Chapter 3
Historical Statewide Emissions and Air Quality

Introduction
Emission Trends

Emissions of NO_x and PM_{10} increased slightly between 1985 and 1990. NO_x emissions have been declining since 1990. PM_{10} emissions continue to increase due to increases in vehicle miles traveled (VMT) on paved and unpaved roads. Emissions of CO and ROG decreased between 1985 and 1990. The decrease in CO, ROG and NO_x since 1990 occurred even with increases of VMT and population levels in the same period.

Statewide Emissions (tons/day, annual average)			
	1985	**1990**	**1995**
NO_x	3963	4043	3518
ROG	5041	4275	3495
PM_{10}	2053	2275	2414
CO	27538	26087	21162

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 1980 through 1997, statewide ozone values decreased 49 percent, and carbon monoxide values dropped 26 percent. These air quality improvements occurred at the same time the State's population increased 39 percent and the number of miles traveled each day (VMT) increased 78 percent. Ambient PM_{10} values show similar improvement — a 31 percent decrease from 1988 to 1997. During this same time, statewide population and VMT increased 16 and 26 percent, respectively. While the air quality improvements are impressive, additional emission controls will be needed to offset future growth.

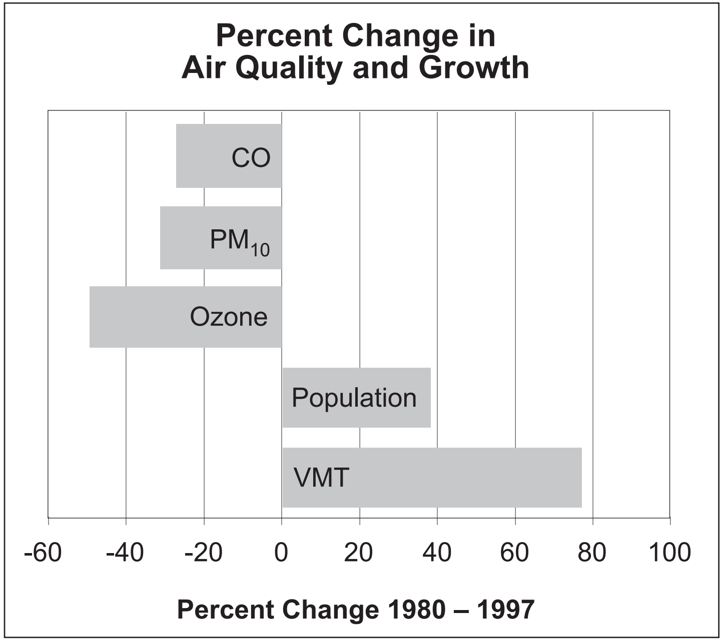

Figure 3-1

Ozone

Emission Trends – Ozone Precursors

NO_x Emission Trends

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 15 percent from 1990 to 1995. This has occurred as vehicles meeting more stringent emission standards enter the fleet, and all vehicles use cleaner burning gasoline and diesel fuel. Stationary source NO_x emissions dropped by 25 percent between 1985 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.

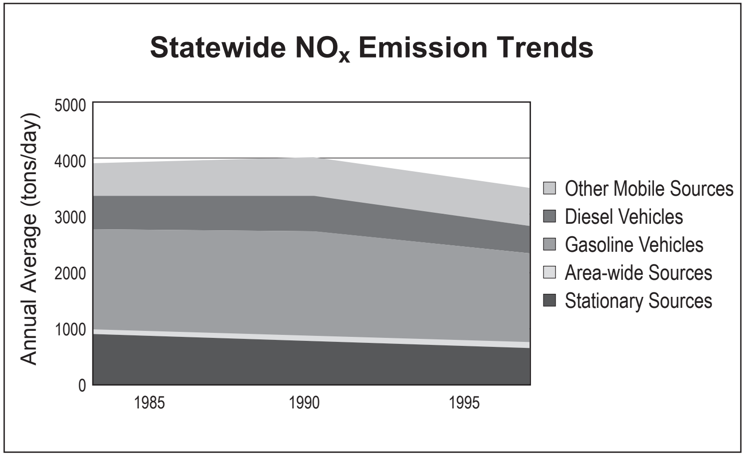

Figure 3-2

ROG Emission Trends

California's motor vehicle emission control program is largely responsible for the 30 percent decline in total statewide ROG emissions since 1985. This includes the use of improved evaporative emission control systems and computerized fuel injection and engine management systems to meet increasingly stringent California emission standards, cleaner gasoline, and the Smog Check program. 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.

