CHAPTER 3

BASE YEAR AND FUTURE EMISSIONS

INTRODUCTION

This chapter summarizes emissions occurring in the Basin during the base year 1997, and projected emissions in the years 2006, 2010, 2020. More detailed emission data analyses are presented in Appendix III of the 2003 AQMP. Additional emission inventories for other interim years (i.e., 1990, 1995, 2000, 2002, 2003, 2005, 2007, and 2008) are also developed. These inventory years are selected to comply with federal and state Clean Air Act requirements. Under the federal and state Clean Air Acts, the District is required to report the Basin's emission reduction progress for nonattainment pollutants. The base year to measure the Basin's progress is 1990 for both the federal and state Clean Air Acts. A 1990 emission inventory was reconstructed to reflect the most recent inventory methodologies. Adopted air quality rules and regulations have current and future compliance dates. The 1997 base year emissions inventory reflects adopted air regulations with current compliance dates as of 1997; whereas future baseline emissions inventories are based on adopted air regulations with both current and future compliance dates. A list of South Coast Air Quality Management District (District) rules and regulations that are part of the base year and future-year baseline emissions inventories is presented in Appendix III of the 2003 AQMP. The District is committed to implement these rules that are incorporated in the 2003 AQMP baseline emissions inventories.

The emissions inventory is divided into four major classifications: point, area, off-road, and on-road sources. The 1997 base year point source emissions are based principally on reported data from facilities. The area source and off-road emissions are estimated jointly by the California Air Resources Board (CARB) and the District. The on-road emissions are calculated using the CARB EMFAC2002 emission factors and the transportation activity data provided by SCAG from their 2001 Regional Transportation Plan (2001 RTP). The 1990 inventories were reconstructed/backcasted based on the same general methodology as the 1997 inventory so as to reflect current knowledge. For example, EMFAC2002 was applied to the 1990 vehicle activity data to backcast 1990 on-road mobile emissions. This approach provides a more consistent basis for evaluation of emission reduction progress.

The future emission forecasts are based on demographic and economic growth projections provided by the Southern California Association of Governments (SCAG). In addition, emission reductions resulting from CARB and District regulations adopted by October 31, 2002 are included in the emission forecasts.

EMISSIONS INVENTORIES

Baseline emissions data presented in this chapter are based on average annual day emissions (i.e., total annual emissions divided by 365 days) and seasonally adjusted planning inventory emissions. The 2003 AQMP uses annual average day emissions to estimate the cost-effectiveness of a control measure, to rank control measure implementation, and to perform PM_{10} modeling and analysis. The planning inventory emissions developed to capture the emission levels during a respective poor air quality season are used to report emission reduction progress as required by the federal and state Clean Air Acts. Three inventories are prepared for the 2003 AQMP for the purpose of regulatory and SIP performance tracking and transportation conformity: an annual average inventory, a summer planning inventory, and a winter planning inventory.

Detailed descriptions of the base year and future baseline emission inventories are presented in Appendix III of the 2003 AQMP - Base Year and Future Year Emission Inventories.

Attachment F to Appendix III has been added due to the recent significance placed on diesel emissions, showing various source categories' emissions associated with combustion of diesel fuel.

Stationary Sources

Stationary sources can be divided into two major subcategories: point and area sources. Point sources are generally large emitters with one or more emission sources at a permitted facility with an identified location (e.g., power plants, refineries). Area sources generally consist of many small emission sources (e.g., residential water heaters, architectural coatings) which are distributed across the region. Their emissions over a given area may be calculated using socioeconomic data. For 1997, reported data are used for point sources emitting more than 4 tons per year of any one of the criteria air contaminants (i.e., VOC, NOx, SOx, PM_{10}).

Area source emissions were jointly developed by the CARB and the District for a total of 350 categories. Several special studies were conducted to improve the area source inventory. Specific source categories such as gasoline dispensing, industrial coatings, consumer products, residential wood combustion, composting, fugitive dust, and ammonia sourced were updated. (See Appendix III of the 2003 AQMP.)

Mobile Sources

Mobile sources consist of two subcategories: on-road and off-road sources. On-road vehicle emissions are calculated using socioeconomic data and transportation models provided by SCAG, spatial distribution data from Caltrans' Direct Travel Impact Model (DTIM4), and EMFAC2002 inventories obtained from the CARB reflecting SCAG's

revised baseline activity data (without 2001 RTP) and the activity data in 2001 RTP. The 1990 Census data combined with SCAG's 1991 origin and destination survey data are used in SCAG's 2001 RTP and in this AQMP. Major improvements made to EMFAC2002 include:

1. Vehicle classes were extended to 13;
2. Forecast capabilities were extended to 2040;
3. Redefined four evaporative processes. Evaporative estimations were improved;
4. Heavy-duty diesel truck emissions factors were updated.

