Chapter 3

Statewide Trends and Forecasts -- Criteria Pollutants

Introduction
Emission Trends and Forecasts

The most current emissions data available are from 2004. Any data prior to this year are derived from historical emissions data. Future year data are forecasted from the 2003 base year and control measures reported through September 2004. Forecasts take into account emissions data, projected growth rates, and future control measures to calculate emissions in future years.

On a statewide basis, emissions of NO_x increased between 1975 and 1980, but are forecasted to decline between 1980 and 2020. Emissions of ROG decreased steadily between 1975 and 2020. In addition to being ozone precursors, both NO_x and ROG are secondary contributors to PM_{10} and $PM_{2.5}$. Direct PM_{10} emissions show a slight increase from 1975 to 1990, a slight decrease in 1995, and then a slow increase after 1995. Direct $PM_{2.5}$ emissions decreased from 1975 to 1985, increased from 1985 to 1990, decreased slightly between 1990 and 1995, and are predicted to increase from 1995 to 2020.

Emissions of CO have decreased since 1985 and are forecasted to continue declining. The recent decrease in NO_x, ROG, and CO is occurring even with increases in vehicle miles traveled (VMT) and population.

Statewide Emissions (tons/day, annual average)										
Pollutant	**1975**	**1980**	**1985**	**1990**	**1995**	**2000**	**2005**	**2010**	**2015**	**2020**
NO_X	4811	4982	4945	4871	4128	3629	3026	2499	2059	1811
ROG	7131	6739	6180	4748	3691	3013	2402	2145	2031	1993
PM_{10}	1901	1931	2004	2144	2047	2061	2113	2177	2234	2298
$PM_{2.5}$	803	785	778	816	758	767	779	796	811	829
CO	41295	37609	35588	29603	22182	16906	13204	10848	9213	8248

Table 3-1

Statewide Population and VMT

Airborne pollutants result in large part from human activities, and growth generally has a negative impact on air quality. California is fortunate in that it boasts the world's most progressive emission controls. These controls have resulted in significant air quality improvements, despite substantial growth.

During 1984 through 2003, statewide maximum 1-hour ozone values decreased 43 percent, and maximum 8-hour carbon monoxide values dropped 46 percent. These air quality improvements occurred at the same time the State's population increased 42 percent and the average daily VMT increased 90 percent. Ambient annual average PM_{10} values in the non-desert areas also show improvement: a 39 percent decrease from 1989 to 2003. While the air quality improvements are impressive, additional emission controls will be needed to offset future growth.

Percent Change in Air Quality and Growth

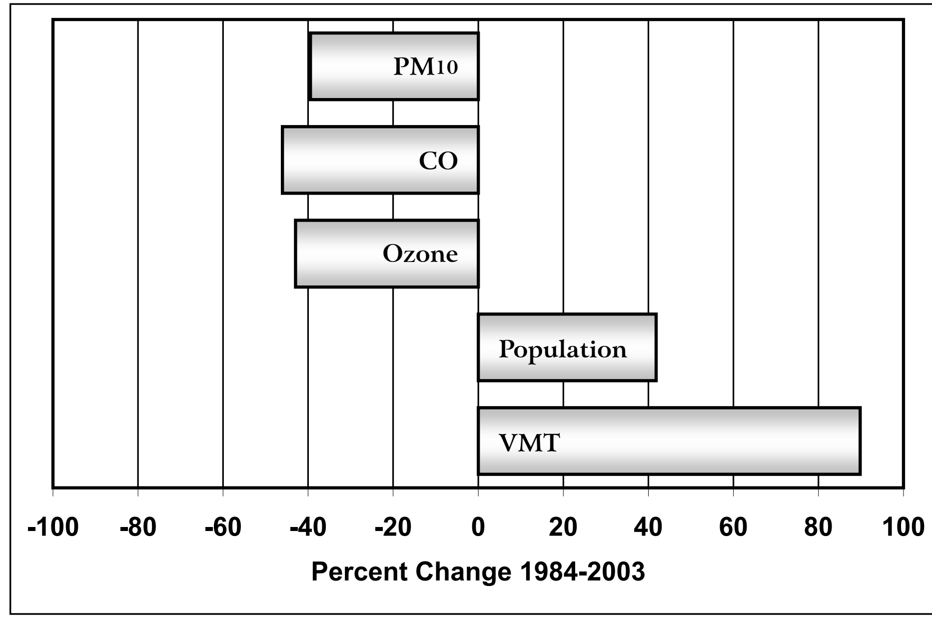

Figure 3-1

Statewide Population and VMT Trends									
Parameter	1980	1985	1990	1995	2000	2005	2010	2015	2020
Population (1000s)	23782	26402	29829	31711	34036	37473	40262	42711	45822
Avg. Daily VMT(1000s)	389107	517683	677171	731207	796075	872885	957360	1032915	1109515

Table 3-2

Ozone

Emission Trends and Forecasts - Ozone Precursors

NO_x Emission Trends and Forecasts

NO_x emission standards for on-road motor vehicles were introduced in 1971 and followed in later years by the implementation of more stringent standards and the introduction of three-way catalysts. NO_x emissions from on-road motor vehicles have declined by over 25 percent from 1990 to 2000, and NO_x emissions are projected to decrease by an additional 50 percent between 2000 and 2020. This has occurred as vehicles meeting more stringent emission standards enter the fleet, and all vehicles use cleaner burning gasoline and diesel fuel or alternative fuels. Stationary source NO_x emissions dropped by 44 percent between 1980 and 1995. This decrease has been largely due to a switch from fuel oil to natural gas and the implementation of combustion controls such as low-NO_x burners for boilers and catalytic converters for both external and internal combustion stationary sources. State Implementation Plan (SIP) and conformity inventory forecasts may differ from the forecasts presented in this almanac. For additional information on these forecasts, please refer to the ARB SIP web page at *www.arb.ca.gov/planning/sip/sip.htm*.

