg-10th Street
- Fremont-Chapel Way

San Joaquin Valley Air Basin
- Corcoran-Patterson Avenue
- Visalia-North Church Street
- Hanford-South Irwin Street
- Fresno-1st Street
- Bakersfield-Golden State Highway
- Oildale-3311 Manor Street

South Central Coast Air Basin
- Lompoc-South H Street
- Simi Valley-Cochran Street
- Nipomo-Guadalupe Road
- Ojai-Ojai Avenue
- El Rio-Rio Mesa School #2

South Coast Air Basin
- Long Beach-East Pacific Coast Highway
- Riverside-Rubidoux
- Fontana-Arrow Highway
- Burbank-West Palm Avenue
- Norco-Norconian

Table 2-14

Sites with 24-hour PM_{10} concentrations above the level of the State PM_{10} standard during 2005. The top five sites in each air basin are listed in descending order of their maximum 24-hour concentration. If an air basin is not listed, the 24-hour PM_{10} concentrations at sites in that air basin were not above the State 24-hour PM_{10} standard. If more than 5 sites are listed, there were multiple sites with the same maximum concentration.

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$PM_{2.5}$ - 2005 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 2005 data from California's $PM_{2.5}$ network are summarized in Table 2-15. Sites in the South Coast 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 2005 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.)

