Chapter 3

Statewide Trends and Forecasts -- Criteria Pollutants

Introduction
Emission Trends and Forecasts

The most current emissions data available are from 2006. These data were presented in the previous edition of the Almanac and will be updated in the 2009 Almanac. Any data prior to this year are derived from historical emissions data where available, and backcasted emissions based on historical socioeconomic growth and control information. Future year data are forecasted from the 2006 base year and control measures reported through September 2006. Forecasts take into account emissions data, projected growth rates, and future adopted control measures to calculate emissions in future years.

On a statewide basis, emissions of NO_x increased between 1975 and 1980, decreased slightly in 1985, and are forecasted to decline between 1990 and 2020. Emissions of ROG decrease 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 an increase from 1975 to 1990, a slight decrease in 1995, hold relatively constant from 1995 to 2010, and then a slow increase after 2010. Direct $PM_{2.5}$ emissions decreased from 1975 to 1985, increased from 1985 to 1990, decreased slightly between 1990 and 1995, held relatively constant from 1995 to 2015, and are predicted to increase after 2015.

Emissions of CO have decreased since 1985 and are forecasted to continue declining. The recent decreases in NO_x, ROG, and CO are occurring even with increases in population and VMT.

Statewide SO_x emissions decreased sharply from 1975 through 1985, decreased steadily through 1995, and remained relatively constant through 2010. On-shore SO_x emissions are projected to increase moderately through 2020. Off-shore emissions are projected to increase substantially through 2020 due to increased shipping activity. In 2005, off-shore emissions represent approximately 40 percent of the statewide SO_x emission inventory. By 2020, off-shore emissions are forecasted to comprise 56 percent of the statewide SO_x emissions.

Statewide Emissions (tons/day, annual average)										
Pollutant	**1975**	**1980**	**1985**	**1990**	**1995**	**2000**	**2005**	**2010**	**2015**	**2020**
NO_X	4928	4941	4791	4991	4429	4025	3556	3025	2553	2273
ROG	7128	6598	5998	4707	3741	3084	2410	2087	1953	1911
PM_{10}	1864	1898	1982	2208	2105	2173	2125	2123	2186	2261
PM_{25}	718	693	691	754	687	696	685	680	690	709
SO_X	1277	953	529	504	294	285	295	323	382	462
CO	42207	37991	35302	30119	22439	17237	13167	10598	9188	8419

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 1987 through 2006, statewide maximum 8-hour ozone values decreased 32 percent, and maximum 8-hour carbon monoxide values dropped 50 percent. These air quality improvements occurred at the same time the State's population increased 35 percent and the average daily VMT increased 56 percent. Ambient annual average PM_{10} values in the non-desert areas also show improvement: a 23 percent decrease from 1989 to 2006. While the air quality improvements are impressive, additional emission controls will be needed to offset future growth.

Percent Change in Air Quality and Growth

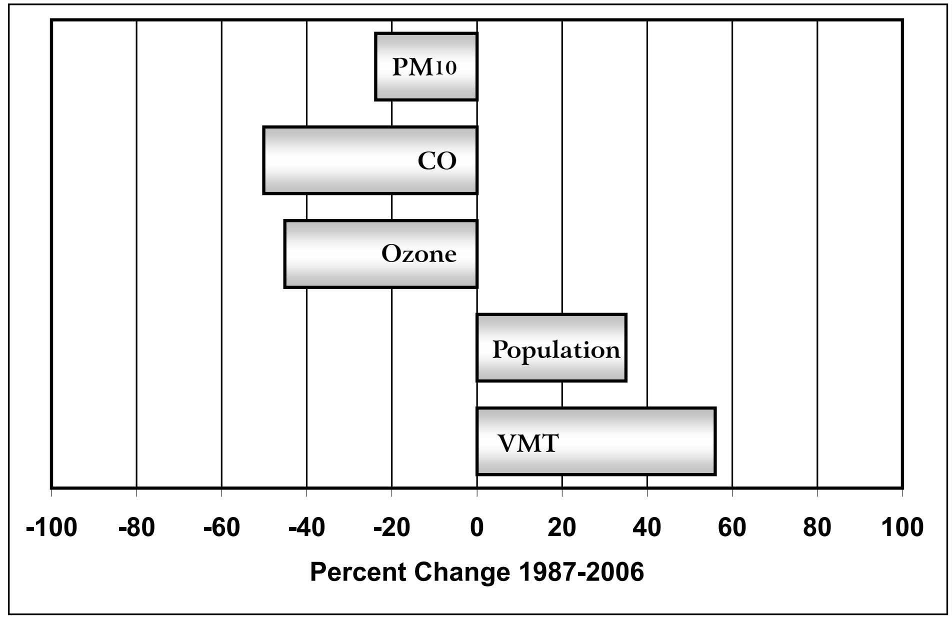

Figure 3-1

Statewide Population and VMT Trends									
Parameter	1980	1985	1990	1995	2000	2005	2010	2015	2020
Population	23782000	26402401	29828496	31711849	34098740	37004660	39246767	41549270	43851741
Avg. Daily VMT/1000	403567	538319	691048	733629	799848	955233	958078	1033400	1104522

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 23 percent from 1990 to 2000. NO_x emissions are projected to decrease by 66 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.

NOx emissions from other mobile categories on the whole decreased from 1990 to 2020. The two largest NOx contributors in the other mobile category are off-road combustion equipment and ships. The emissions from off-road combustion equipment decrease significantly over the entire forecast period. However, the emissions for ships have increased to better reflect actual shipping activity resulting in a fairly constant NO_x emission level for the trend and forecast period for the other mobile category as a whole. Stationary source NO_x emissions dropped by 68 percent between 1980 and 2005. 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. 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.*

In the previous edition of the Almanac, the NO_x emissions were lower for on-road motor vehicles from 1995 onward and lower for other mobile sources from 1990 onward. The higher values in this edition reflect the use of the EMFAC2007 and OFFROAD2007 models. Also

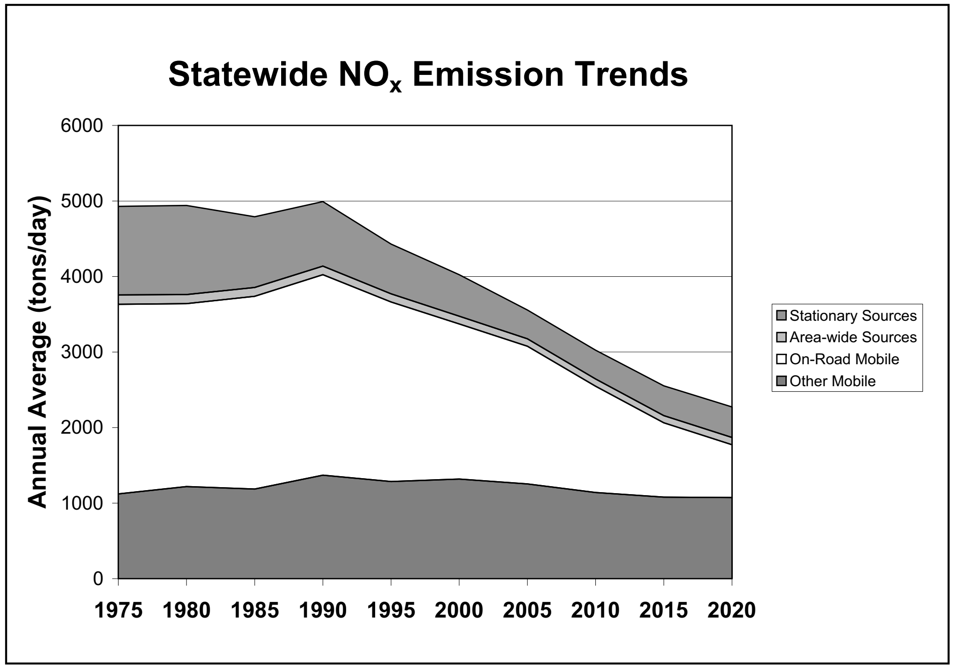

Figure 3-2

in this edition, lower NO_x values for area-wide sources after 1995 are mainly the result of updates to the statewide waste burning categories.