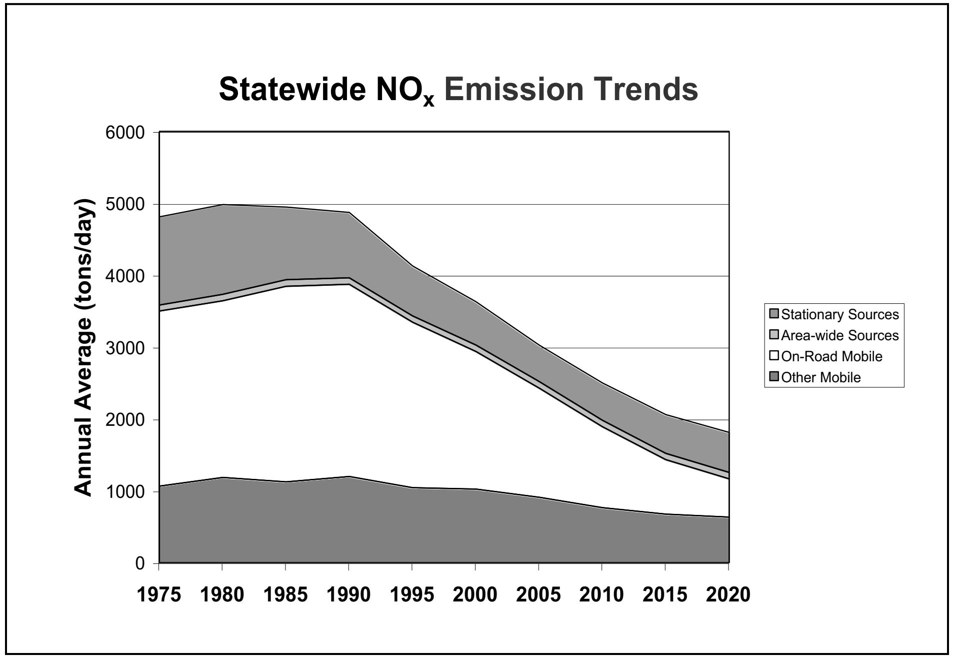

Figure 3-2

ROG Emission Trends and Forecasts

ROG emissions in California are projected to decrease by over 72 percent between 1975 and 2020, largely as a result of the State's on-road motor vehicle emission control program. This includes the use of improved evaporative emission control systems, computerized fuel injection, engine management systems to meet increasingly stringent California emission standards, cleaner gasoline, and the Smog Check program. ROG emissions from other mobile sources are projected to decline between 1990 and 2020 as more stringent emission standards are adopted and implemented. Substantial reductions have also been obtained for area-wide sources through the vapor recovery program for service stations, bulk plants, and other fuel distribution operations. There are also on-going programs to reduce overall solvent ROG emissions from coatings, consumer products, cleaning and degreasing solvents, and other substances used within California. Again, State Implementation Plan (SIP) and conformity inventory forecasts may differ from the forecasts presented in this almanac. For additional information on these forecasts, please refer to the ARB SIP web page at *www.arb.ca.gov/planning/sip/sip.htm*.

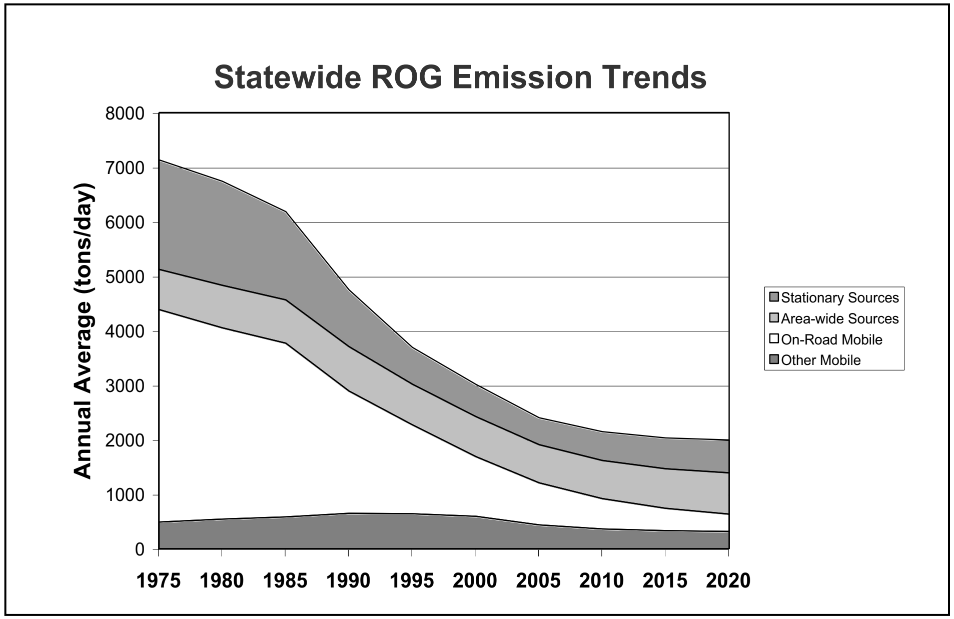

Figure 3-3

Emission Trends and Forecasts - Ozone Precursors

NO_x Emission Trends (tons/day, annual average)										
Emission Source	**1975**	**1980**	**1985**	**1990**	**1995**	**2000**	**2005**	**2010**	**2015**	**2020**
All Sources	***4811***	***4982***	***4945***	***4871***	***4128***	***3629***	***3026***	***2499***	***2059***	***1811***
Stationary Sources	1228	1250	1009	909	696	602	506	519	538	556
Area-wide Sources	83	88	91	89	87	90	93	89	88	89
On-Road Mobile	2435	2459	2721	2675	2301	1915	1518	1127	757	532
Gasoline Vehicles	2149	1975	1936	1789	1535	1113	757	536	371	266
Diesel Vehicles	286	484	784	885	766	802	761	590	386	266
Other Mobile	1065	1185	1125	1199	1044	1022	908	764	675	634
Gasoline Fuel	43	48	52	61	60	67	74	68	62	60
Diesel Fuel	941	1052	988	1043	899	868	748	614	528	483
Other Fuel	82	85	85	95	85	87	86	83	85	90

Table 3-3

ROG Emission Trends (tons/day, annual average)										
Emission Source	**1975**	**1980**	**1985**	**1990**	**1995**	**2000**	**2005**	**2010**	**2015**	**2020**
All Sources	***7131***	***6739***	***6180***	***4748***	***3691***	***3013***	***2402***	***2145***	***2031***	***1993***
Stationary Sources	2007	1907	1616	1043	674	589	494	526	564	603
Area-wide Sources	739	783	796	812	745	735	699	701	727	756
On-Road Mobile	3896	3506	3186	2243	1634	1096	772	557	410	318
Gasoline Vehicles	3880	3475	3138	2198	1597	1064	741	530	389	300
Diesel Vehicles	17	31	48	45	36	32	31	27	21	18
Other Mobile	489	543	583	650	639	593	436	362	330	315
Gasoline Fuel	347	392	444	502	512	471	320	258	235	226
Diesel Fuel	88	98	91	97	86	81	72	58	46	40
Other Fuel	54	53	48	51	40	41	44	46	48	50

Table 3-4

Statewide Air Quality - Ozone

Air quality as it relates to ozone has improved greatly in all areas of California over the last 20 years, despite significant growth. The statewide trend, which reflects values for the South Coast Air Basin, shows that the maximum peak 1-hour indicator declined by almost half from 1984 to 2003. During 1984 to 2003, the statewide population grew by 42 percent and the number of vehicle miles traveled each day was up more than 90 percent. Motor vehicles are the largest source category of ozone precursor emissions, and reducing their emissions will continue to be the cornerstone of California's ozone control efforts. New vehicles must meet the ARB's low emission vehicle standards, which equate to about 95 percent fewer smog-forming emissions than vehicles produced in the 1970s. However, increases in population and driving are partially offsetting the benefits of cleaner vehicles. In addition to motor vehicle controls, the ARB is establishing controls for other sources of ozone precursor emissions, such as consumer products. The ARB and other agencies are also looking at new and more efficient ways of doing business and implementing incentive programs to improve air quality.