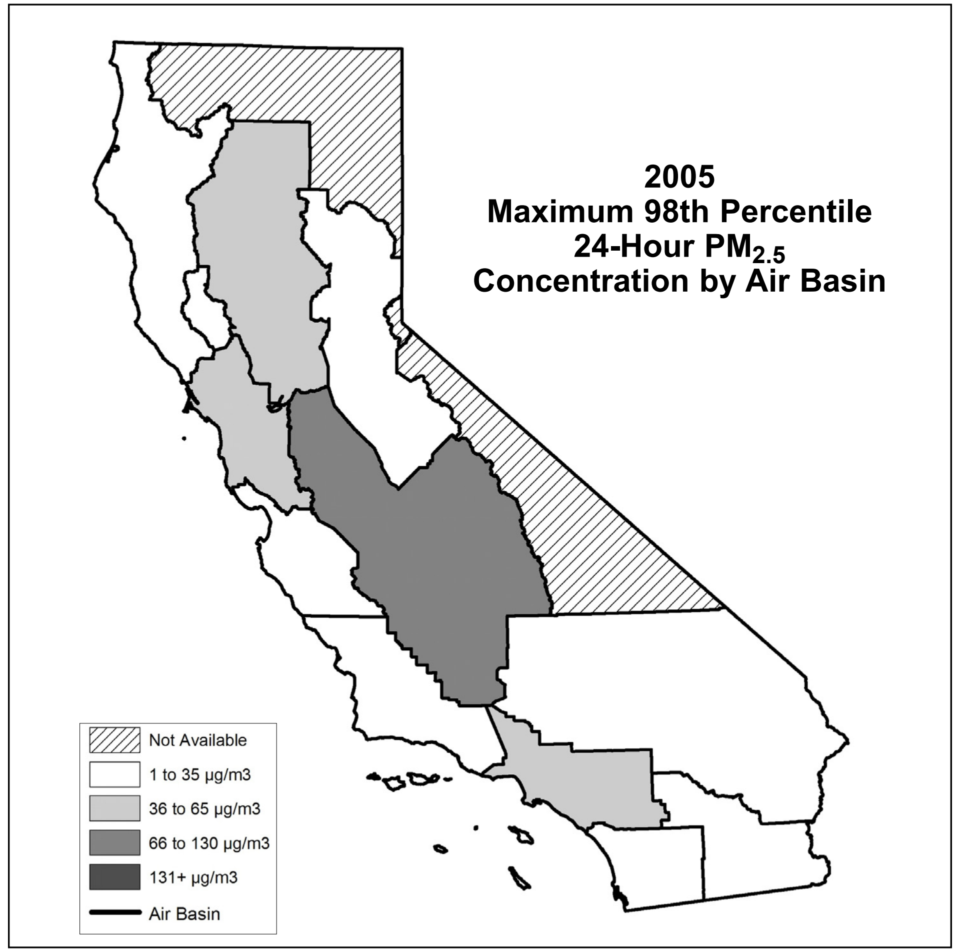

Figure 2-9

$PM_{2.5}$ - 2005 Air Quality Tables

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

AIR BASIN	2005 Maximum 24-Hr Concentration in micrograms/cubic meter		98th Percentile 24-Hr Conc. (ug/m³)*	2005 Max Annual Avg of Quarters in micrograms/cubic meter*	
	State	National		State	National
Great Basin Valleys	27.0	27.0	Incomplete Data	Incomplete Data	Incomplete Data
Lake County	11.3	11.3	10.5	4.8	4.8
Lake Tahoe	Incomplete Data	Incomplete Data	Incomplete Data	Incomplete Data	Incomplete Data
Mojave Desert	28.0	28.0	20.0	8.9	9.4
Mountain Counties	179.7	60.0	27.0	10.6	10.6
North Central Coast	21.7	21.7	14.2	6.8	6.8
North Coast	31.8	31.8	15.2	6.2	6.2
Northeast Plateau	26.0	26.0	Incomplete Data	Incomplete Data	Incomplete Data
Sacramento Valley	82.7	80.0	54.0	13.8	12.3
Salton Sea	85.2	67.6	22.1	15.5	9.1
San Diego	44.1	44.1	30.2	Incomplete Data	11.8
San Francisco Bay Area	54.6	54.6	39.8	11.8	11.8
San Joaquin Valley	102.1	92.5	74.9	22.4	19.9
South Central Coast	51.1	42.4	26.3	11.7	11.2
South Coast	132.6	132.6	58.3	21.0	21.0