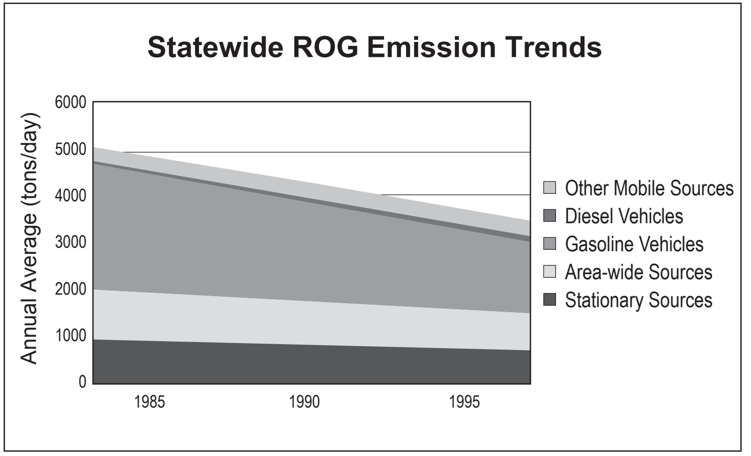

Figure 3-3

Emission Trends – Ozone Precursors

NO_x Emission Trends (tons/day, annual average)			
Emission Source	**1985**	**1990**	**1995**
All Sources	**3963**	**4043**	**3518**
Stationary Sources	883	780	663
Area-wide Sources	133	117	99
On-Road Mobile	2299	2454	2071
Gasoline Vehicles	1747	1807	1563
Diesel Vehicles	552	647	508
Other Mobile Sources	648	692	685

Table 3-2

ROG Emission Trends (tons/day, annual average)			
Emission Source	**1985**	**1990**	**1995**
All Sources	**5041**	**4275**	**3495**
Stationary Sources	936	796	689
Area-wide Sources	1064	906	783
On-Road Mobile	2724	2224	1643
Gasoline Vehicles	2660	2143	1579
Diesel Vehicles	64	81	64
Other Mobile Sources	317	349	380

Statewide Air Quality – Ozone

Air quality as it relates to ozone has improved greatly in all areas of California over the last 17 years, despite significant growth. The statewide trend, which reflects values for the South Coast Air Basin, shows the maximum peak 1-hour indicator declined 49 percent from 1980 to 1997. During this same time period, the population grew by 39 percent and the number of vehicle miles traveled each day was up 78 percent. Motor vehicles are the largest source 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 market incentives to improve air quality.

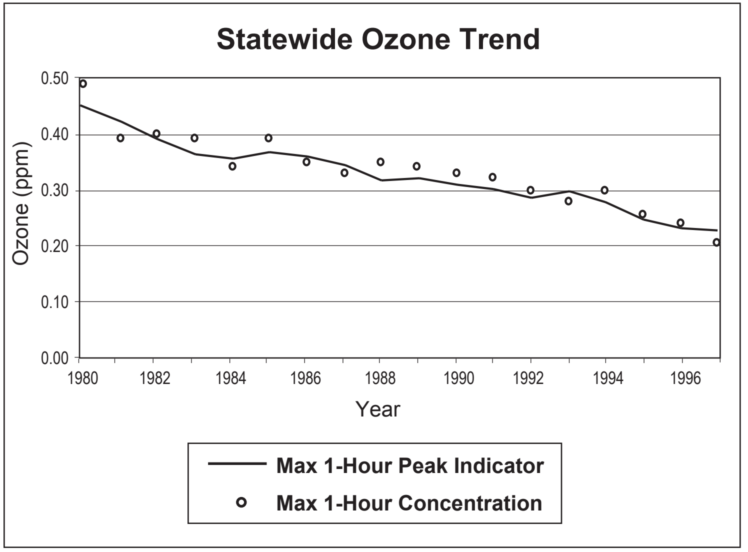

Figure 3-4

Particulate Matter (PM_{10})

Emission Trends – PM_{10}

The upward trend in statewide directly emitted PM_{10} emissions is primarily due to an increase in emissions from area-wide sources. This includes an increase in emissions of unpaved and paved road dust due to increases in vehicle miles traveled (VMT) over these roads. With the adoption of PM_{10} State Implementation Plans and required control measures for the Los Angeles area and the San Joaquin Valley, it is expected that directly emitted PM_{10} emissions from many of the major area-wide sources will decline in the future. Exhaust emissions from diesel vehicles dropped by over 40 percent from 1990 to 1995 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.