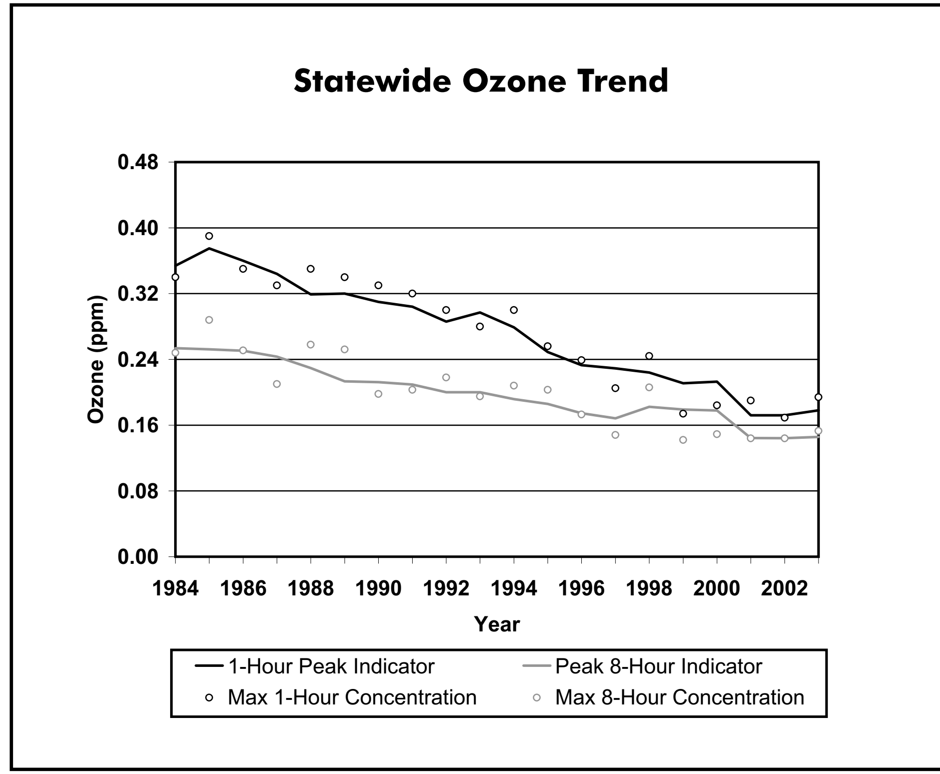

Figure 3-4

Population-Weighted Exposures Over the State Ozone Standard

There are a number of ways to look at how ozone levels have changed over the years. Though simple indicators are most commonly used, complex indicators can offer additional insight concerning air quality. One such indicator is the *population-weighted exposure* indicator. As used here, an "exposure" occurs when a person experiences a one-hour ozone concentration outdoors that is higher than 0.09 ppm, the level of the State standard. The population-weighted exposure indicator considers both the level and the duration of ozone concentrations above the State standard. The annual exposure is the sum of all the hourly exposures during the year and presents the result as an average per exposed person.

In contrast to the peak indicator, which provides an indication of the potential for acute adverse health impacts, the population-weighted exposure provides an indication of the potential for chronic adverse health impacts. For the purposes of computing the exposures in this almanac, individuals are presumed to have been exposed to concentrations measured by the ambient (outdoor) air quality monitoring network. However, daily activity patterns (for example, being inside a building or exercising outdoors) may diminish or increase exposures to some outdoor concentrations that exceed the State standard. While many indicators characterize air quality at an individual monitoring location, the exposure indicator provides an integrated regional perspective. For each hour, the calculations simultaneously consider ozone data from all of the monitors in a region. People living in areas where ozone exceeds the standard are then included in the population-weighted exposure for that hour.

The examples below show two simple exposure calculations. First, a measured ozone concentration of 0.11 ppm for one hour represents an exposure of 0.02 ppm-hours above the State ozone standard of 0.09 ppm:

$$(0.11 \text{ ppm} - 0.09 \text{ ppm}) \times 1 \text{ hour} = 0.02 \text{ ppm-hours}$$

Second, a measured concentration of 0.10 ppm for two hours also equals an exposure of 0.02 ppm-hours:

$$(0.10 \text{ ppm} - 0.09 \text{ ppm}) \times 2 \text{ hours} = 0.02 \text{ ppm-hours}$$

In contrast to these examples, when the concentration is equal to or below the level of the State standard of 0.09 ppm, the exposure is zero. The population associated with these "zero" exposures are not included in the exposure calculations in this almanac because including population with the zero exposures dilutes the real impact of the ozone concentrations that are above the State standard and are, therefore, adversely affecting public health. In all cases, an exposure calculation that excludes the zero values will be higher than one incorporating concentrations at or below the level of the standard (areas of zero exposure).

The population-weighted exposures in Table 3-5 are listed for each year, from 1983 through 2003, for the five most populated areas of California: the South Coast Air Basin, the San Francisco Bay Area Air Basin, the San Joaquin Valley Air Basin, the San Diego Air Basin, and the Sacramento Metropolitan Area (the southern, urbanized portion of the Sacramento Valley Air Basin and a portion of the Mountain Counties Air Basin). While these areas do not encompass all of California's ozone nonattainment areas, they do include the major urban areas where the majority of the State's population lives.

The exposure values listed in Table 3-5 are presented in parts per million to be consistent with the units in which the State standard is expressed. In addition to the exposure values, Table 3-5 also lists the percent of the total population represented in the exposure value. The percent value reflects the percent of the total population in the area that was exposed to an ozone concentration above the level of the State standard for at least one hour during the year. Because the exposure result is an average, it may not accurately portray the exposure of any particular individual or subarea. Some people in the region experience higher exposure while others experience lower exposure. Nevertheless, this method provides a reasonable approach for comparing exposures among various regions and for assessing trends in exposure reductions.

The calculations for the exposure indicators are based on all concentrations measured in the area that satisfy the specified data requirements. The population is based on census tract data, and the calculation is performed at the census tract level and then aggregated to the regional level. Exposures for the years 1983 through 1999 use census information for 1990, while exposures for the years 2000, 2001, 2002 and 2003 use census information for the year 2000. General details about the computational procedure can be found in the ARB publication entitled: *"Guidance for Using Air Quality-Related Indicators in Reporting Progress in Attaining the State Ambient Air Quality Standards"* (September 1993).

Ozone Exposures Over the State Standard: Population-Weighted (ppm-hours / person)

	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
South Coast Air Basin																					
Exposure	41.61	36.58	36.90	35.68	31.41	34.28	29.58	22.10	22.21	21.99	17.96	18.90	13.26	10.67	6.28	8.90	3.28	5.33	6.95	7.16	8.92
% Pop. Represented*	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	97%	100%	92%	98%	99%	100%	88%	78%	91%
San Francisco Bay Area Air Basin																					
Exposure	2.28	2.28	1.45	0.85	1.81	1.24	0.67	0.46	0.48	0.54	0.41	0.26	1.06	1.03	0.10	0.95	0.62	0.33	0.35	0.35	0.32
% Pop. Represented	97%	100%	73%	46%	72%	73%	53%	41%	45%	50%	72%	39%	81%	60%	48%	54%	65%	25%	48%	28%	62%
San Joaquin Valley Air Basin																					
Exposure	5.61	7.25	8.09	10.00	10.09	9.38	7.12	5.21	6.09	5.64	6.18	6.43	6.10	6.96	3.73	6.63	4.51	4.63	4.75	5.84	5.24
% Pop. Represented	97%	97%	97%	95%	98%	99%	99%	99%	99%	99%	99%	99%	99%	99%	99%	99%	99%	99%	99%	99%	99%
San Diego Air Basin																					
Exposure	9.60	6.94	8.17	5.16	5.64	7.40	7.29	6.35	3.92	3.31	2.74	2.28	2.41	1.19	0.83	1.93	0.60	0.52	0.71	0.38	0.45
% Pop. Represented	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	79%	100%	98%	100%	82%	69%	72%	89%	62%	36%
Broader Sacramento Metropolitan Area																					
Exposure	2.32	3.11	2.88	2.57	3.19	4.22	1.83	2.14	2.47	2.35	1.10	1.76	2.20	1.85	0.51	1.98	1.45	1.15	1.08	1.52	1.15
% Pop. Represented	94%	100%	93%	94%	100%	100%	100%	100%	99%	100%	100%	95%	100%	100%	98%	100%	100%	99%	100%	99%	97%

* *% Population Represented* is the percent of the total population residing in an area exposed to an ozone concentration above the level of the State standard for at least one hour during the year.

Table 3-5

Ozone Transport

Since 1989, the ARB staff has evaluated the impacts of the transport of ozone and ozone precursor emissions from upwind areas to the ozone concentrations in downwind areas. These analyses demonstrate that the air basin boundaries are not true boundaries of air masses. All urban areas are upwind contributors to their downwind neighbors with the exception of San Diego. Figure 3-5 shows the upwind areas that impact downwind areas throughout the State. The ozone problem in some rural areas is caused almost solely by transported pollutants. These areas, although designated as nonattainment, are not required to adopt an air quality plan because local control strategies in these areas would not be effective in reducing ozone concentrations. However, these areas are subject to many statewide control strategies, such as cleaner fuels and low emission vehicles. More detailed information about ozone transport is available on the web at *www.arb.ca.gov/aqd/transport/transport.htm*.