Figure 3-1 compares the on-road baseline emissions between EMFAC7G and EMFAC2002 used in the 1997 AQMP and 2003 AQMP respectively. It should be noted that the comparison reflects the change in methodology as well as adopted rules since the release of EMFAC7G.

Emissions from off-road vehicle categories (e.g., trains, ships, construction equipment, utility engines) were developed primarily based on the estimated activity levels and emission factors. Special studies were conducted to improve the emission estimates for aircraft, marine vessels, and Metrolink train activity. (See Appendix III of 2003 AQMP.) More recent activity and population data were applied in the 2003 AQMP to calculate the emissions of lawn and garden equipment and locomotive categories.

Gridded Emissions

For air quality modeling purposes, the region is composed of the South Coast Air Basin, Coachella Valley, Antelope Valley, Ventura County (upwind area), and Mojave Desert. The modeling area is divided into a grid system composed of 5 km by 5 km grid cells defined by Universal Transverse Mercator (UTM) coordinates. Both stationary and mobile emissions are allocated to individual grid cells within this system. In general, the modeling emission data features episodic-day emissions. Seasonal variations in activity levels are taken into account in developing gridded stationary point and area source emissions. Variations in temperature, hours of operation, speed of motor vehicles, or other factors are considered in developing gridded motor vehicle emissions. Hence, "gridded" emissions data used for ozone modeling applications (Chapter 5) differ from the average annual day or planning inventory emission data in two respects: 1) the modeling region covers larger geographic areas than the Basin; and 2) emissions represent day-specific instead of average or seasonal conditions. In the 2003 AQMP, gridded inventories associated with selected ozone episodes have been prepared for air quality modeling analyses. In addition, gridded emissions for 1995 and 2006 were developed to calculate annual average PM_{10} concentrations.