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

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

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

Table 2-15

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

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

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

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

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

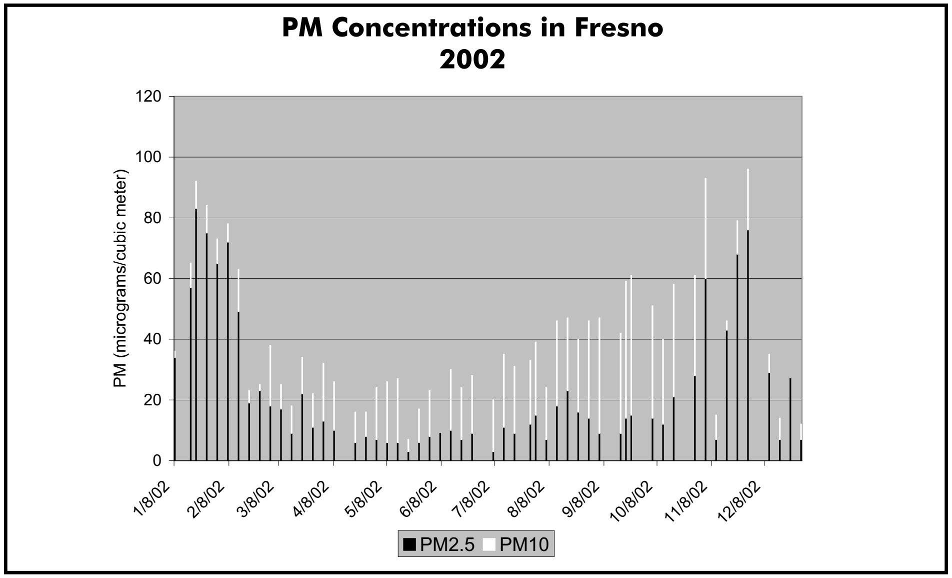

Figure 2-10

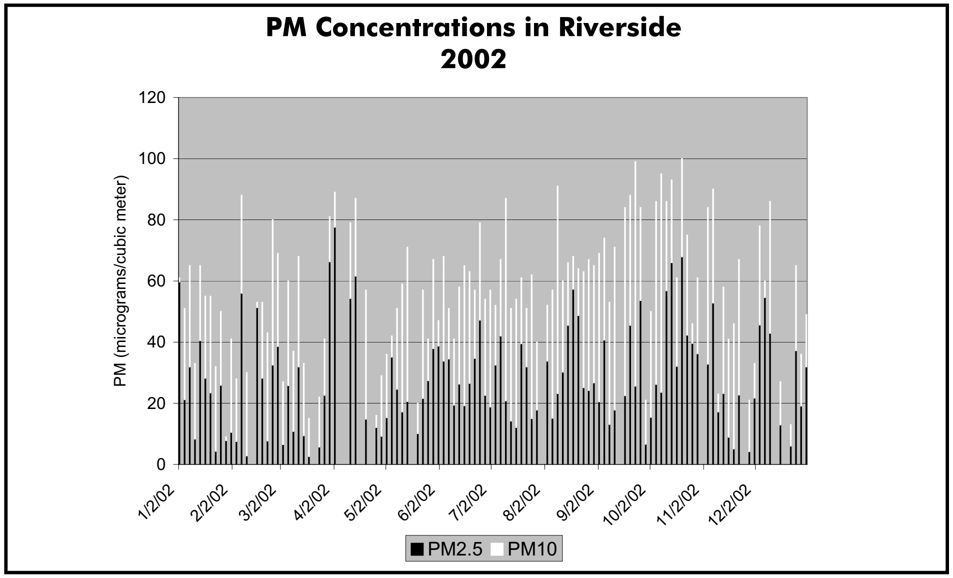

Figure 2-11

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

Chemical Mass Balance (CMB) models are used to establish which sources and how much of their emissions contribute to ambient PM concentrations. CMB models use chemical composition data from ambient PM samples and from emission sources. These data are often collected during special source attribution studies. The source attribution data presented in this section were derived from a variety of studies with differing degrees of chemical speciation. In general, however, the source categories can be interpreted in the following manner. The road and other dust, wood smoke, cooking, vehicle exhaust, and construction categories represent sources which directly emit particles. Road and other dust represents the combination of mechanically disturbed soil (paved and unpaved roads, agricultural activities) and wind-blown dust. Wood smoke generally represents residential wood combustion, but may also include combustion from other biomass burning such as agricultural or prescribed burning. The vehicle exhaust category represents direct motor vehicle exhaust particles from both gasoline and diesel vehicles. Construction reflects construction and demolition activities. Ammonium nitrate and ammonium sulfate represent secondary species (i.e., they form in the atmosphere from the emissions of 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)	
Air Basin	Secondary $PM_{2.5}$ (%)
Great Basin Valleys	30
Lake County	30
Lake Tahoe	40
Mojave Desert	40
Mountain Counties	30
North Central Coast	40
North Coast	30
Northeast Plateau	30
Sacramento Valley	30
Salton Sea	40
San Diego	50
San Francisco Bay Area	40
San Joaquin Valley	40
South Central Coast	50
South Coast	60

Table 2-16

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

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

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

San Joaquin Valley Air Basin

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

During the winter in Fresno, secondary ammonium nitrate was the largest contributor to PM_{10}, formed from 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.