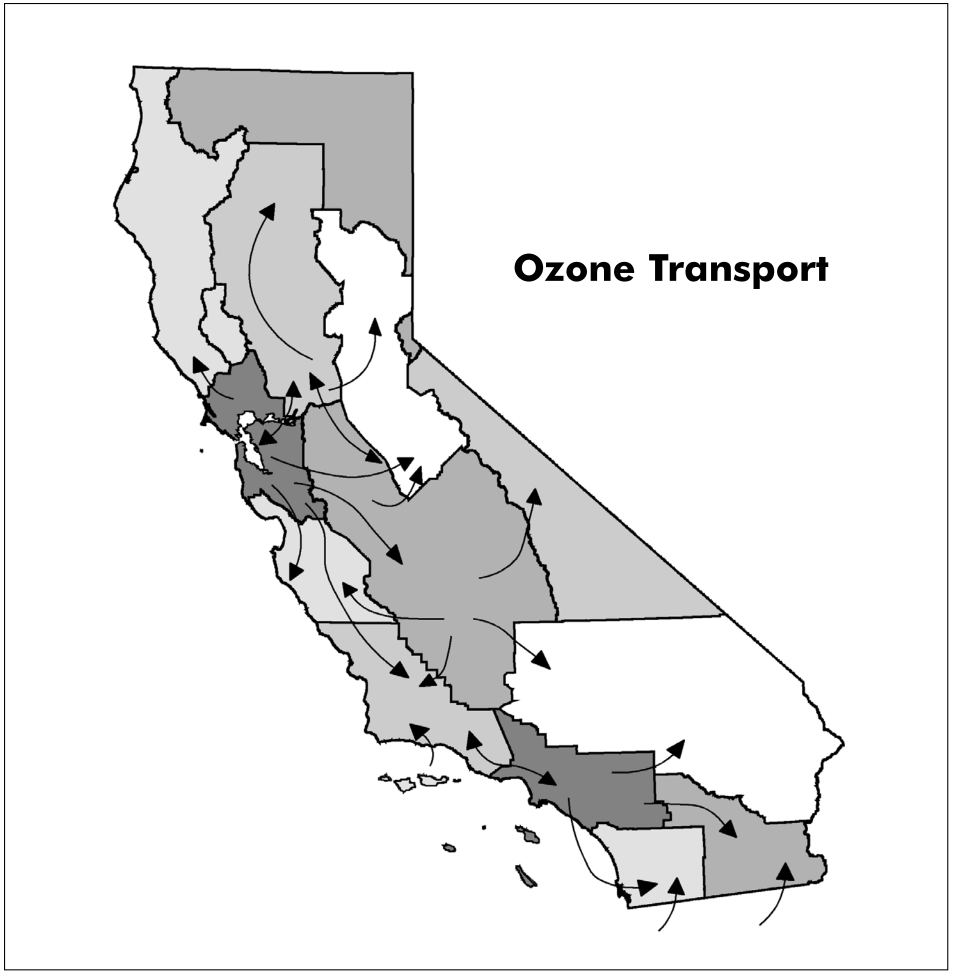

Figure 3-5

Directly Emitted Particulate Matter (PM_{10})

Emission Trends and Forecasts - Directly Emitted PM_{10}

PM_{10} emissions increase from 1975 to 1990, then decrease slightly in 1995 and 2000, and are projected to slowly increase after 2000. PM_{10} emissions are dominated by area-wide sources. Emissions from paved road dust more than double between 1975 and 2000. Unpaved road dust and other area-wide source emissions increase slightly, while other area-wide sources is unchanged. The increase in emissions of unpaved and paved road dust are due to increases in VMT over these roads. Exhaust emissions from diesel mobile sources dropped by 36 percent from 1990 to 2000 due to more stringent emissions standards and the introduction of cleaner burning diesel fuel. PM_{10} emissions from stationary sources are expected to increase slightly in the future due to industrial growth.

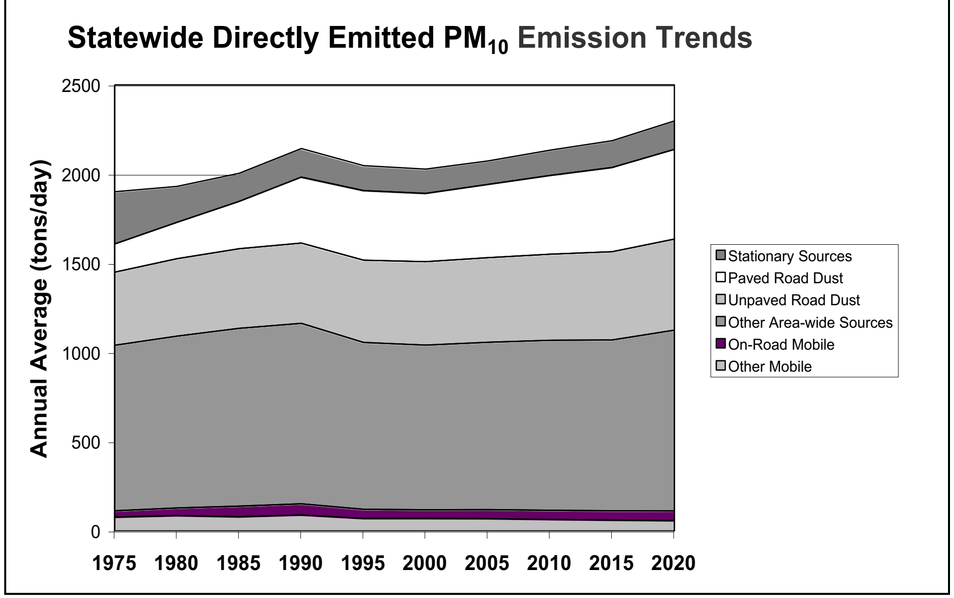

Figure 3-6

Directly Emitted PM_{10} Emission Trends (tons/day, annual average)										
Emission Source	**1975**	**1980**	**1985**	**1990**	**1995**	**2000**	**2005**	**2010**	**2015**	**2020**
All Sources	***1901***	***1931***	***2004***	***2144***	***2047***	***2061***	***2113***	***2177***	***2234***	***2298***
Stationary Sources	293	201	157	160	140	135	132	141	150	159
Area-wide Sources	1496	1601	1708	1831	1787	1808	1862	1920	1971	2027
Paved Road Dust	159	204	266	370	390	383	411	441	472	503
Unpaved Road Dust	409	434	446	450	461	468	474	483	495	511
Other Area-wide Sources	928	963	996	1011	936	923	938	953	957	1013
On-Road Mobile	36	43	60	63	51	49	50	51	52	54
Gasoline Vehicles	22	19	21	25	27	30	34	39	43	47
Diesel Vehicles	14	24	38	38	24	18	16	12	9	8
Other Mobile	77	85	80	89	70	70	69	64	60	57
Gasoline Fuel	6	7	8	10	11	13	15	17	18	19
Diesel Fuel	62	68	61	67	51	49	46	39	34	30
Other Fuel	10	10	10	13	8	8	8	8	8	9

Table 3-6

Directly Emitted Particulate Matter ($PM_{2.5}$)
Emission Trends and Forecasts - Directly Emitted $PM_{2.5}$

$PM_{2.5}$ emissions decrease from 1975 to 1985 as a result of reduced stationary source emissions. Emissions increase slightly between 1995 and 2000 and are projected to increase through 2020. $PM_{2.5}$ emissions are dominated by area-wide sources. Emissions from paved road dust more than double between 1975 and 2000. Unpaved road dust and other area-wide source emissions increase slightly in the same time period. The increase in emissions of unpaved and paved road dust are due to increases in VMT over these roads. Exhaust emissions from diesel mobile sources dropped by 36 percent from 1990 to 2000 due to more stringent emissions standards and the introduction of cleaner burning diesel fuel. $PM_{2.5}$ emissions from stationary sources are expected to increase slightly in the future due to industrial growth.