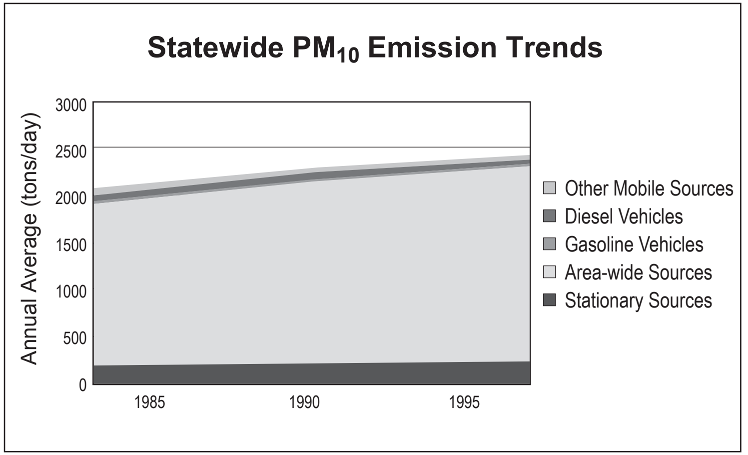

Figure 3-5

Emission Trends – PM_{10}

PM_{10} **Emission Trends** (tons/day, annual average)			
Emission Source	**1985**	**1990**	**1995**
All Sources	**2053**	**2275**	**2414**
Stationary Sources	189	212	230
Area-wide Sources	1709	1917	2077
On-Road Mobile	105	96	66
Gasoline Vehicles	26	21	23
Diesel Vehicles	79	75	43
Other Mobile Sources	50	50	41

Table 3-3

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 to high PM_{10} can include wood burning, agricultural activities, and driving on unpaved roads. This graph shows the maximum statewide annual geometric mean PM_{10} concentrations from 1988 to 1997. The trend line does not reflect concentrations measured in the Owens Valley and other desert areas. Typically, concentrations in these desert areas are far above those measured in the populated areas, and they do not reflect the concentrations to which the majority of people are exposed. The trend line shows a fairly steady decline over the trend period, reflecting an overall decrease of about 31 percent. The higher value in 1997 may be due to meteorology rather than an increase 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, particulate matter is commanding greater attention, and much effort will be needed to attain the standards for this pollutant.

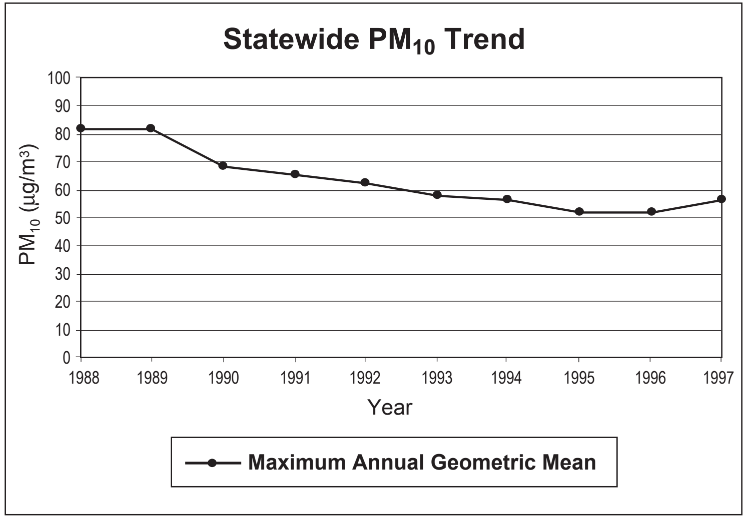

Figure 3-6

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Carbon Monoxide

Emission Trends – Carbon Monoxide

Since 1985, even though motor vehicle miles traveled (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 20 percent. With continued vehicle fleet turnover to cleaner vehicles including ultra low emitting vehicles (ULEV's) and electric vehicles (EV's), and the incorporation of cleaner burning fuels, CO emissions are forecast to continue decreasing at least through the year 2010. CO emissions for stationary sources are expected to increase slowly due to projected industrial growth and the higher emphasis on NO_x controls, which can sometimes increase CO emissions. 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.