ROG Emission Trends and Forecasts

ROG emissions in California are projected to decrease by over 73 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, 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*.

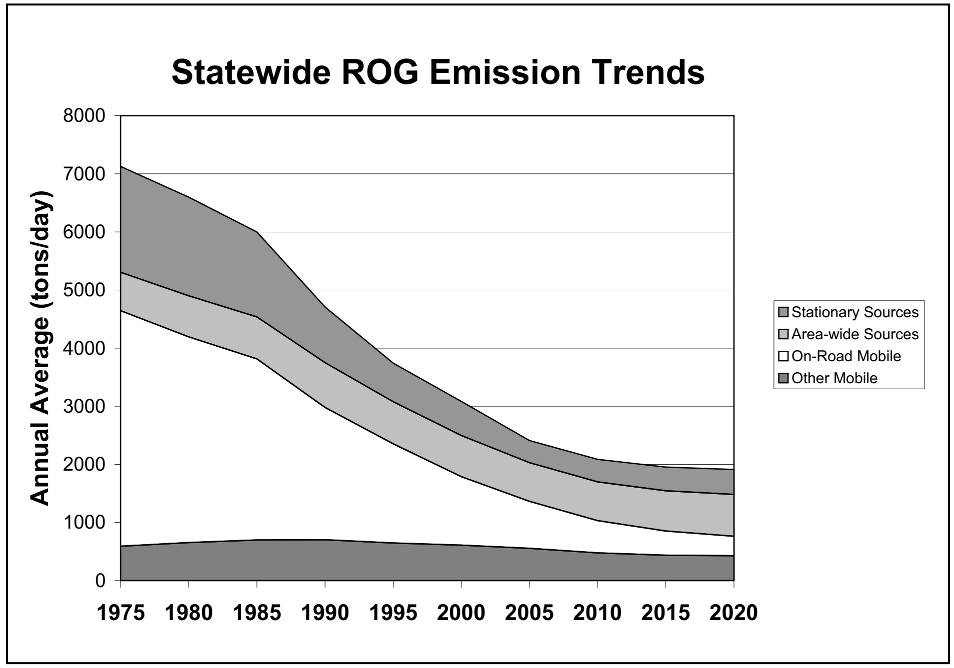

Figure 3-3

The ROG emissions for other mobile sources are generally higher than the emissions presented in the previous edition of the Almanac. This is due to the use of the OFFROAD2007 model. Also, the ROG emissions for area-wide sources are lower than in the previous edition, due to updates for the waste burning categories.

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	***4928***	***4941***	***4791***	***4991***	***4429***	***4025***	***3556***	***3025***	***2553***	***2273***
Stationary Sources	1172	1180	936	853	659	551	381	381	394	404
Area-wide Sources	125	121	117	114	108	102	99	96	95	97
On-Road Mobile	2510	2421	2552	2654	2377	2053	1823	1407	984	699
Gasoline Vehicles	2197	2014	1958	1839	1574	1160	754	504	359	263
Diesel Vehicles	312	407	593	815	803	893	1069	904	625	435
Other Mobile	1122	1219	1186	1370	1286	1319	1254	1140	1079	1074
Gasoline Fuel	52	57	62	72	70	70	76	68	64	64
Diesel Fuel	917	1002	954	1095	980	966	854	696	567	464
Other Fuel	154	160	169	202	237	284	325	376	448	546

Table 3-3

ROG Emission Trends (tons/day, annual average)										
Emission Source	**1975**	**1980**	**1985**	**1990**	**1995**	**2000**	**2005**	**2010**	**2015**	**2020**
All Sources	***7128***	***6598***	***5998***	***4707***	***3741***	***3084***	***2410***	***2087***	***1953***	***1911***
Stationary Sources	1822	1697	1460	958	664	588	381	389	408	428
Area-wide Sources	661	707	723	771	724	708	666	666	692	720
On-Road Mobile	4054	3540	3116	2275	1706	1179	808	555	417	334
Gasoline Vehicles	4015	3487	3044	2184	1645	1120	743	497	373	302
Diesel Vehicles	39	53	72	91	62	59	65	58	44	33
Other Mobile	591	654	699	703	647	610	555	477	436	428
Gasoline Fuel	416	462	518	498	457	436	396	341	316	316
Diesel Fuel	123	137	129	149	140	131	116	91	70	57
Other Fuel	52	56	52	56	50	42	43	45	50	56

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 peak 8-hour and 1-hour indicators declined by over 45 percent and over 53 percent respectively from 1987 to 2006.

During 1987 to 2006, the statewide population grew by 35 percent and the number of vehicle miles traveled each day was up more than 56 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 (LEV) standards, which equate to about 95 percent fewer smog-forming emissions than vehicles produced in the 1970s.

In recent years, increases in population and driving are partially offsetting the benefits of ARB's emission control programs. As part of the SIP, California will be implementing a comprehensive set of new programs. These programs will include new emission control standards as well as very innovative incentive programs to accelerate clean air technologies and reduce emissions from goods movement. These programs are now being developed and implemented at the National, State, and local levels.

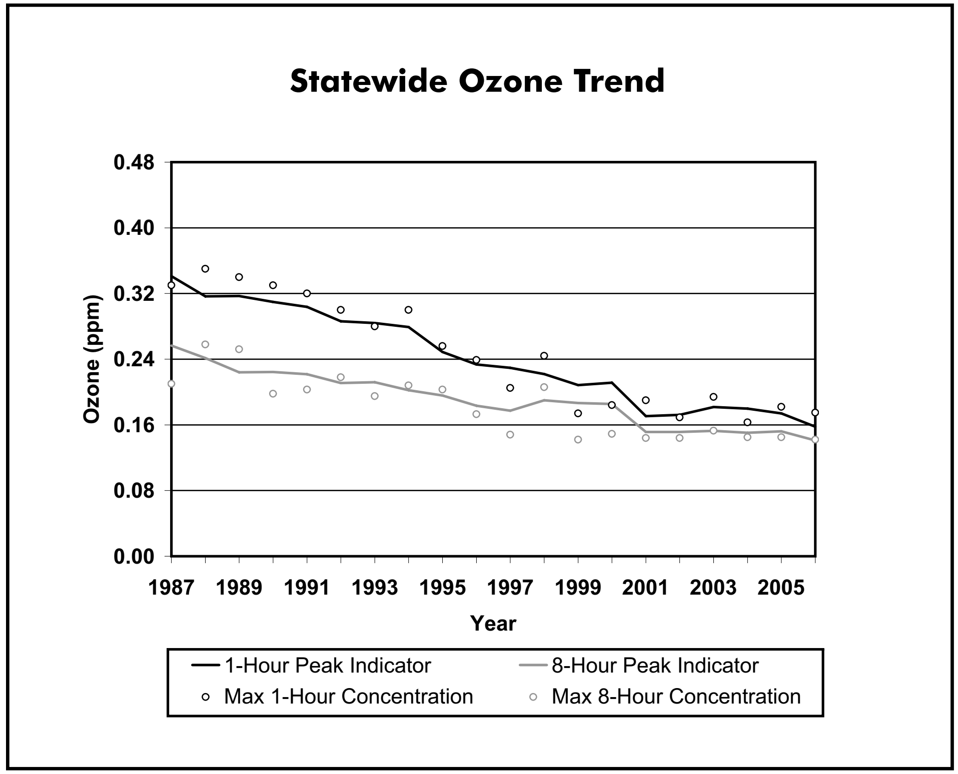

Figure 3-4

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 an 8-hour ozone concentration outdoors that is higher than 0.070 ppm, the level of the State 8-hour 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 daily 8-hour ozone exposures during the year and presents the result as an average per exposed person. For a more detailed discussion see Appendix B.