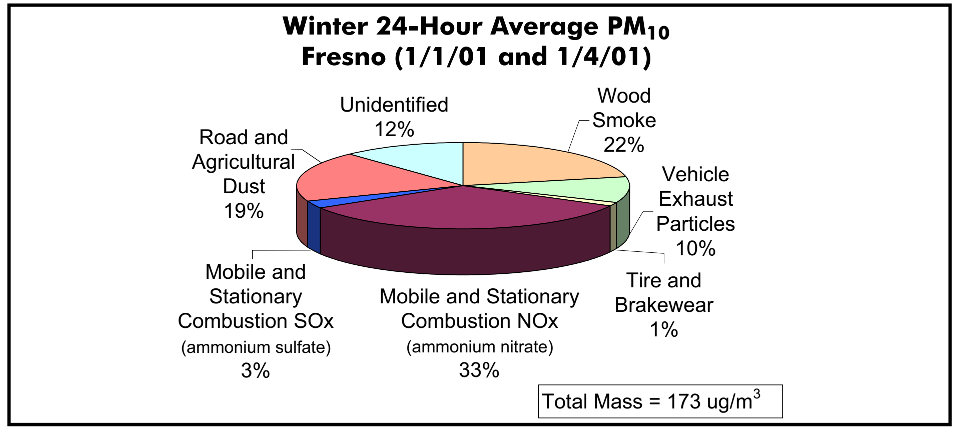

Figure 2-12

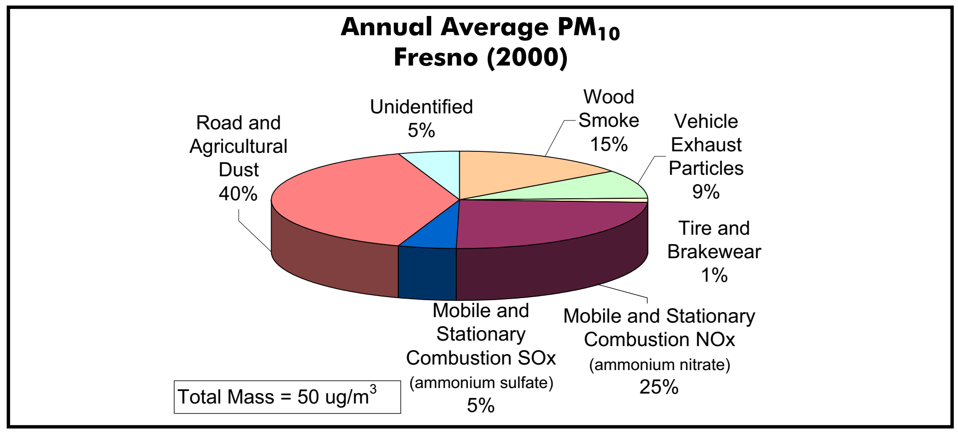

Figure 2-13

San Francisco Bay Area Air Basin

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

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

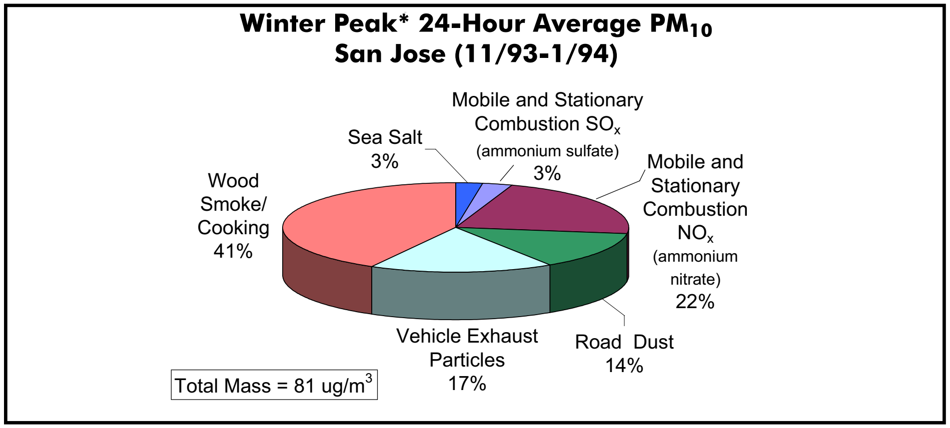

Figure 2-14

* Average of days with PM_{10} > 50 ug/m^3

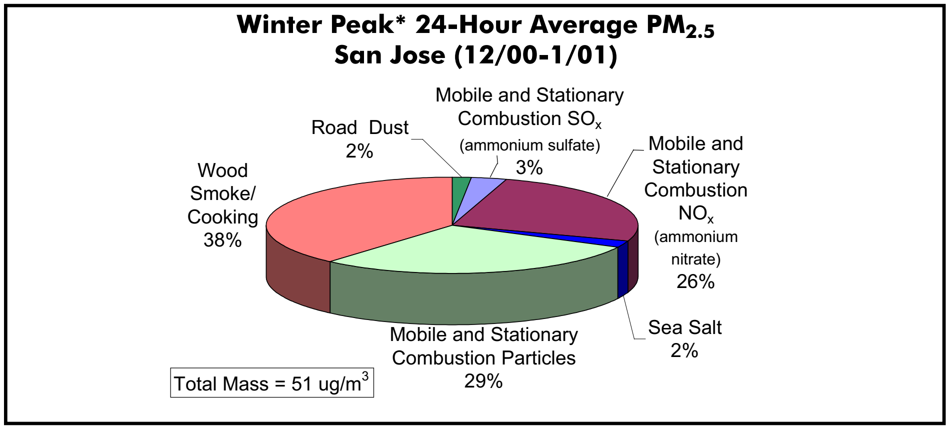

Figure 2-15

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

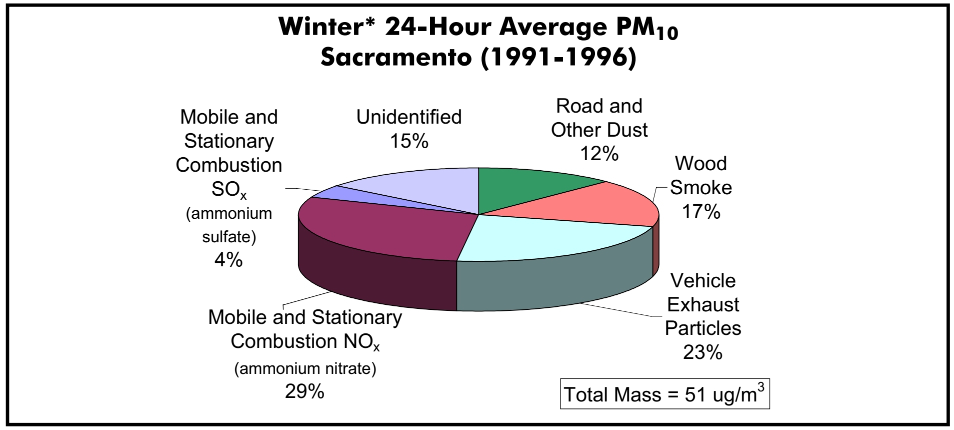