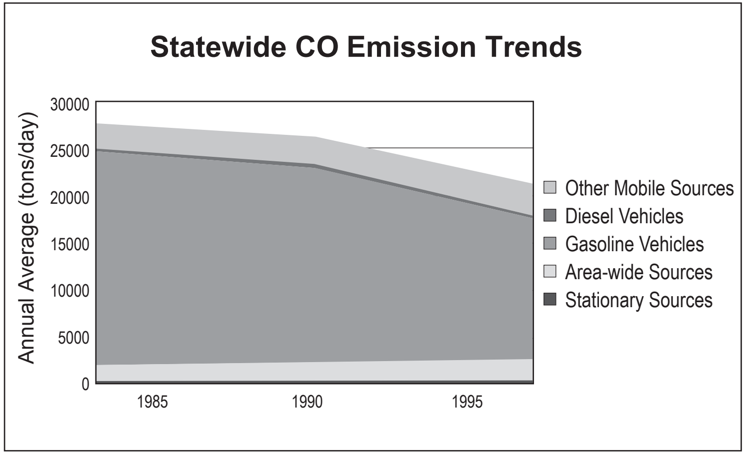

Figure 3-7

Emission Trends – Carbon Monoxide

CO Emission Trends (tons/day, annual average)			
Emission Source	**1985**	**1990**	**1995**
All Sources	**27538**	**26088**	**21162**
Stationary Sources	253	292	299
Area-wide Sources	1810	2082	2140
On-Road Mobile	22856	20787	15444
Gasoline Vehicles	22634	20455	15134
Diesel Vehicles	222	332	310
Other Mobile Sources	2619	2927	3279

Table 3-4

Statewide Air Quality – Carbon Monoxide

Similar to ozone, carbon monoxide concentrations in all areas of California have decreased substantially over the last 17 years, despite significant growth. Statewide, the maximum peak 8-hour indicator declined 26 percent from 1980 to 1997. Currently, the State and national carbon monoxide standards are violated in only two areas: the South Coast Air Basin portion of Los Angeles County and the city of Calexico, in Imperial County. The recent introduction of Cleaner Burning Gasoline has helped bring the rest of the State into attainment. While Cleaner Burning Gasoline has 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. In addition, the introduction of zero emission vehicles, such as the electric car, will play an increasingly important role in the coming years.

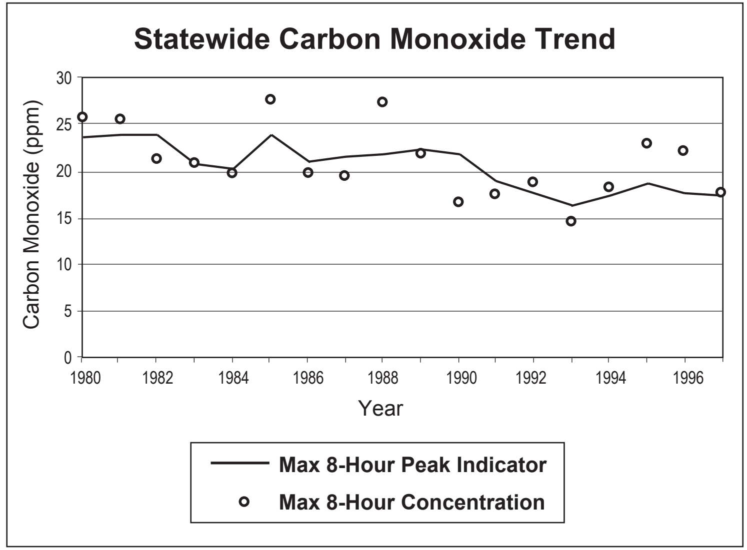

Figure 3-8

Success Stories

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 United States Environmental Protection Agency 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.