In Figure 3-5, the population-weighted exposures have been graphed from 1985 to 2006 in order to provide a visual representation of how the ozone exposures, in ppm-hours/person, are distributed over the years and how they compare with the increase in population. These values are meant to be a general representation of ozone exposure in the South Coast Air Basin. This graph gives a good indication of how ozone exposures have been steadily declining while the population has been increasing. For example, in Table 3-5 South Coast shows the highest exposure of all five air basins, however, the graph makes it clear that this exposure has been significantly declining and is now one fifth of what it was two decades ago.

The population-weighted exposures in Table 3-5 are listed for each year, from 1985 through 2006, for the five most populated areas of California. While these areas do not encompass all of California’s ozone nonattainment areas, they do include the urban areas where 86 percent of the State’s population lives.

This table also lists the percent of the total population represented in the exposure value. This reflects the percent of the total population in the area that was exposed to an ozone concentration above the level of the State 8-hour standard for at least one 8-hour period during the year. This method provides a reasonable approach for comparing exposures among various regions and for assessing trends in exposure reductions.

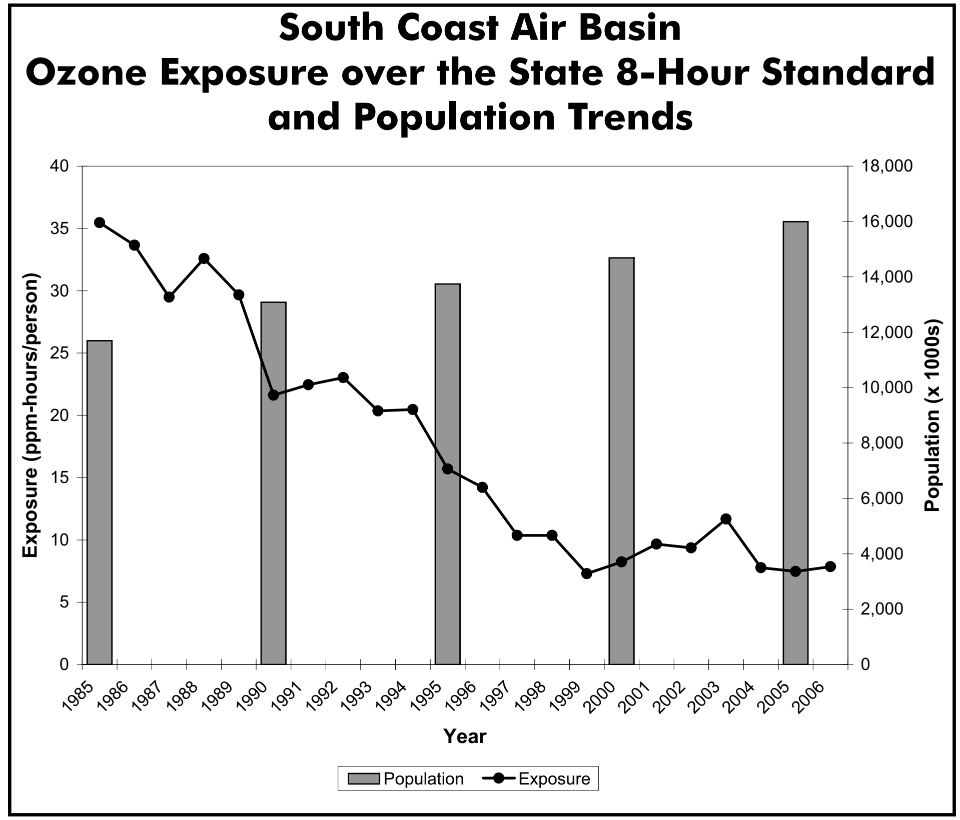

Figure 3-5

Ozone Exposures Over the State 8-Hour Standard: Population-Weighted (ppm-hours / person)																					
	1986	**1987**	**1988**	**1989**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**
South Coast Air Basin																					
Exposure	33.66	29.48	32.59	29.67	21.62	22.45	23.03	20.36	20.47	15.70	14.22	10.36	10.36	7.29	8.24	9.67	9.36	11.68	7.77	7.47	7.85
% Pop. Represented *	100%	100%	100%	100%	100%	100%	100%	100%	100%	98%	98%	99%	92%	95%	97%	97%	81%	97%	100%	98%	84%
San Francisco Bay Area Air Basin																					
Exposure	1.49	3.30	2.90	1.39	0.98	0.87	1.18	0.92	0.74	1.68	1.58	0.23	1.52	1.21	0.62	0.73	0.68	0.67	0.33	0.27	0.90
% Pop. Represented	47%	69%	90%	59%	41%	41%	51%	66%	36%	88%	60%	68%	42%	64%	18%	34%	36%	68%	42%	41%	44%
San Joaquin Valley Air Basin																					
Exposure	18.58	19.42	18.83	13.76	10.86	12.23	11.65	12.50	11.02	11.52	13.96	9.50	11.70	12.02	11.49	12.18	12.86	12.17	7.50	6.32	8.22
% Pop. Represented	97%	97%	98%	98%	98%	99%	99%	99%	99%	99%	99%	99%	99%	99%	99%	99%	99%	99%	99%	99%	99%
San Diego Air Basin																					
Exposure	8.37	8.64	10.88	10.97	9.63	7.54	6.25	5.31	5.19	4.59	3.49	1.96	3.58	2.76	2.85	2.41	1.77	2.12	1.64	1.39	2.38
% Pop. Represented	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	98%	94%	90%	100%	86%	54%	100%	42%	73%
Broader Sacramento Metropolitan Area																					
Exposure	5.37	6.90	8.19	4.54	4.88	5.64	5.49	2.77	4.41	4.82	5.15	2.09	4.23	4.58	3.19	3.51	4.68	3.72	2.28	2.88	3.94
% Pop. Represented	95%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

* *% Population Represented* is the percent of the total population residing in an area exposed to an ozone concentration above the level of the State 8-hr standard for at least one 8-hour period during the year.

Table 3-5

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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 3-6 shows the upwind areas that impact downwind areas throughout the State.

The ozone problem in the southern desert areas and some rural areas is significantly impacted by transported pollutants. National ozone air quality plans take into account the shared responsibility between upwind and downwind areas where transport can at times be signficant. Areas impacted by overwhelming transport, although designated nonattainment, are not required to adopt an air quality plan to meet State standards 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 LEVs. More detailed information about ozone transport is available on the web at *www.arb.ca.gov/aqd/transport/transport.htm*.