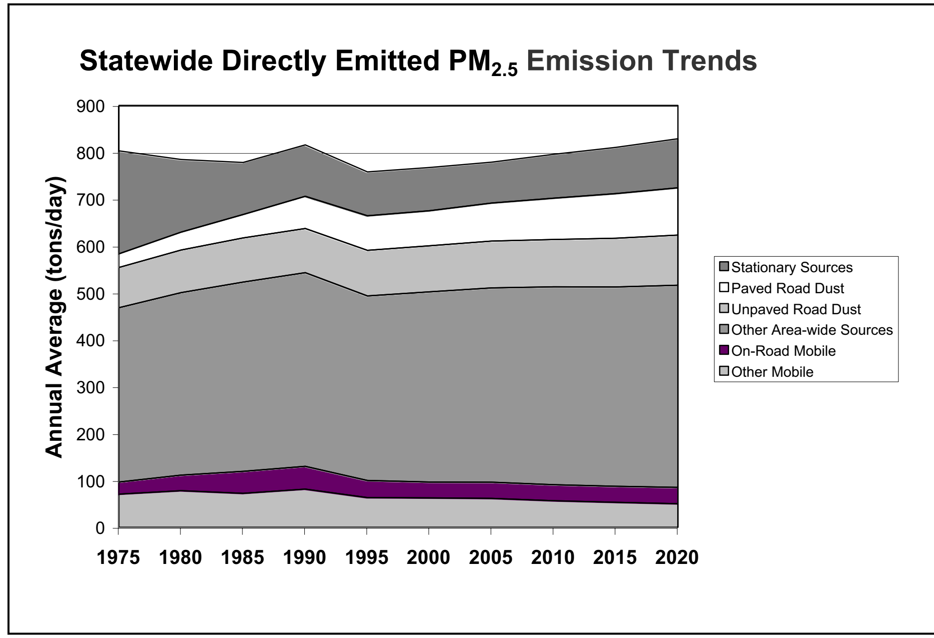

Figure 3-7

Directly Emitted $PM_{2.5}$ Emission Trends (tons/day, annual average)										
Emission Source	**1975**	**1980**	**1985**	**1990**	**1995**	**2000**	**2005**	**2010**	**2015**	**2020**
All Sources	***803***	***785***	***778***	***816***	***758***	***767***	***779***	***796***	***811***	***829***
Stationary Sources	220	155	111	110	93	92	87	94	99	105
Area-wide Sources	487	518	548	576	565	579	596	611	624	639
Paved Road Dust	29	38	50	69	74	75	81	88	95	101
Unpaved Road Dust	86	91	94	94	97	98	100	101	104	107
Other Area-wide Sources	372	389	404	413	394	406	415	422	425	431
On-Road Mobile	26	33	47	48	37	34	34	34	34	35
Gasoline Vehicles	13	11	12	13	15	17	20	23	26	28
Diesel Vehicles	12	22	35	35	22	17	15	11	9	7
Other Mobile	71	78	73	82	63	63	62	57	53	50
Gasoline Fuel	4	5	6	7	8	10	12	13	14	15
Diesel Fuel	57	63	57	62	47	45	42	36	31	27
Other Fuel	10	10	10	13	8	8	8	8	8	8

Table 3-7

Statewide Air Quality - PM_{10}

In contrast to ozone and carbon monoxide, PM_{10} concentrations do not relate as well to growth in population or vehicle usage, and high PM_{10} concentrations do not always occur in high population areas. Activities that contribute directly to high PM_{10} include wood burning, agricultural activities, and driving on unpaved roads. In addition, emissions from stationary sources and motor vehicles form secondary particles that contribute to PM_{10} in many areas. Figure 3-8 shows the statewide annual average of quarters for PM_{10} concentrations for a non-desert area. The trend line reflects, for the most part, the South Coast Air Basin. The low value for the annual average in 1988 is due to the limited number of monitors with complete data for this year during the startup of the PM_{10} monitoring network. The period between 1989 and 2003 provides a better indication of trends. Over this period, the annual average shows a decrease of more than 39 percent. However, there is a great deal of variability, especially during the late 1990's. Much of this variability may be due to meteorology rather than changes in emissions. Currently, over 99 percent of Californians breathe air that violates the State PM_{10} standards during at least part of the year. As a result, PM is commanding greater attention.

In 2003, the Legislature enacted Senate Bill 656 (SB656) to reduce public exposure to PM_{10} and $PM_{2.5}$. SB656 requires the ARB in consultation with local and pollution control districts to develop and adopt a list of the most readily available, feasible, cost-effective control measures that could be employed to reduce PM_{10} and $PM_{2.5}$. The goal is to make progress towards attaining the State and national PM_{10} and $PM_{2.5}$ standards.

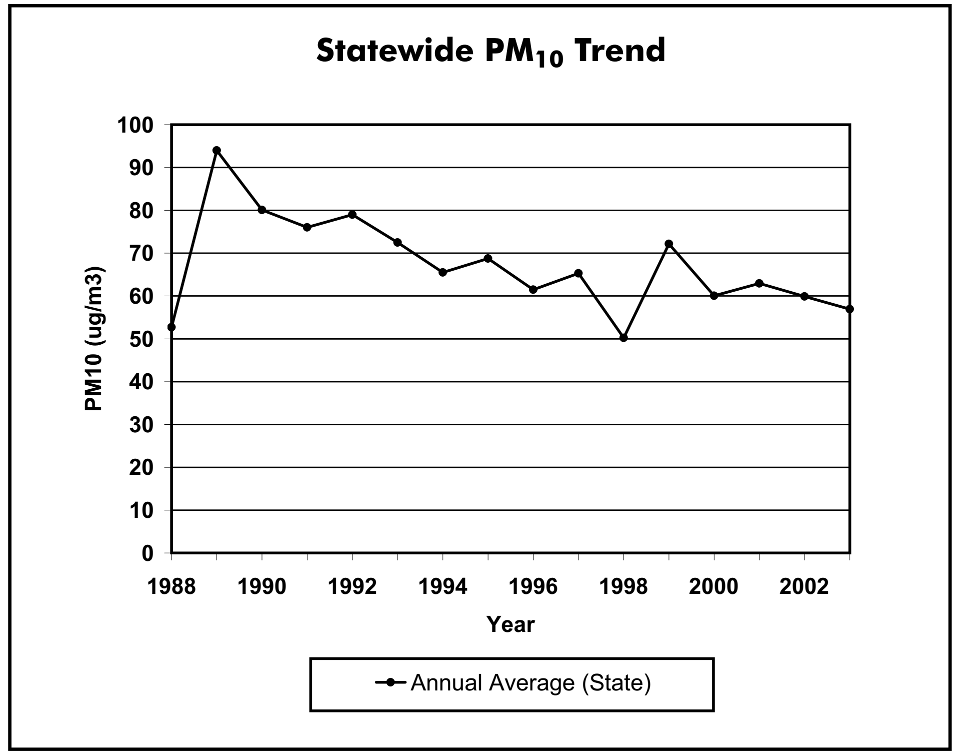

Figure 3-8

Statewide Air Quality - $PM_{2.5}$

Comprehensive monitoring for $PM_{2.5}$ began in 1999, therefore only limited data is available to evaluate statewide trends. Currently, most urban areas in the State, as well as several isolated sub-areas violate the State $PM_{2.5}$ annual average standard. Activities that contribute to high $PM_{2.5}$ concentrations include direct particulate emissions from mobile sources and burning, as well as the formation of $PM_{2.5}$ from the reactions of precursor gases. Figure 3-9 shows the maximum statewide annual average $PM_{2.5}$ concentrations from 1999 through 2003. The trend line reflects for the most part the South Coast Air Basin. Although concentrations in recent years have been relatively stable, over the five year period, the maximum annual average of quarters shows a decrease of approximately 20 percent. Similar to PM_{10}, year to year changes in meteorology can mask the impacts of emission control programs. Several more years are needed before determining longer-term trends. As with PM_{10}, $PM_{2.5}$ represents one of the most formidable health challenges in California. The measures adopted as part of SB656 to reduce PM_{10} and $PM_{2.5}$, as well as programs to reduce ozone and diesel PM will help in reducing public exposure to $PM_{2.5}$.