Figure 2-16

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

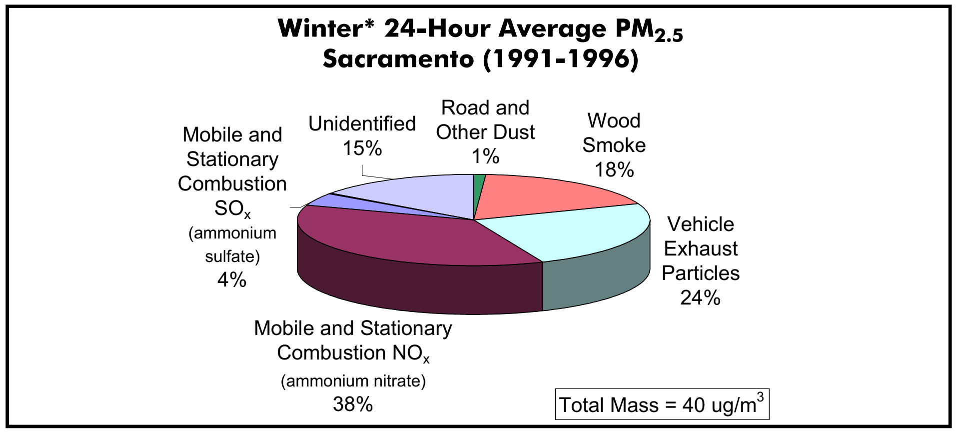

Figure 2-17

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

South Coast Air Basin

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

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

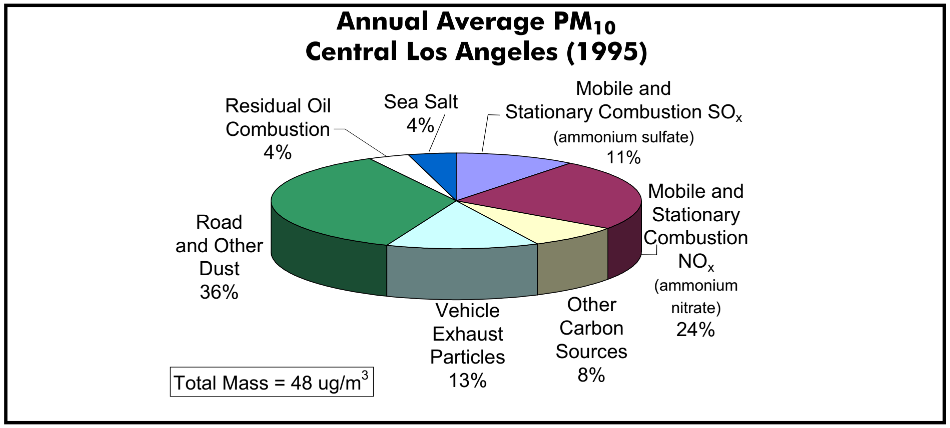

Figure 2-18

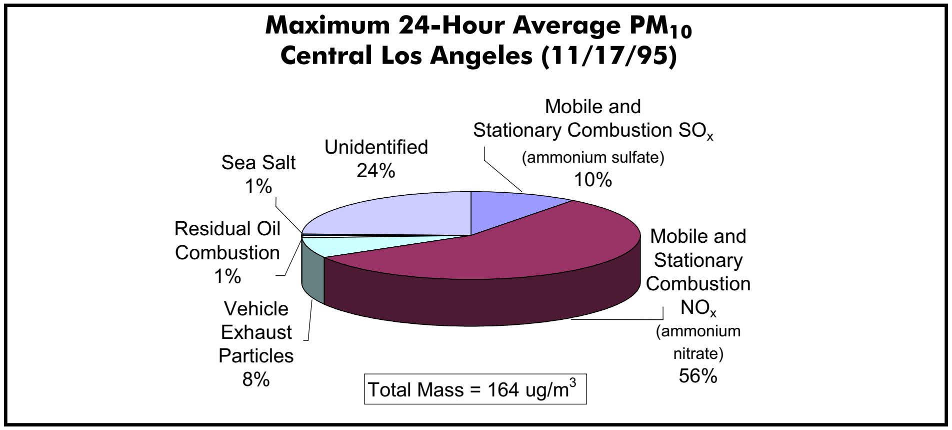

Figure 2-19

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.