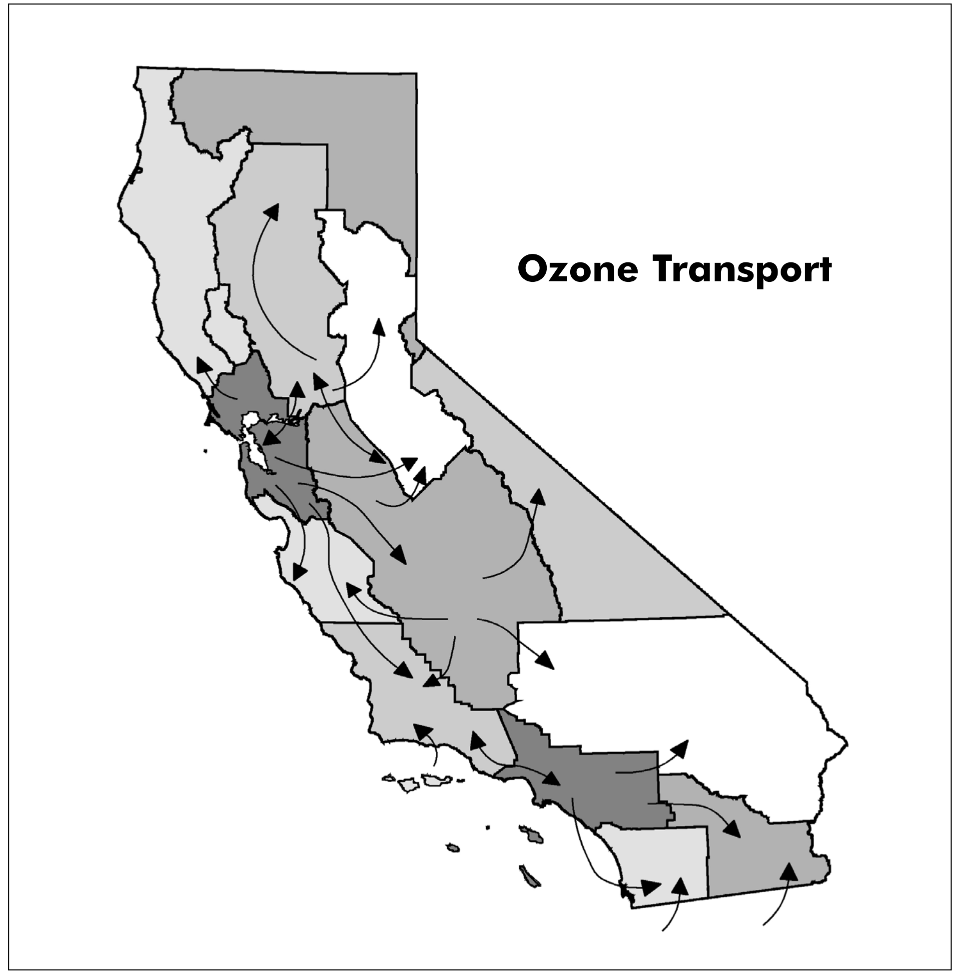

Figure 3-6

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, increase in 2000, decrease in 2005, and are projected to slowly increase after 2005. PM_{10} emissions are dominated by area-wide sources. Emissions from paved road dust more than double between 1975 and 2000. Unpaved road dust emissions generally increase through the forecast period. Other area-wide sources include farming operations, construction and demolition, and fugitive wind blown dust from agricultural lands. Emissions from these categories have compensating effects resulting in a fairly constant statewide emission level; emissions increase slightly over the forecast 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 39 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.

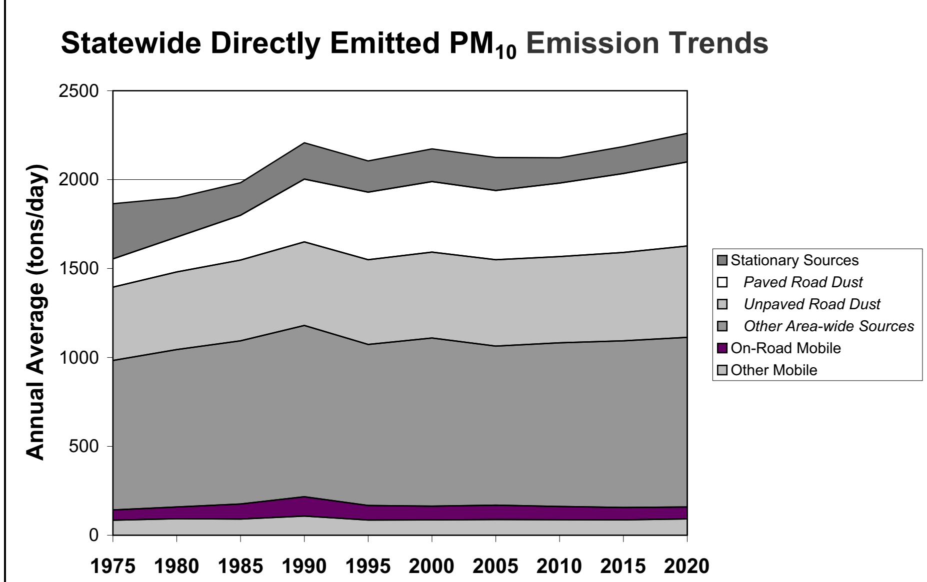

Figure 3-7

Directly Emitted PM_{10} Emission Trends (tons/day, annual average)										
Emission Source	**1975**	**1980**	**1985**	**1990**	**1995**	**2000**	**2005**	**2010**	**2015**	**2020**
All Sources	***1864***	***1898***	***1982***	***2208***	***2105***	***2173***	***2125***	***2123***	***2186***	***2261***
Stationary Sources	310	221	183	204	176	184	186	142	152	161
Area-wide Sources	1412	1518	1623	1787	1762	1826	1770	1819	1878	1941
Paved Road Dust	159	196	251	354	379	397	390	413	444	473
Unpaved Road Dust	412	437	454	470	477	483	486	485	497	514
Other Area-wide Sources	841	885	918	963	906	946	895	921	937	954
On-Road Mobile	57	66	85	109	82	77	81	75	69	66
Gasoline Vehicles	23	20	22	27	29	33	39	42	47	51
Diesel Vehicles	34	46	63	82	53	44	42	33	23	15
Other Mobile	85	93	91	107	86	87	88	87	87	92
Gasoline Fuel	6	7	9	10	11	12	12	15	18	22
Diesel Fuel	60	66	61	71	52	50	46	37	26	18
Other Fuel	19	20	21	26	23	25	30	35	42	52

Table 3-6

The PM_{10} emissions for area-wide sources are lower than the emissions presented in the previous edition of the Almanac, due to updated fugitive dust emission estimates. The emissions for stationary sources are higher between 1975 and 2005 than in the previous edition, mainly due to updated cement production estimates for the South Coast air basin. Also, the emissions for on-road motor vehicles are higher than in the previous edition, due to the use of the EMFAC2007 model.

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

Emission Trends and Forecasts - Directly Emitted $PM_{2.5}$

$PM_{2.5}$ emissions decrease from 1975 to 1980 as a result of reduced stationary source emissions. Emissions increase slightly between 1980 and 1990, hold steady through 2005, and are projected to increase after 2005. $PM_{2.5}$ emissions are dominated by area-wide sources. Emissions from paved road dust more than double between 1975 and 2000. Unpaved road dust emissions increase through the year 1990, decrease in 1995, hold relatively constant through the year 2010, with increased emissions expected after 2015. Other area-wide source emissions increase slightly over the forecast 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 38 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.