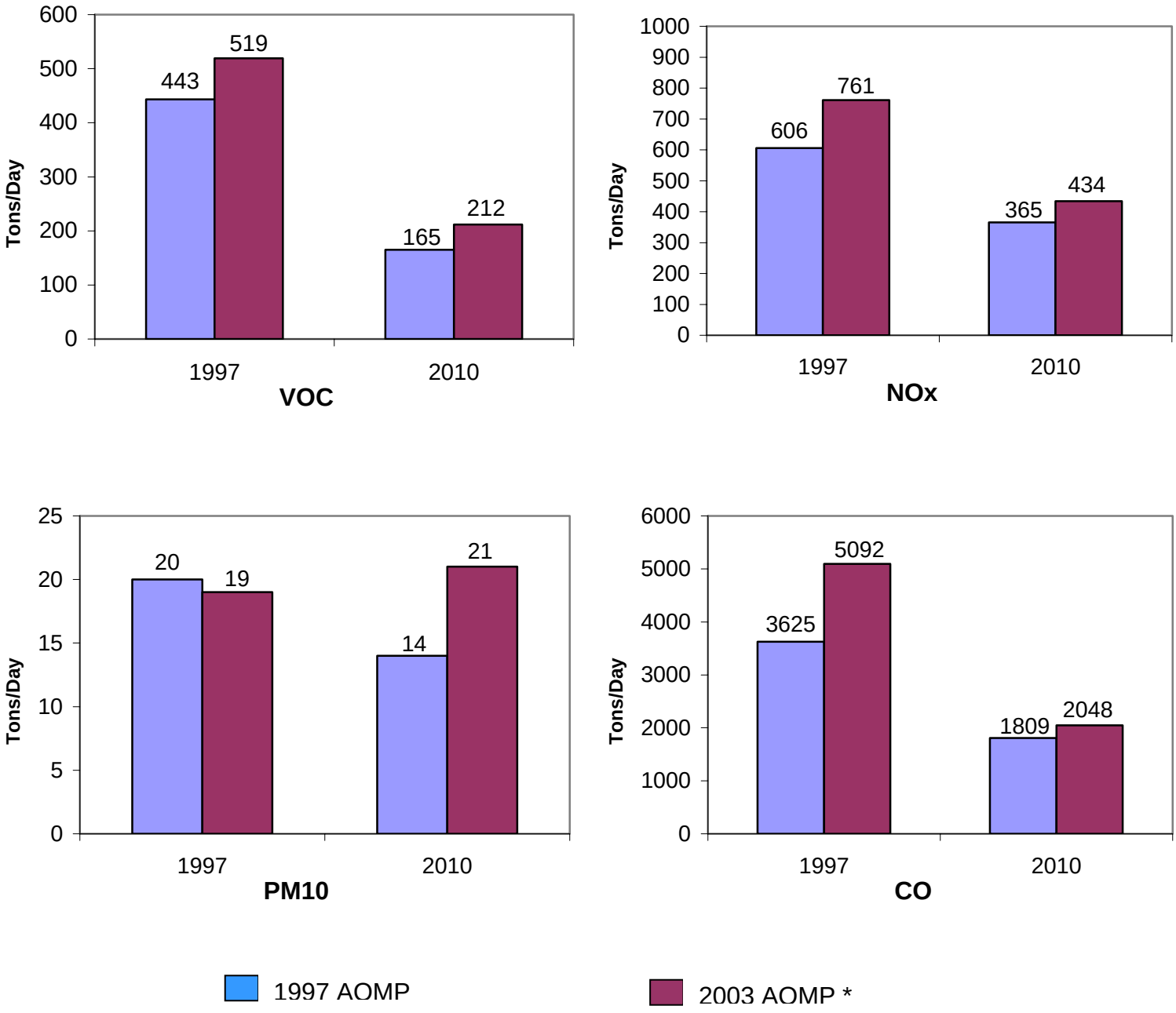


FIGURE 3-1

Comparison of Emissions Between EMFAC7G (1997 AQMP)

and EMFAC2002 (2003 AQMP)

* Year 2010 inventories incorporated rules adopted since the release of EMFAC7G

BASE YEAR EMISSIONS

Reconstructed 1990 Emission Inventories

The federal and state Clean Air Acts have specified the 1990 emission inventory as the baseline for measuring emission reduction progress. Therefore, inventories for year 1990 have been revised since the adoption of the 1997 AQMP and the 1999 Amendments to reflect improvements in emissions estimates and inventory methodology; this provides a consistent basis for emission trends analysis. Most noticeably, a significant change in methodology has been made to on-road, off-road and PM_{10} categories. For annual average day emissions (tons/day), year 1990 has the following inventory amounts.

VOC: 1,780 NOx: 1,592 PM10: 339

1997 Emission Inventory

Table 3-1 shows the 1997 emissions inventory. Figure 3-2 characterizes relative contributions by stationary and mobile source categories. Stationary sources are subdivided into point (e.g., chemical manufacturing, petroleum production, and electric utilities) and area sources (e.g., architectural coatings, residential water heaters, and consumer products). Mobile sources consist of on-road (e.g., light-duty passenger cars) and off-road sources (e.g., trains and ships).

Overall, total mobile source emissions account for 65 percent of the VOC and 89 percent of the NO_x emissions for these two ozone-forming pollutants. The on-road mobile category alone contributes about 45 and 63 percent of the VOC and NO_x emissions, respectively and approximately 76 percent of the CO.

Within stationary sources, point sources contribute more NO_x and SO_x emissions than area sources. However, area sources play a major role in VOC emissions, emitting about three times more than point sources. Furthermore, area sources are the predominant source (82 percent) of directly emitted PM10 emissions due to inclusion of travel-related activities (road dust).

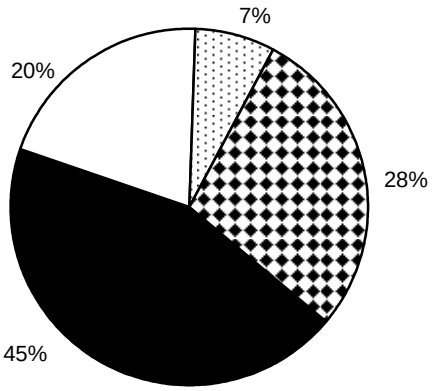
TABLE 3-1A
Summary of Emissions By Major Source Category: 1997 Base Year
Average Annual Day (tons/day[1])