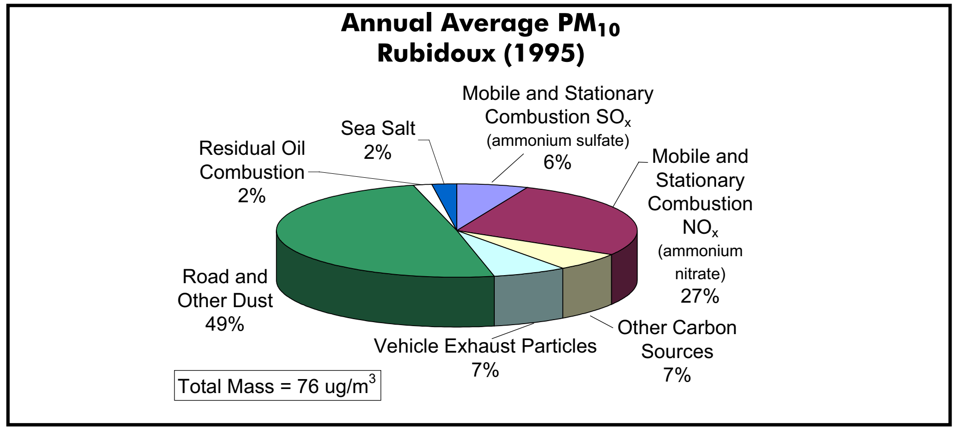

Figure 2-20

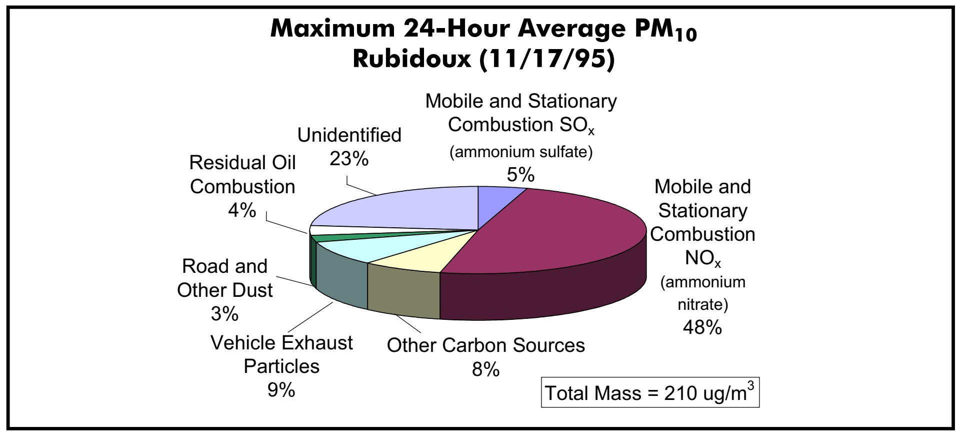

Figure 2-21

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

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.