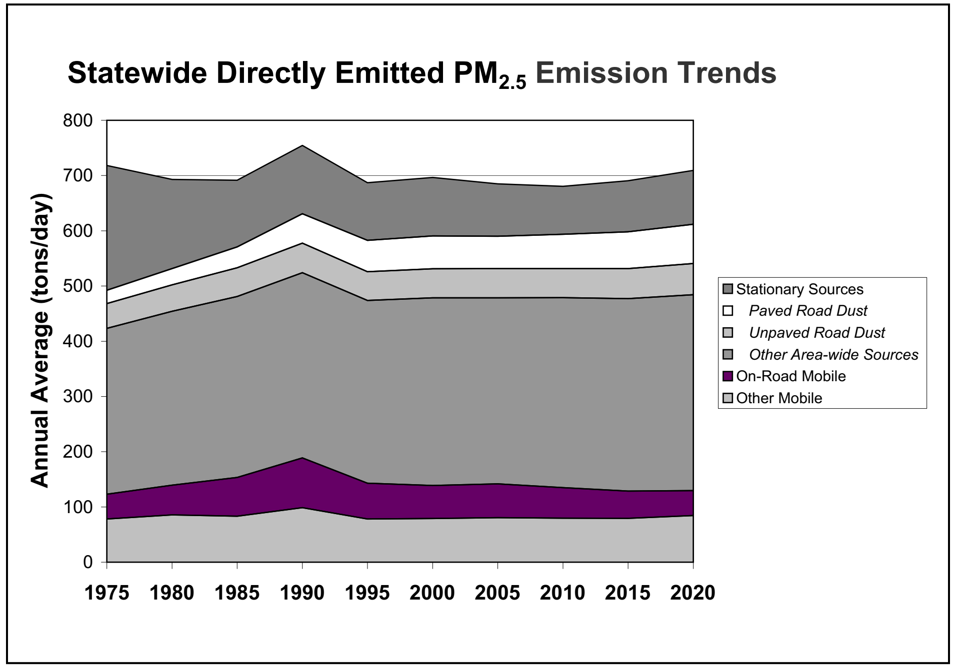

Figure 3-8

The $PM_{2.5}$ emissions for area-wide sources are lower than the emissions presented in the previous edition of the Almanac, due to updated fugitive dust emission estimates and to updated size fractions. The emissions for on-road motor vehicles are higher than in the previous edition and reflect the use of the EMFAC2007 model.

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	***718***	***693***	***691***	***754***	***687***	***696***	***685***	***680***	***690***	***709***
Stationary Sources	226	161	121	124	104	106	95	87	92	98
Area-wide Sources	369	392	417	442	440	452	448	459	469	482
Paved Road Dust	24	29	38	53	57	60	58	62	67	71
Unpaved Road Dust	45	48	52	54	52	53	53	53	54	56
Other Area-wide Sources	300	315	328	335	331	340	337	344	348	355
On-Road Mobile	45	54	70	90	65	60	61	55	49	45
Gasoline Vehicles	14	11	12	14	16	19	23	25	28	31
Diesel Vehicles	31	42	58	76	49	41	38	30	21	14
Other Mobile	78	85	83	99	78	79	81	80	79	84
Gasoline Fuel	4	5	7	8	8	9	9	11	14	17
Diesel Fuel	55	60	56	65	48	46	42	34	24	17
Other Fuel	19	20	21	25	23	24	29	34	41	51

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 3-9 shows the statewide annual average 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 2006 provides a better indication of trends. Over this period, the three-year average of the annual average shows a decrease of more than 33 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 live in air basins with concentrations that violate 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 (SB 656) to reduce public exposure to PM_{10} and $PM_{2.5}$. As a first step in the implementation of SB 656, in November 2004, the ARB approved an extensive list of the most readily available, feasible, cost-effective control measures that can be employed by air districts to reduce PM_{10} and $PM_{2.5}$. Recently, air districts adopted implementation schedules for the subset of measures selected to address the nature and severity of their PM problem. The goal is to make progress towards attaining the State and national PM_{10} and $PM_{2.5}$ standards.

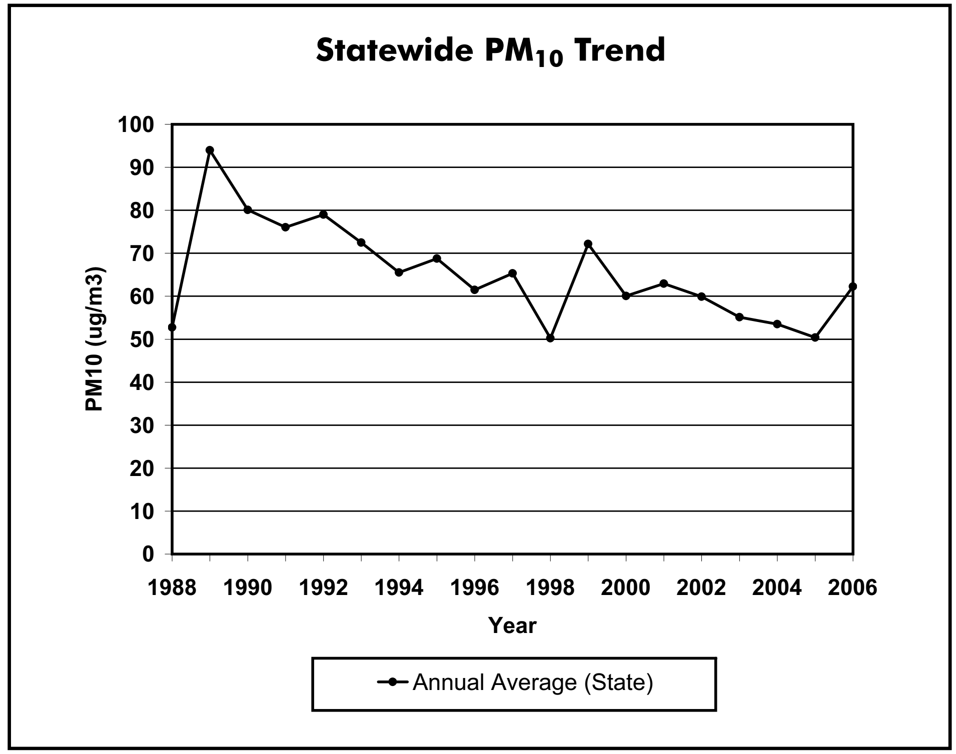

Figure 3-9

Statewide Air Quality - $PM_{2.5}$

Comprehensive monitoring for $PM_{2.5}$ began in 1999, therefore only limited data are 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. Attainment plans due in 2008, for the national $PM_{2.5}$ standards, are the focus of current planning efforts.

Figure 3-10 shows the maximum statewide annual average $PM_{2.5}$ concentrations from 1999 through 2006 from the national perspective. The national annual average is also used in the air basin summaries in Chapter 4. The trend line reflects the South Coast Air Basin. Over the seven year period, the annual average shows a decrease of over 31 percent. Similar to PM_{10}, year-to-year changes in meteorology can mask the impacts of emission control programs.

As with PM_{10}, $PM_{2.5}$ represents one of the most formidable health challenges in California. The measures adopted as part of SB 656 to reduce PM_{10} and $PM_{2.5}$ (program description can be found on the ARB website at *www.arb.ca.gov/pm/pmmeasures/pmmeasures.htm*), as well as programs to reduce ozone and diesel PM will help in reducing public exposure to $PM_{2.5}$.