Source Category	VOC	NO_x	CO	SO_x	PM_{10}
Stationary Sources					
Fuel Combustion	9	39	35	2	8
Waste Disposal	9	1	1	0	0
Cleaning and Surface Coatings	122	0	0	0	0
Petroleum Production and Marketing	63	0	5	4	1
Industrial Processes	20	0	4	0	6
Solvent Evaporation					
Consumer Products	118	0	0	0	0
Architectural Coatings	51	0	0	0	0
Others	3	0	0	0	0
Misc. Processes *	21	29	106	0	224
RECLAIM Sources	0	62	0	18	0
Total Stationary Sources	**416**	**131**	**151**	**25**	**239**
Mobile Sources					
On-Road Vehicles	519	761	5092	4	19
Off-Road Vehicles	237	312	1410	29	21
Total Mobile Sources	**756**	**1073**	**6502**	**33**	**40**
TOTAL	**1172**	**1204**	**6653**	**58**	**279**

TABLE 3-1B
Summary of Emissions By Major Source Category: 1997 Base Year
Planning Inventory** (tons/day[1])

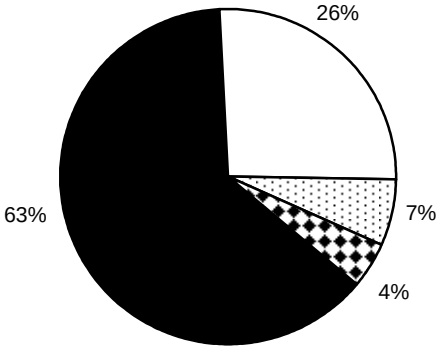
	SUMMER OZONE PRECURSORS		WINTER PRECURSORS	
Source Category	VOC	NO_x	NO_x	CO
Stationary Sources				
Fuel Combustion	9	41	43	38
Waste Disposal	10	2	2	1
Cleaning and Surface Coatings	138	0	0	0
Petroleum Production and Marketing	63	1	1	5
Industrial Processes	24	0	0	4
Solvent Evaporation				
Consumer Products	118	0	0	0
Architectural Coatings	60	0	0	0
Others	4	0	0	0
Misc. Processes	17	21	38	204
RECLAIM SOURCES	0	63	63	0
Total Stationary Sources	**443**	**128**	**147**	**252**
Mobile Sources				
On-Road Vehicles	506	717	827	5027
Off-Road Vehicles	273	320	304	1182
Total Mobile Sources	**779**	**1037**	**1131**	**6209**
TOTAL	**1222**	**1165**	**1278**	**6461**

* Travel related road dust included
**Planning inventories are not used for PM_{10} analysis
[1] Values are rounded to nearest integer

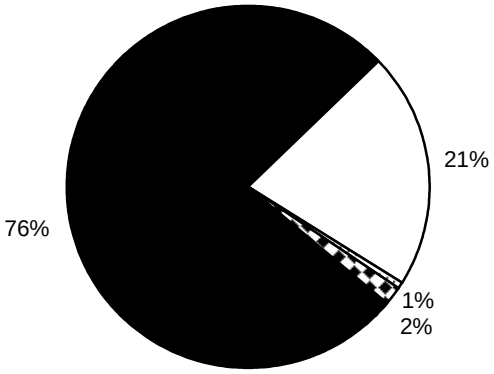


VOC Emissions: 1,172 Tons/Day

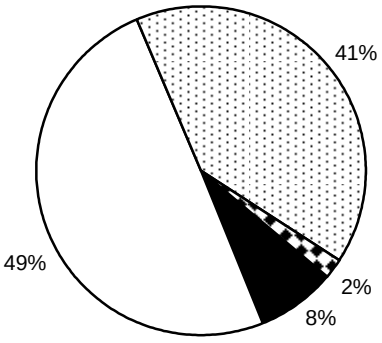
Note: Consumer products and architectural coatings under the area source category represent 118 and 51 tons per day of VOC emissions, respectively.