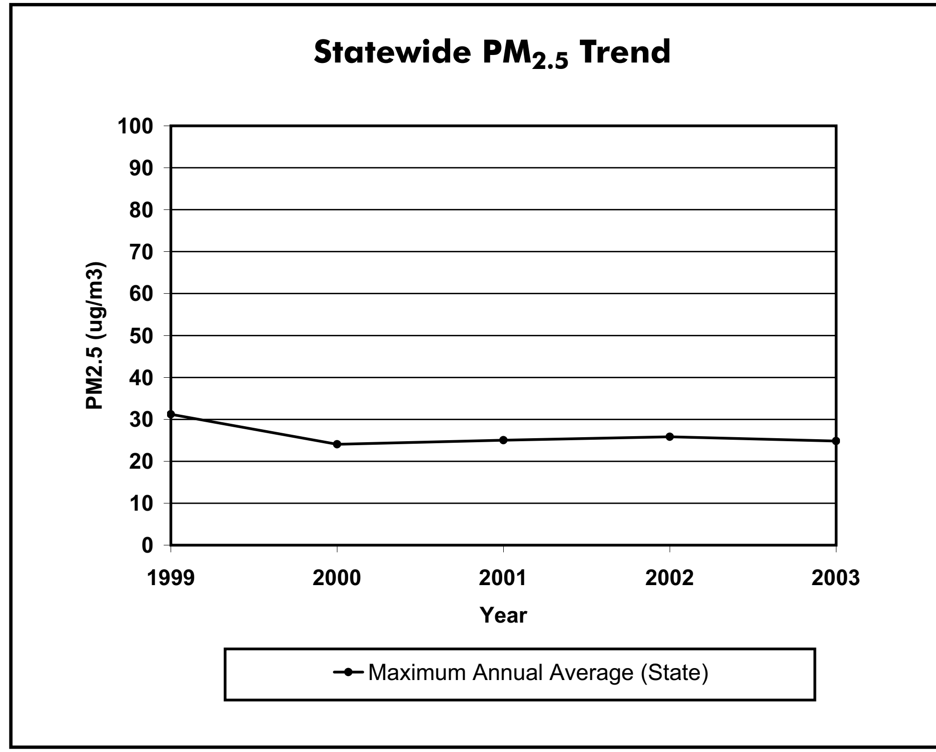

Figure 3-9

Carbon Monoxide (CO)

Emission Trends and Forecasts - Carbon Monoxide

Since 1975, even though VMT have continued to climb, the adoption of more stringent motor vehicle emissions standards has dropped statewide CO emissions from on-road motor vehicles by over 68 percent in 2000. With continued vehicle fleet turnover to cleaner vehicles, including super ultra low emitting vehicles (SULEVs) and zero emission vehicles (ZEVs), and the incorporation of cleaner burning fuels, CO emissions are forecast to continue decreasing through the year 2020. CO emissions from other mobile sources are also projected to decrease through 2015 as more stringent emissions standards are implemented with moderate increases expected after 2015. CO emissions from area-wide sources are expected to increase slightly due to increased waste burning and additional residential fuel combustion resulting from population increases.

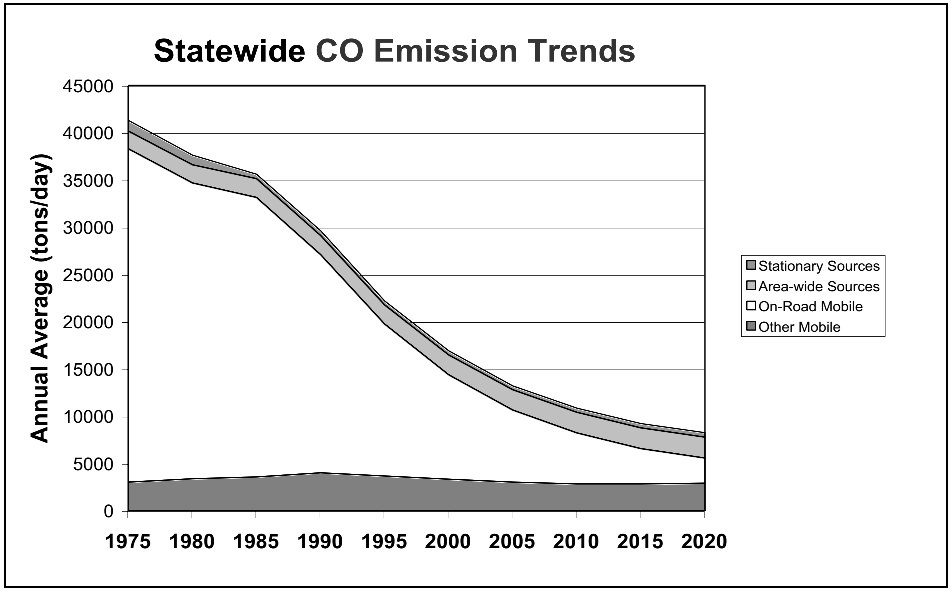

Figure 3-10

CO Emission Trends (tons/day, annual average)										
Emission Source	**1975**	**1980**	**1985**	**1990**	**1995**	**2000**	**2005**	**2010**	**2015**	**2020**
All Sources	***41295***	***37609***	***35588***	***29603***	***22182***	***16906***	***13204***	***10848***	***9213***	***8248***
Stationary Sources	1138	1013	456	498	415	435	411	442	456	475
Area-wide Sources	1873	1925	1997	2017	2010	2089	2146	2181	2191	2207
On-Road Mobile	35269	31295	29565	23087	16090	11059	7629	5397	3744	2661
Gasoline Vehicles	35199	31171	29359	22878	15915	10909	7487	5272	3636	2561
Diesel Vehicles	69	124	205	209	174	150	143	125	108	101
Other Mobile	3016	3376	3570	4001	3667	3322	3018	2828	2823	2905
Gasoline Fuel	2275	2565	2832	3213	2981	2685	2394	2201	2184	2251
Diesel Fuel	358	410	395	426	357	309	270	252	244	241
Other Fuel	383	401	343	362	329	328	354	375	395	413

Table 3-8

Statewide Air Quality - Carbon Monoxide

Similar to ozone, carbon monoxide concentrations in all areas of California have decreased substantially over the last 20 years, despite significant growth. Statewide, the maximum peak 8-hour indicator declined about 43 percent from 1984 to 2003.

During 2003, measured CO concentrations exceeded the State and national standards only in San Diego County. San Diego experienced unusually high CO values during late October, including levels that exceeded the CO standards on October 28, 2003. These high values were due to extensive wildfires that impacted air quality throughout southern California. These types of exceptional events do not affect the area's attainment status.

The introduction of cleaner fuels has helped bring the entire State into attainment with the exception of the City of Calexico. While cleaner fuels will have a continuing impact on carbon monoxide levels, additional emission reductions will be needed in the future to keep pace with increases in population and vehicle usage. These reductions will come from continued fleet turnover, expanded use of low emission vehicles, and measures to promote less polluting modes of transportation.