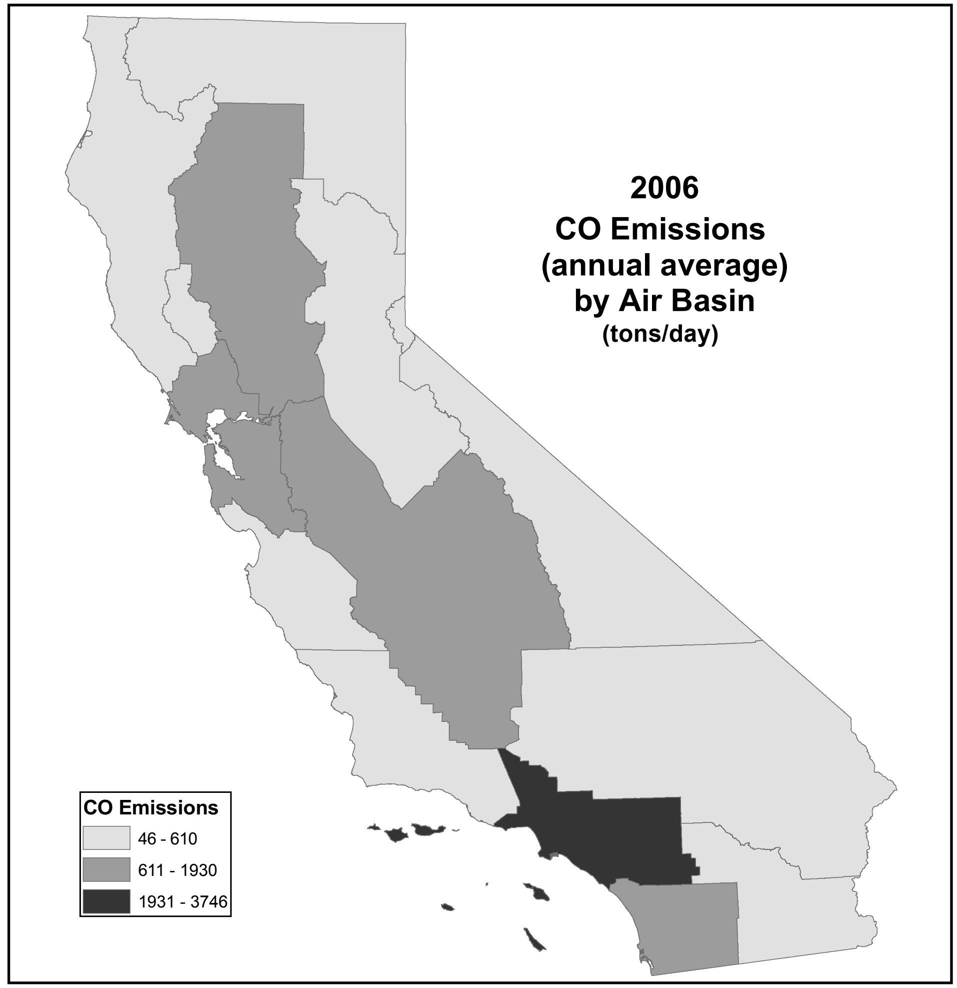

Figure 2-22

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 2-17

Carbon Monoxide - 2005 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.

The final problem area, the City of Calexico in Imperial County, now meets both national and State standards for CO.