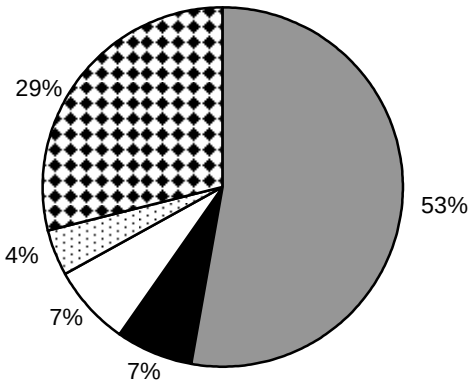
NOx Emissions: 1,204 Tons/Day



CO Emissions: 6,653 Tons/Day



SOx Emissions: 58 Tons/Day



Directly Emitted PM10 Emissions: 279 Tons/Day

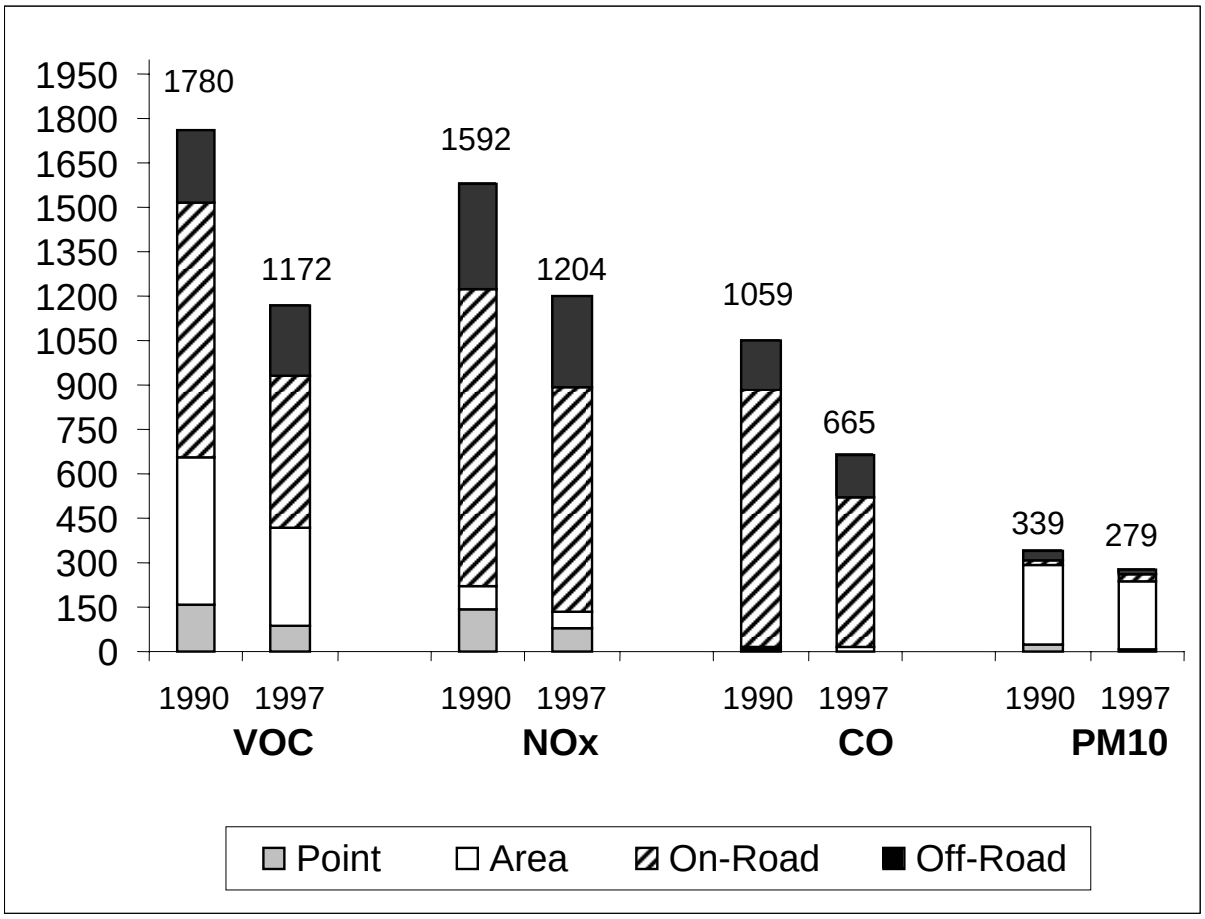
On-Road **Off-Road** **Point** **Area** **Entrained Road Dust**

FIGURE 3-2

Relative Contribution By Source Category to the 1997 Average Annual Inventory

In the mobile source category, emissions from on-road vehicles are much higher than those from off-road sources for all criteria pollutants except SO_x. This can be explained by the fact that the sulfur content in fuels used for off-road vehicles is relatively higher than those for on-road vehicles.

Figure 3-3 compares the 1997 inventory with the reconstructed 1990 inventories. As can be seen, emission reductions are shown for all pollutants due to adopted air regulations.



*CO Emission values were divided by 10.