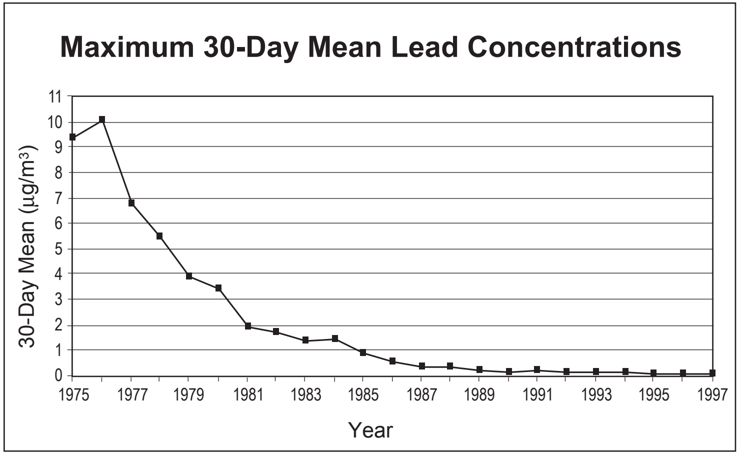

Figure 3-9

Nitrogen Dioxide

Emission Trends – Oxides of Nitrogen

Nitrogen dioxide (NO_2) is a colorless, odorless 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 have decreased by 13 percent from 1990 to 1995 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.

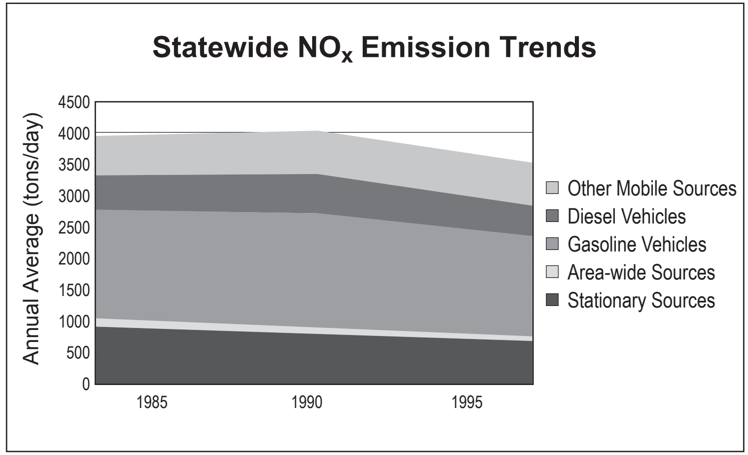

Figure 3-10

Emission Trends – Oxides of Nitrogen

NO_x **Emission Trends** (tons/day, annual average)			
Emission Source	**1985**	**1990**	**1995**
All Sources	**3963**	**4043**	**3518**
Stationary Sources	883	780	663
Area-wide Sources	133	117	99
On-Road Mobile	2299	2454	2071
Gasoline Vehicles	1747	1807	1563
Diesel Vehicles	552	647	508
Other Mobile Sources	648	692	685

Table 3-5

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 1975, maximum NO_2 concentrations have decreased more than 50 percent, due primarily to the implementation of tighter controls on both mobile and stationary sources. Many of these controls were implemented to reduce ozone, however, they also benefited NO_2. All areas of California are currently designated as attainment for the State standard and unclassified/attainment for the national nitrogen dioxide standard. Projections show NO_x emissions will continue to decline, thereby assuring continued attainment.