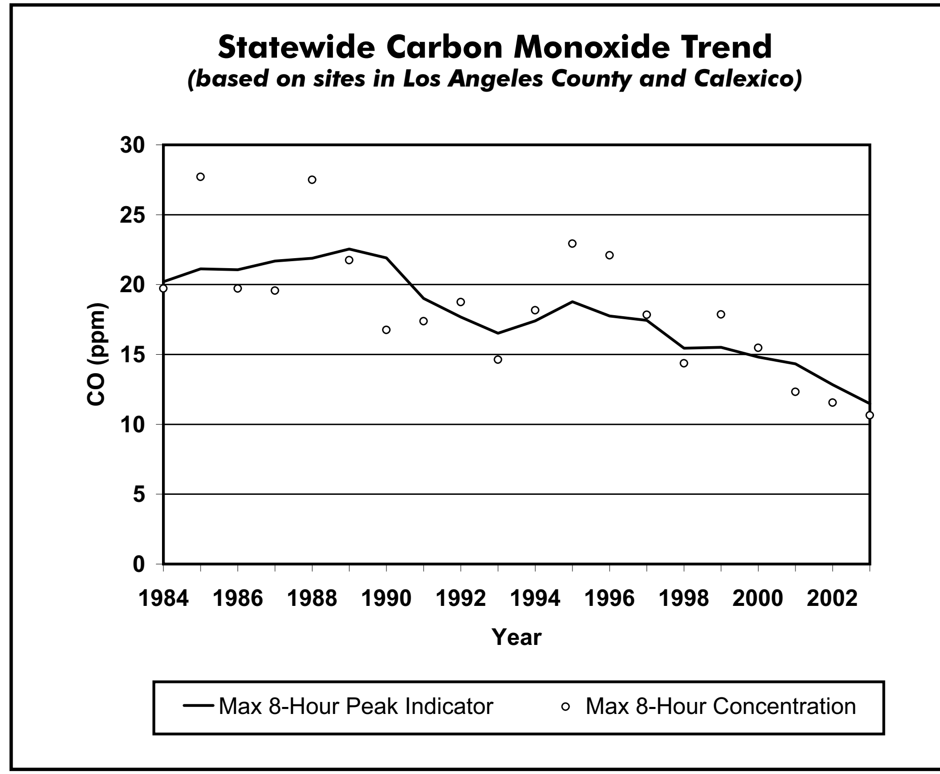

Figure 3-11

Statewide Air Quality - Lead

The decrease in lead emissions and ambient lead concentrations over the past 20 years is California's most dramatic success story. The rapid decrease in lead concentrations can be attributed primarily to phasing out the lead in gasoline. This phase-out began during the 1970s, and subsequent ARB regulations have virtually eliminated all lead from the gasoline now sold in California. All areas of the State are currently designated as attainment for the State lead standard (the U.S. EPA does not designate areas for the national lead standard). Although the ambient lead standards are no longer violated, lead emissions from stationary sources still pose "hot spot" problems in some areas. As a result, the ARB identified lead as a toxic air contaminant in 1997.

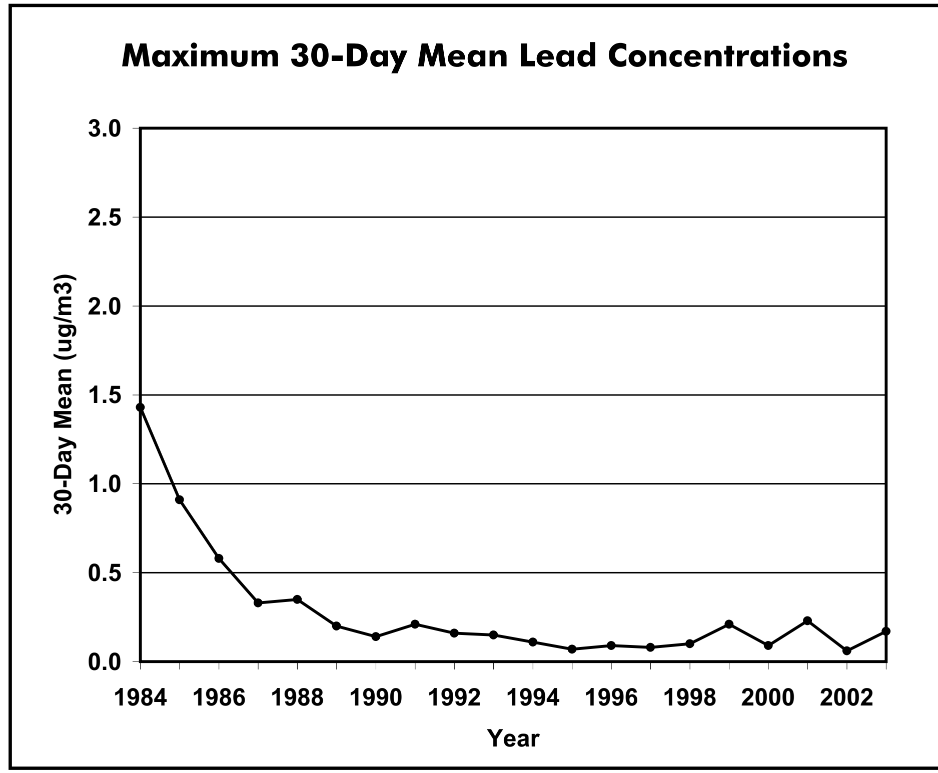

Figure 3-12

Sulfur Dioxide
Emission Trends and Forecasts - Oxides of Sulfur

Oxides of Sulfur (SO_x) is a group of compounds of sulfur and oxygen. A major constituent of SO_x is sulfur dioxide (SO_2). Emissions of SO_x declined tremendously in California between 1975 and 2000. Emissions in 2000 are about 83 percent less than emissions in 1975. Sulfur dioxide emissions from stationary sources decreased between 1975 and 2000 due to improved industrial source controls and switching from fuel oil to natural gas for electric generation and industrial boilers. The SO_x emissions from both gasoline and diesel vehicle exhaust have also decreased due to lower sulfur content in the fuel. SO_x emissions are forecasted to increase slightly by 2020 due to population increases.