FIGURE 3-3

Comparison of Reconstructed 1990 Inventory and 1997 Inventory

FUTURE EMISSIONS

Data Development

The milestone years 2000, 2002, 2003, 2005, 2006, 2007, 2008, 2010 and 2020 are the target years for emissions rate-of-progress estimates under the federal Clean Air Act and the state Clean Air Act. Due to the adoption of the NO_x and SO_x RECLAIM program in October 1993, future emissions are divided into RECLAIM and non-RECLAIM emissions. Future NO_x and SO_x emissions from RECLAIM sources are estimated based on their initial allocations as specified by District Rule 2002 –Allocations for NOx and SOx. The forecasts for non-RECLAIM emissions were derived using: 1) emissions from the 1997 base year; 2) expected controls after implementation of District and CARB rules adopted by October 31, 2002; and 3) emissions growth in various source categories between the base and future years. Rules adopted after October 31, 2002 are treated as baseline adjustment measures for emissions reduction accounting purposes. A detailed description of the forecasting methodology is provided in Appendix III of the 2003 AQMP.

Demographic growth forecasts for various socioeconomic categories (e.g., population, housing, employment by industries), developed by SCAG for their 2001 RTP, were used to estimate future emissions. Industry growth factors for 2000, 2005, 2010, 2015 and 2020 were provided by SCAG. Growth factors for other interim years were interpolated between key forecast years. Table 3-2 summarizes key socioeconomic parameters used in the 2003 AQMP for emissions inventory development.

TABLE 3-2

Baseline Socioeconomic Forecasts Used in 2003 AQMP

Category	1997	2010 (% Growth) *		2020 (% Growth) *	
Population (Millions)	14.3	16.5	(+15)	18.2	(+27)
Housing Units (Millions)	4.6	5.3	(+15)	5.9	(+18)
Total Employment (Millions)	6.3	7.8	(+24)	8.5	(+35)
Daily VMT (Millions)	296.8	387.4	(+31)	454.7	(+53)

* Relative to 1997

Current forecasts indicate that this region will experience a population growth of 15 percent by the year 2010 with a 31 percent increase in vehicle miles traveled (VMT).

The current projection for the year 2010 shows about 200,000 (1%) decrease in population, 200,000 (2.5%) decrease in total employment and 9.5 million mile (2.5%) increase in daily VMT forecast as compared to the projection from the 1997 AQMP.

Summary of Baseline Emissions

Emission data by source categories (point, area, on-road mobile and off-road mobile sources) and by pollutants are presented in Tables 3-3 through 3-5 for the years 2006, 2010, and 2020.

Without any additional controls, VOC, NO_x, and CO emissions are expected to decrease due to existing regulations, such as the LEV and oxygenated fuel programs, and the RECLAIM program. Figure 3-4 illustrates the relative contribution to the 2010 inventory by source category. A comparison between Figures 3-2 and 3-4 indicates that the on-road mobile category continues to be a major contributor to CO and NO_x emissions. However, due to the adopted LEV regulation, by 2010 on-road mobile accounts for about 34 percent of total VOC emissions compared to 45 percent in 1997. Meanwhile, area sources become the major contributor to VOC emissions from 28 percent in 1997 to 36 percent in 2010.

TABLE 3-3A
Summary of Emissions By Major Source Category: 2006 Base Year
Average Annual Day (tons/day[1])

Source Category	VOC	NO_x	CO	SO_x	PM_{10}
Stationary Sources					
Fuel Combustion	10	29	41	2	8
Waste Disposal	10	2	1	0	0
Cleaning and Surface Coatings	54	0	0	0	0
Petroleum Production and Marketing	37	0	5	5	1
Industrial Processes	18	0	6	0	7
Solvent Evaporation					
Consumer Products	104	0	0	0	0
Architectural Coatings	32	0	0	0	0
Others	3	0	0	0	0
Misc. Processes*	25	30	158	0	236
RECLAIM Sources	0	34	0	12	0
Total Stationary Sources	**293**	**95**	**211**	**19**	**252**
Mobile Sources					
On-Road Vehicles	266	563	2602	5	20
Off-Road Vehicles	139	292	1160	36	21
Total Mobile Sources	**405**	**855**	**3762**	**41**	**41**
TOTAL	**698**	**950**	**3973**	**60**	**293**

TABLE 3-3B
Summary of Emissions By Major Source Category: 2006 Base Year
Planning Inventory** (tons/day[1])

	SUMMER OZONE PRECURSORS		WINTER PRECURSORS	
Source Category	VOC	NO_x	NO_x	CO
Stationary Sources				
Fuel Combustion	10	30	31	44
Waste Disposal	10	2	2	1
Cleaning and Surface Coatings	64	0	0	0
Petroleum Production and Marketing	37	1	1	5
Industrial Processes	21	0	0	6
Solvent Evaporation				
Consumer Products	104	0	0	0
Architectural Coatings	39	0	0	0
Others	3	0	0	0
Misc. Processes	19	21	42	320
RECLAIM Sources	0	36	36	0
Total Stationary Sources	**307**	**90**	**112**	**376**
Mobile Sources				
On-Road Vehicles	261	536	605	2566
Off-Road Vehicles	162	303	283	965
Total Mobile Sources	**423**	**839**	**888**	**3531**
TOTAL	**730**	**929**	**1000**	**3907**