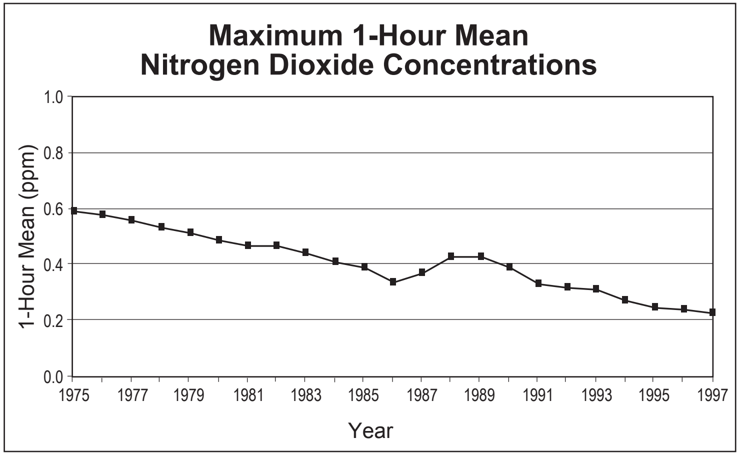

Figure 3-11

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Sulfur Dioxide

Emission Trends – Oxides of Sulfur

SO_x (oxides of sulfur) is a group of compounds of sulfur and oxygen. A major constituent of SO_x is sulfur dioxide (SO_2). Emissions of SO_x have been declining over the last 20 years. Emissions in 1995 were about 40 percent less than emissions in 1985. Sulfur dioxide emissions from stationary and area-wide sources were decreased between 1985 and 1995 due to improved industrial source controls and switching from fuel oil to natural gas for electric generation. The SO_x emissions from both gasoline and diesel vehicle exhaust have also decreased due to lower sulfur content in the fuel.

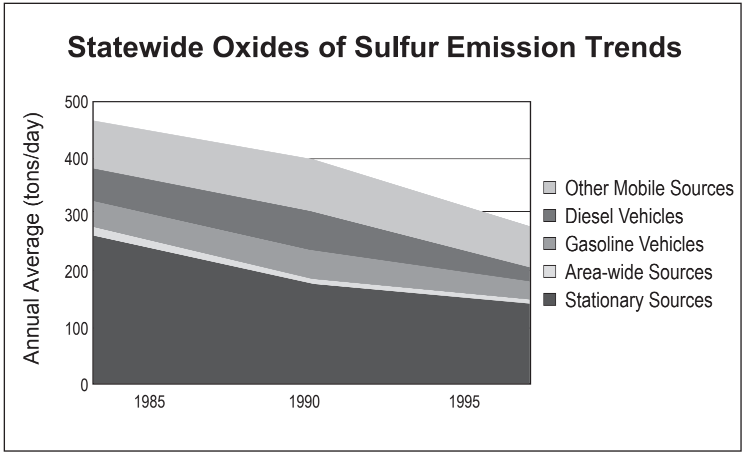

Figure 3-12

Emission Trends – Oxides of Sulfur

SO_x Emission Trends (tons/day, annual average)			
Emission Source	**1985**	**1990**	**1995**
All Sources	**464**	**393**	**275**
Stationary Sources	262	174	140
Area-wide Sources	10	7	6
On-Road Mobile	104	121	55
Gasoline Vehicles	48	53	32
Diesel Vehicles	56	68	23
Other Mobile Sources	88	91	74

Table 3-6

Statewide Air Quality – Sulfur Dioxide

Similar to oxides of nitrogen, oxides of sulfur (SO_x) emissions come from both mobile and stationary sources. These SO_x emissions contribute to ambient sulfur dioxide (SO_2) concentrations. While SO_2 poses significant problems in other parts of the nation, SO_x emissions in California have been reduced sufficiently over the last 20 years so that all areas of California now attain the State standards for sulfur dioxide. Many of the major urban areas are also designated as attainment for the national sulfur dioxide standards. However, most of California is designated as unclassified. With current and anticipated SO_x emission control measures, all areas of the State are expected to remain attainment for SO_2.

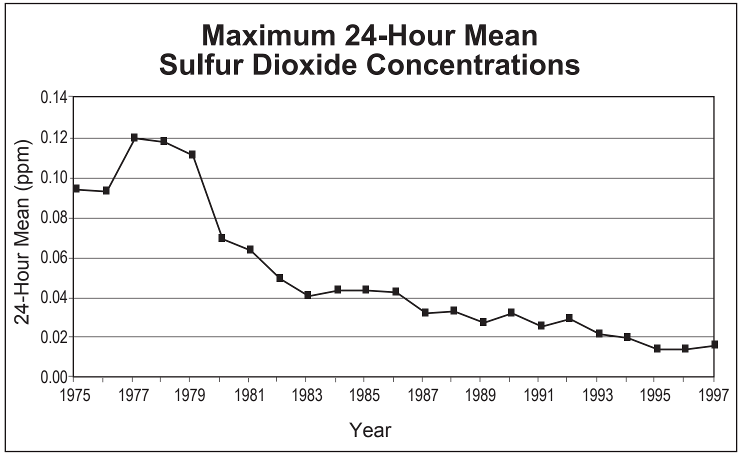

Figure 3-13