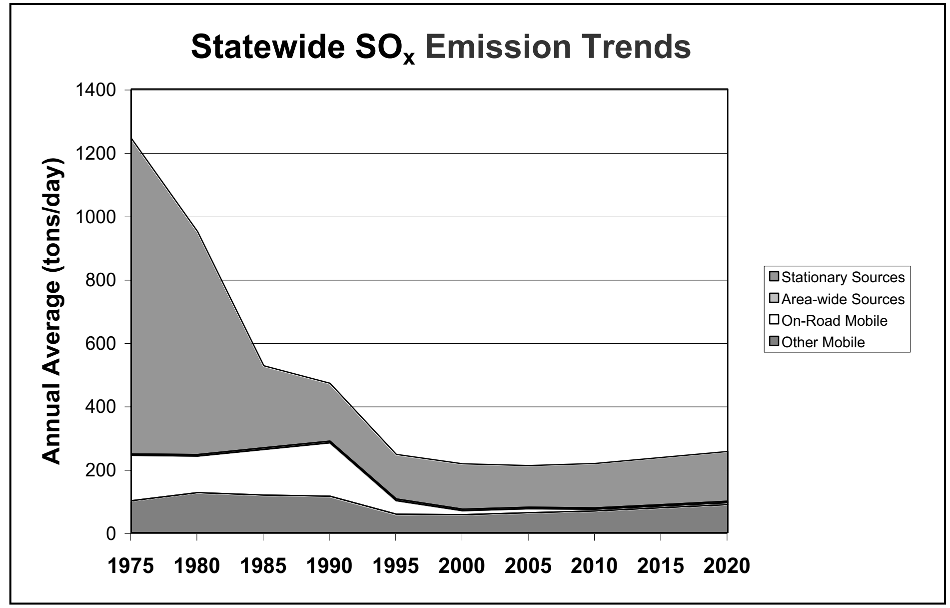

Figure 3-13

SO_x Emission Trends (tons/day, annual average)										
Emission Source	**1975**	**1980**	**1985**	**1990**	**1995**	**2000**	**2005**	**2010**	**2015**	**2020**
All Sources	***1244***	***950***	***526***	***471***	***247***	***217***	***211***	***218***	***237***	***256***
Stationary Sources	996	704	259	182	140	143	131	140	148	157
Area-wide Sources	4	5	5	5	5	5	5	4	4	4
On-Road Mobile	144	115	144	169	43	13	12	5	6	6
Gasoline Vehicles	108	52	55	60	36	5	4	4	5	5
Diesel Vehicles	35	63	89	109	7	7	9	1	1	1
Other Mobile	101	126	119	115	58	57	63	69	79	89
Gasoline Fuel	7	8	9	2	1	1	1	2	2	2
Diesel Fuel	86	111	102	106	50	49	55	61	70	80
Other Fuel	7	7	7	8	7	7	7	6	6	6

Table 3-9

Nitrogen Dioxide

Emission Trends and Forecasts - Oxides of Nitrogen

Nitrogen dioxide (NO_2) is a colorless, tasteless gas that can cause lung damage, chronic lung disease, and respiratory infections. Nitrogen dioxide is a component of oxides of nitrogen (NO_x), and its presence in the atmosphere can be correlated with emissions of NO_x. Statewide emissions of NO_x decreased by 27 percent between 1980 and 200 and are projected to decrease by almost 50 percent from 2000 to 2020 as a result of more stringent emissions standards for stationary source combustion and motor vehicles, and cleaner burning fuels. The introduction of lower emitting vehicles will continue to further reduce NO_x emissions.

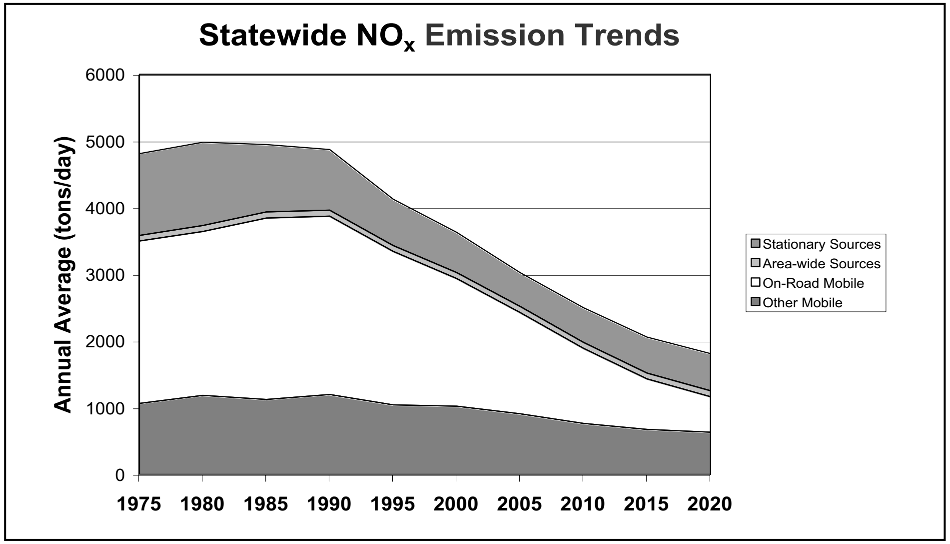

Figure 3-14

NOx Emission Trends (tons/day, annual average)										
Emission Source	**1975**	**1980**	**1985**	**1990**	**1995**	**2000**	**2005**	**2010**	**2015**	**2020**
All Sources	***4811***	***4982***	***4945***	***4871***	***4128***	***3629***	***3026***	***2499***	***2059***	***1811***
Stationary Sources	1228	1250	1009	909	696	602	506	519	538	556
Area-wide Sources	83	88	91	89	87	90	93	89	88	89
On-Road Mobile	2435	2459	2721	2675	2301	1915	1518	1127	757	532
Gasoline Vehicles	2149	1975	1936	1789	1535	1113	757	536	371	266
Diesel Vehicles	286	484	784	885	766	802	761	590	386	266
Other Mobile	1065	1185	1125	1199	1044	1022	908	764	675	634
Gasoline Fuel	43	48	52	61	60	67	74	68	62	60
Diesel Fuel	941	1052	988	1043	899	868	748	614	528	483
Other Fuel	82	85	85	95	85	87	86	83	85	90

Table 3-10

Statewide Air Quality - Nitrogen Dioxide

Oxides of nitrogen (NO_x) emissions are a by-product of combustion from both mobile and stationary sources, and they contribute to ambient nitrogen dioxide (NO_2) concentrations. Since 1984, maximum NO_2 concentrations have decreased over 53 percent, due primarily to the implementation of tighter controls on both mobile and stationary sources. Although many of these controls were implemented to reduce ozone, they also benefited NO_2. All areas of California are currently designated as attainment for the State nitrogen dioxide standard and unclassified/attainment for the national nitrogen dioxide standard. Projections show NO_x emissions will continue to decline, thereby assuring continued attainment.

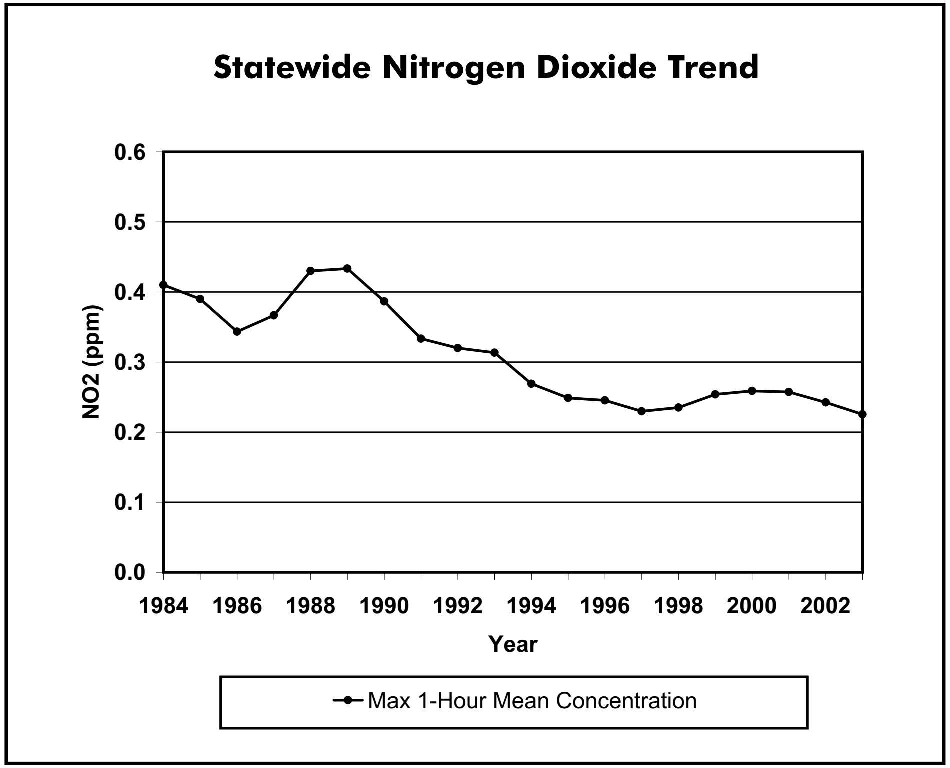

Figure 3-15

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