* Travel related road dust included
**Planning inventories are not used for PM_{10} analysis
[1] Values are rounded to nearest integer

TABLE 3-4A
Summary of Emissions By Major Source Category: 2010 Base Year
Average Annual Day (tons/day[1])

Source Category	VOC	NO_x	CO	SO_x	PM_{10}
Stationary Sources					
Fuel Combustion	10	25	43	2	9
Waste Disposal	10	2	1	0	0
Cleaning and Surface Coatings	61	0	0	0	0
Petroleum Production and Marketing	35	0	5	5	1
Industrial Processes	20	0	6	0	8
Solvent Evaporation					
Consumer Products	108	0	0	0	0
Architectural Coatings	24	0	0	0	0
Others	3	0	0	0	0
Misc. Processes*	25	28	162	0	243
RECLAIM Sources	0	34	0	12	0
Total Stationary Sources	**296**	**89**	**217**	**19**	**261**
Mobile Sources					
On-Road Vehicles	212	434	2048	2	21
Off-Road Vehicles	122	257	1094	39	19
Total Mobile Sources	**334**	**691**	**3142**	**41**	**40**
TOTAL	**630**	**780**	**3359**	**60**	**301**

TABLE 3-4B
Summary of Emissions By Major Source Category: 2010 Base Year
Planning Inventory** (tons/day[1])

	SUMMER OZONE PRECURSORS		WINTER PRECURSORS	
Source Category	VOC	NO_x	NO_x	CO
Stationary Sources				
Fuel Combustion	11	26	27	47
Waste Disposal	10	2	2	1
Cleaning and Surface Coatings	72	0	0	0
Petroleum Production and Marketing	36	1	1	5
Industrial Processes	23	0	0	6
Solvent Evaporation				
Consumer Products	108	0	0	0
Architectural Coatings	28	0	0	0
Others	3	0	0	0
Misc. Processes	19	19	40	325
RECLAIM Sources	0	36	36	0
Total Stationary Sources	**310**	**84**	**106**	**384**
Mobile Sources				
On-Road Vehicles	210	414	466	2019
Off-Road Vehicles	139	266	248	912
Total Mobile Sources	**349**	**680**	**714**	**2931**
TOTAL	**659**	**764**	**820**	**3315**

* Travel related road dust included
**Planning inventories are not used for PM_{10} analysis
[1] Values are rounded to nearest integer

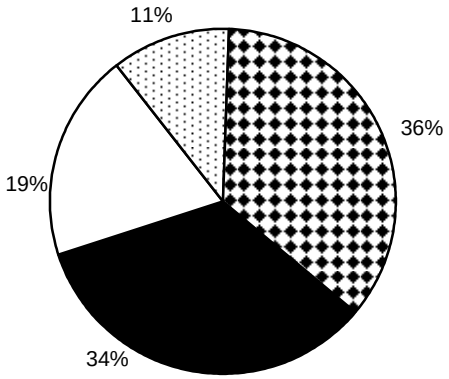
TABLE 3-5A
Summary of Emissions By Major Source Category: 2020 Base Year
Average Annual Day (tons/day[1])

Source Category	VOC	NO_x	CO	SO_x	PM_{10}
Stationary Sources					
Fuel Combustion	12	27	49	2	9
Waste Disposal	10	2	1	0	1
Cleaning and Surface Coatings	82	0	0	0	0
Petroleum Production and Marketing	37	0	5	5	1
Industrial Processes	26	0	9	0	9
Solvent Evaporation					
Consumer Products	118	0	0	0	0
Architectural	27	0	0	0	0
Others	3	0	0	0	0
Misc. Processes*	25	27	170	0	256
RECLAIM Sources	0	34	0	12	0
Total Stationary Sources	**340**	**90**	**234**	**19**	**276**
Mobile Sources					
On-Road Vehicles	130	206	1097	3	24
Off-Road Vehicles	114	241	1104	54	18
Total Mobile Sources	**244**	**447**	**2201**	**57**	**42**
TOTAL	**584**	**537**	**2435**	**76**	**318**