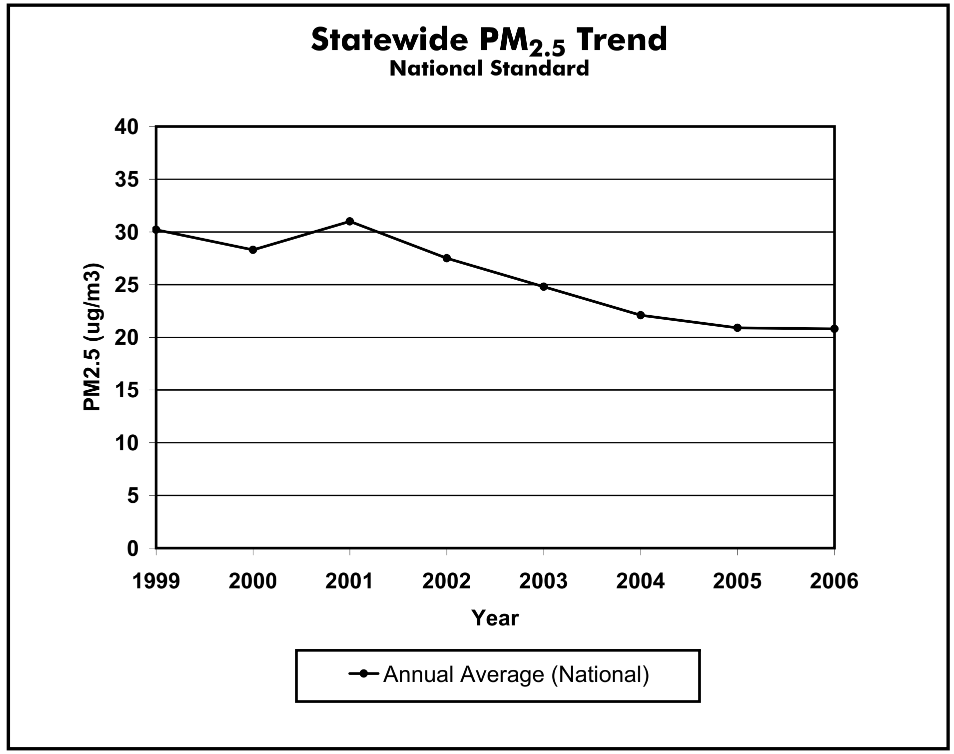

Figure 3-10

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 78 percent in 2005. 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 2010 as more stringent emissions standards are implemented with moderate increases expected after 2010. 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.

The CO emissions for area-wide sources are lower than the emissions presented in the previous edition of the Almanac, due to updates to the statewide waste burning categories.

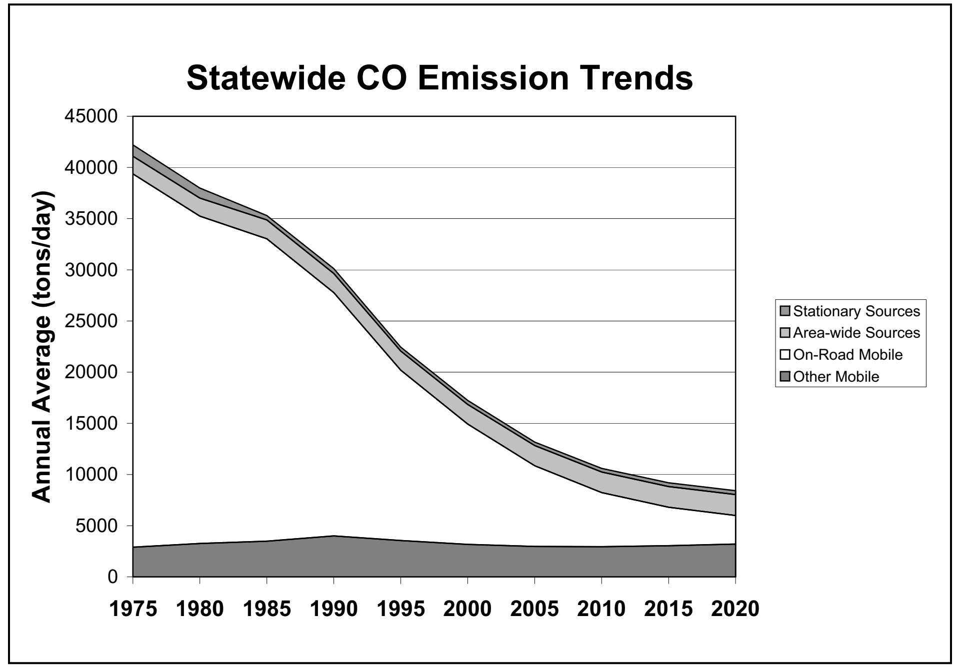

Figure 3-11

CO Emission Trends (tons/day, annual average)										
Emission Source	**1975**	**1980**	**1985**	**1990**	**1995**	**2000**	**2005**	**2010**	**2015**	**2020**
All Sources	***42207***	***37991***	***35302***	***30119***	***22439***	***17237***	***13167***	***10598***	***9188***	***8419***
Stationary Sources	1113	984	425	478	375	389	340	354	367	379
Area-wide Sources	1716	1763	1847	1866	1873	1917	1965	2006	2021	2043
On-Road Mobile	36483	31987	29546	23775	16644	11762	7895	5290	3759	2793
Gasoline Vehicles	36342	31796	29281	23432	16339	11491	7612	5034	3553	2623
Diesel Vehicles	141	191	265	343	305	271	283	256	207	170
Other Mobile	2894	3257	3483	4001	3546	3169	2967	2947	3041	3205
Gasoline Fuel	2093	2380	2660	3068	2690	2394	2219	2179	2222	2327
Diesel Fuel	396	448	439	529	474	416	364	361	382	410
Other Fuel	405	428	384	404	382	358	383	407	436	467

Table 3-8

Statewide Air Quality - Carbon Monoxide

Similar to ozone, CO 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 63 percent from 1987 to 2006. California now meets all CO standards.

The introduction of cleaner fuels has helped bring the entire State into attainment. The U.S. EPA recently redesignated the South Coast as attainment, effective June 11, 2007. While cleaner fuels will have a continuing impact on CO 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 LEVs, and measures to promote less polluting modes of transportation.