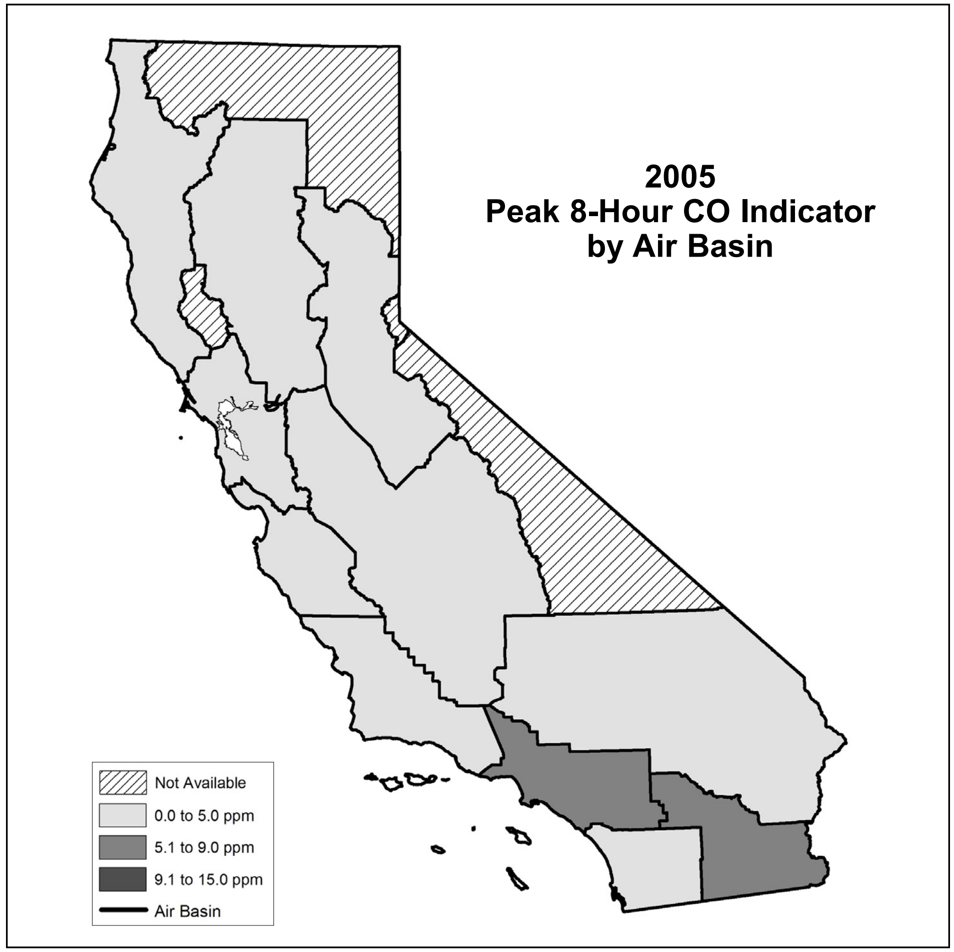

Figure 2-23

Carbon Monoxide - 2005 Air Quality Tables

Maximum Peak 8-Hour Indicator by Air Basin

AIR BASIN	2005 Maximum Peak 8-Hour Indicator in parts per million	Number of Days in 2005 above the 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	1.9	0	0
Mountain Counties	2.8	0	0
North Central Coast	1.2	0	0
North Coast	1.8	0	0
Northeast Plateau	No Data	No Data	No Data
Sacramento Valley	4.4	0	0
Salton Sea	8.4	0	0
San Diego	4.5	0	0
San Francisco Bay Area	3.7	0	0
San Joaquin Valley	3.7	0	0
South Central Coast	1.9	0	0
South Coast	7.1	0	0

Table 2-18

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.

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	0%
Other Mobile*	0	0%
Gasoline Vehicles	0	0%
Diesel Vehicles	0	0%
Other	0	0%
Total Statewide	***738***	***100%***

* No data available

Table 2-19

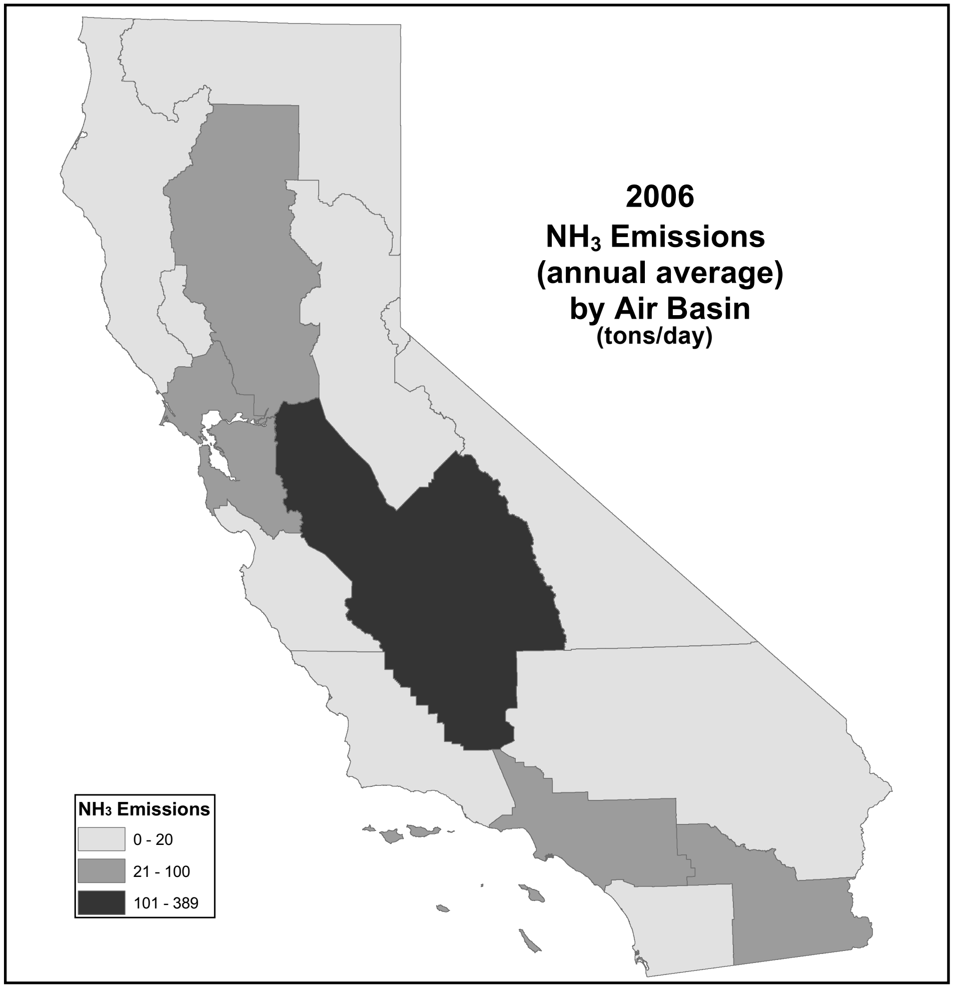

Figure 2-24

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