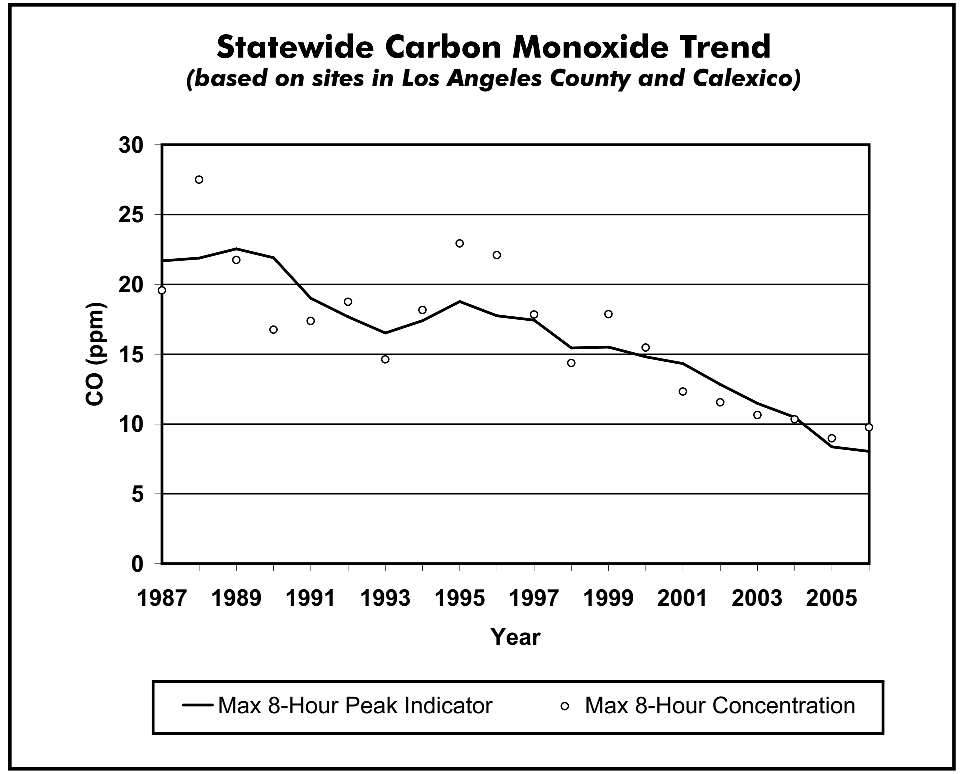

Figure 3-12

Statewide Air Quality - Lead

The decrease in lead emissions and ambient lead concentrations over the past 32 years is California's most dramatic success story. For the purpose of understanding the progress and impact of emission controls a more exhaustive historical record is provided.

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 TAC in 1997. Additionally, the EPA is currently reviewing the national lead standards and is considering revising the standard, with the final rule expected to be published on September 1, 2008.

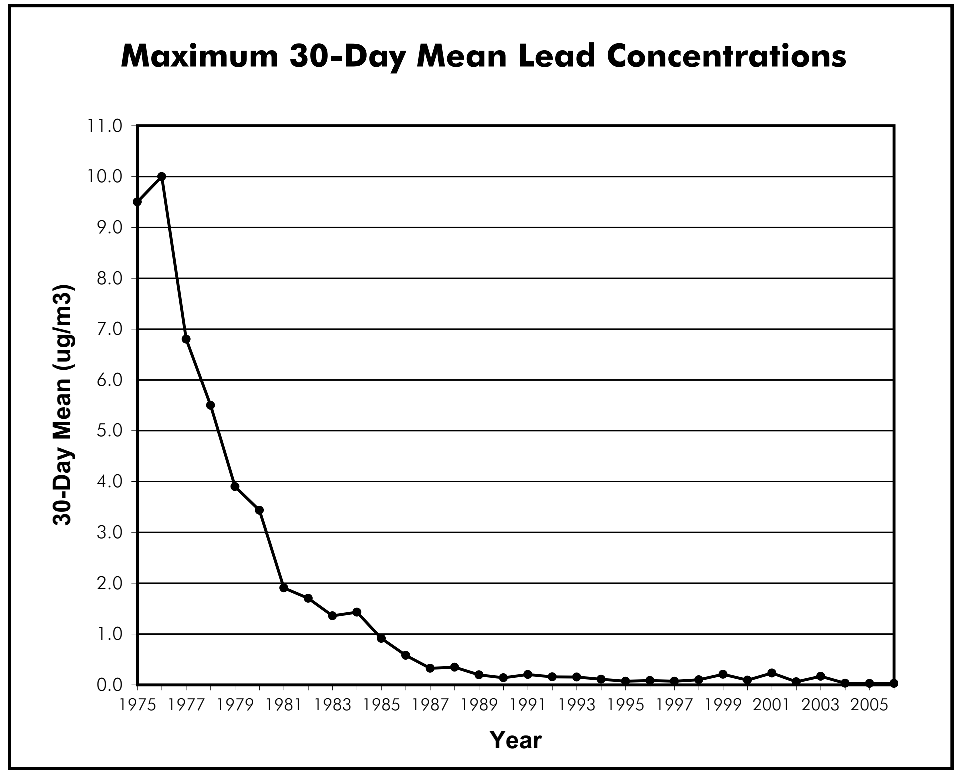

Figure 3-13

Sulfur Dioxide

Emission Trends and Forecasts - Oxides of Sulfur

Oxides of Sulfur (SO_x) are 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 2005. Emissions in 2005 are about 77 percent less than emissions in 1975. Sulfur dioxide emissions from stationary sources decreased between 1975 and 2005 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 land-based on- and off-road gasoline and diesel-fueled engines and vehicles have also decreased due to lower sulfur content in the fuel; and recent regulations adopted by the ARB will reduce the sulfur content in fuel used by commercial harbor craft such as tug boats and fishing vessels beginning in 2006. However, as shown in the table below, the SO_x emissions from the "other mobile" categories are expected to increase in the future. This is due to the significant growth in shipping activities predicted for California and the high-sulfur fuels that ocean-going ships typically use. The ARB recently adopted a regulation for fuels used in ship auxiliary engines that will help offset this trend. Substantial reductions in SO_x emissions will occur with implementation of this regulation. In addition, ARB is investigating other options for reversing this trend.

SO_x Emission Trends (tons/day, annual average)										
Emission Source	**1975**	**1980**	**1985**	**1990**	**1995**	**2000**	**2005**	**2010**	**2015**	**2020**
All Sources	***1277***	***953***	***529***	***504***	***294***	***285***	***295***	***323***	***382***	***462***
Stationary Sources	996	705	262	183	138	140	113	118	124	131
Area-wide Sources	6	6	7	7	7	7	6	6	6	6
On-Road Mobile	159	118	142	168	43	13	14	6	6	6
Gasoline Vehicles	112	54	56	62	37	5	5	4	5	5
Diesel Vehicles	47	64	85	106	7	7	9	1	1	1
Other Mobile	116	124	118	146	105	126	162	193	245	319
Gasoline Fuel	5	3	4	6	4	1	1	1	1	1
Diesel Fuel	64	74	63	72	15	14	14	3	3	4
Other Fuel	47	47	51	68	87	112	147	189	241	314

Table 3-9

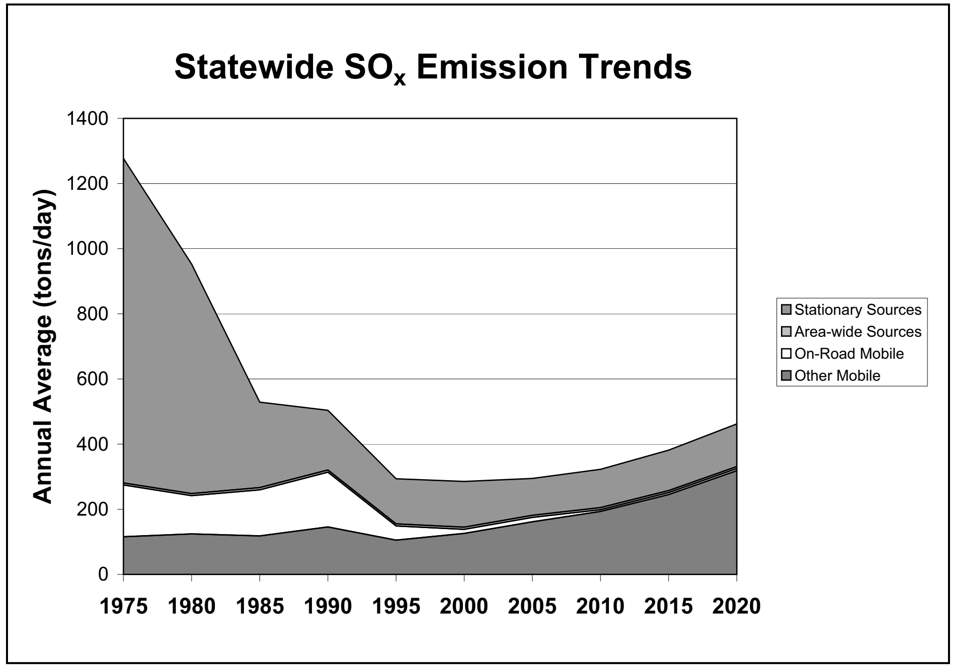

Figure 3-14

Among these options is the Goods Movement Action Plan which was recently adopted.

The SO_x emissions for other mobile sources are lower from 1975 to 1985 when compared to the emissions presented in the previous edition of the Almanac. The lower emissions are due to updates to the ship backcast methodology. Also the emissions for area-wide sources are lower than in the previous edition, due to updates to the statewide burning categories.

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 NO_x, and its presence in the atmosphere can be correlated with emissions of NO_x. Statewide emissions of NO_x decreased by 28 percent between 1980 and 2005 and are projected to decrease by almost 36 percent from 2005 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 reduce NO_x emissions.

In the previous edition of the Almanac, the NO_x emissions were lower for on-road motor vehicles from 1995 onward and lower for other mobile sources from 1990 onward. The higher values in this edition reflect the use of the EMFAC2007 and OFFROAD2007 models. Also in this edition, lower NO_x values for area-wide sources after 1995 are mainly the result of updates to the statewide waste burning categories.

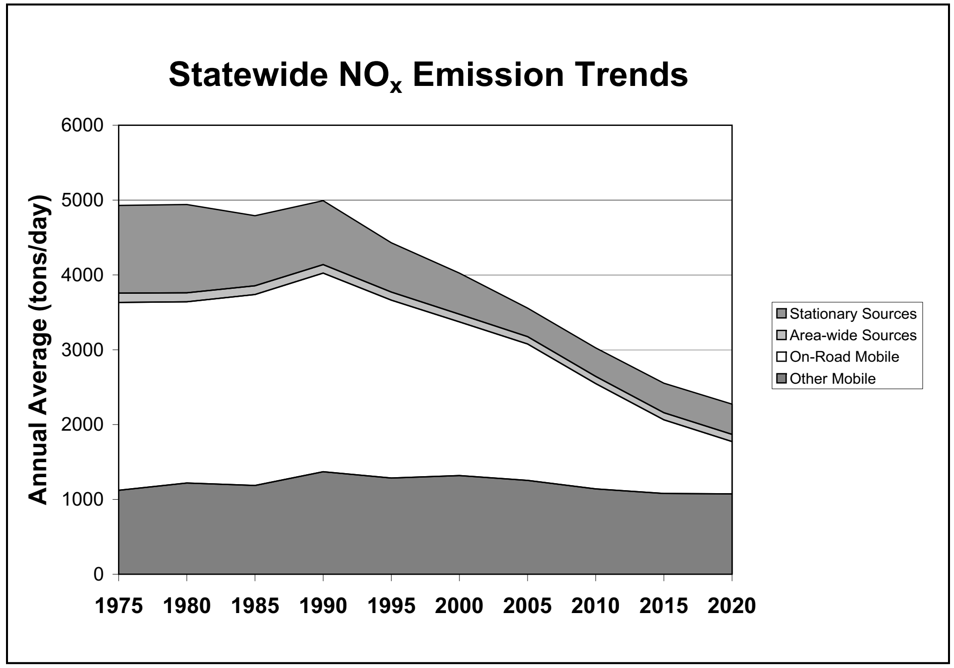

Figure 3-15

NO_x Emission Trends (tons/day, annual average)										
Emission Source	**1975**	**1980**	**1985**	**1990**	**1995**	**2000**	**2005**	**2010**	**2015**	**2020**
All Sources	***4928***	***4941***	***4791***	***4991***	***4429***	***4025***	***3556***	***3025***	***2553***	***2273***
Stationary Sources	1172	1180	936	853	659	551	381	381	394	404
Area-wide Sources	125	121	117	114	108	102	99	96	95	97
On-Road Mobile	2510	2421	2552	2654	2377	2053	1823	1407	984	699
Gasoline Vehicles	2197	2014	1958	1839	1574	1160	754	504	359	263
Diesel Vehicles	312	407	593	815	803	893	1069	904	625	435
Other Mobile	1122	1219	1186	1370	1286	1319	1254	1140	1079	1074
Gasoline Fuel	52	57	62	72	70	70	76	68	64	64
Diesel Fuel	917	1002	954	1095	980	966	854	696	567	464
Other Fuel	154	160	169	202	237	284	325	376	448	546

Table 3-10

Statewide Air Quality - Nitrogen Dioxide

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 1987, maximum NO_2 concentrations have decreased over 67 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 NO_2 standard and unclassified/attainment for the national NO_2 standard. Projections show NO_x emissions will continue to decline, thereby assuring continued attainment.

ARB revised the State 1-hour and adopted a new annual NO_2 standard on February 22, 2007. Designations incorporating new State NO_2 standards are expected in 2009.

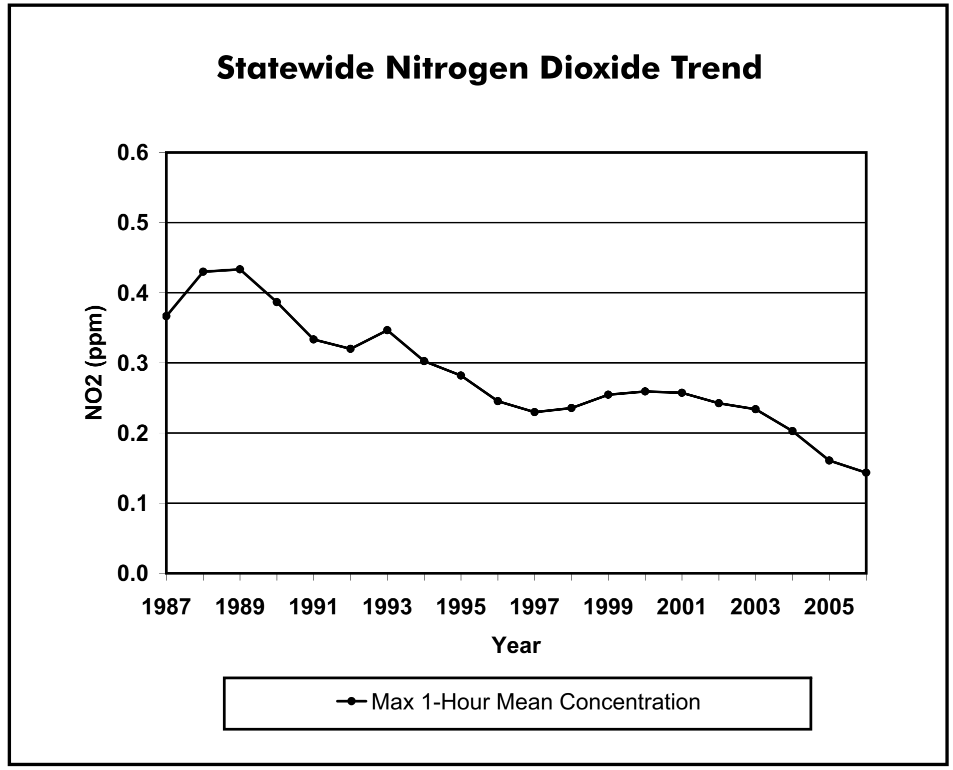

Figure 3-16

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