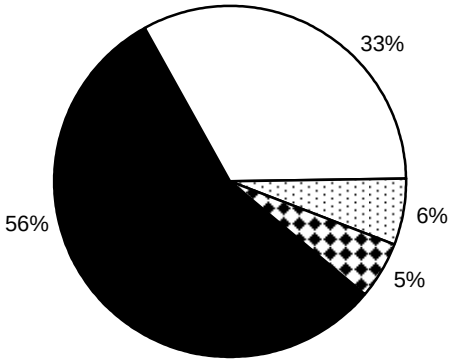
TABLE 3-5B
Summary of Emissions By Major Source Category: 2020 Base Year
Planning Inventory** (tons/day[1])

	SUMMER OZONE PRECURSORS		WINTER PRECURSORS	
Source Category	VOC	NOx	NOx	CO
Stationary Sources				
Fuel Combustion	12	29	30	53
Waste Disposal	10	2	2	1
Cleaning and Surface Coatings	99	0	0	0
Petroleum Production and Marketing	37	1	1	5
Industrial Processes	31	1	0	9
Solvent Evaporation				
Consumer Products	118	0	0	0
Architectural	32	0	0	0
Others	3	0	0	0
Misc. Processes	19	18	39	340
RECLAIM Sources	0	36	36	0
Total Stationary Sources	**361**	**86**	**108**	**408**
Mobile Sources				
On-Road Vehicles	131	196	220	1078
Off-Road Vehicles	125	250	232	928
Total Mobile Sources	**256**	**446**	**452**	**2006**
TOTAL	**617**	**532**	**560**	**2414**

* Travel related road dust included
**Planning inventories are not used for PM_{10} analysis
[1] Values are rounded to nearest integer

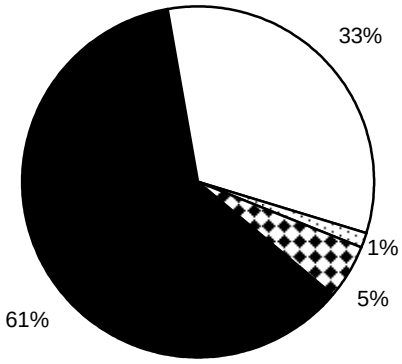


VOC Emissions: 630 Tons/Day

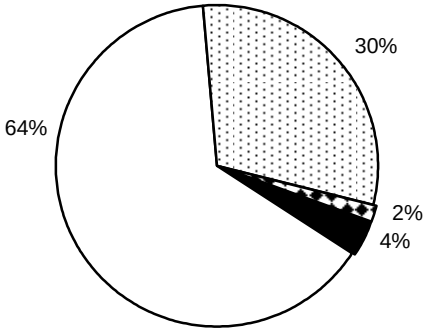


NOx Emissions: 780 Tons/Day

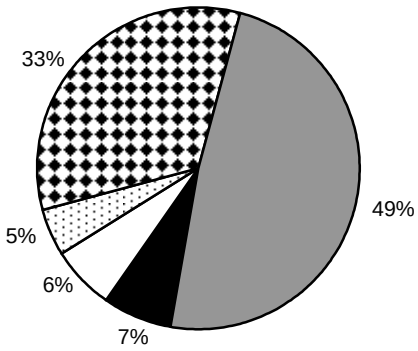
Note: Consumer products and architectural coatings under the area source category represent 108 and 24 tons per day of VOC emissions, respectively.



CO Emissions: 3,359 Tons/Day



SOx Emissions: 60 Tons/Day



Directly Emitted PM10 Emissions: 301 Tons/Day

On-Road **Off-Road** **Point** **Area** **Entrained Road Dust**

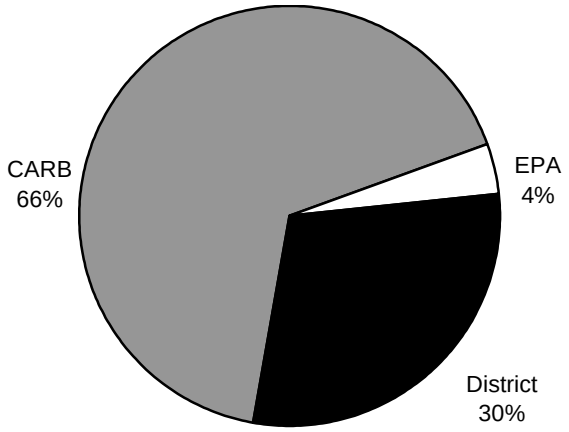
FIGURE 3-4

Relative Contribution By Source Category to the 2010 Average Annual Inventory

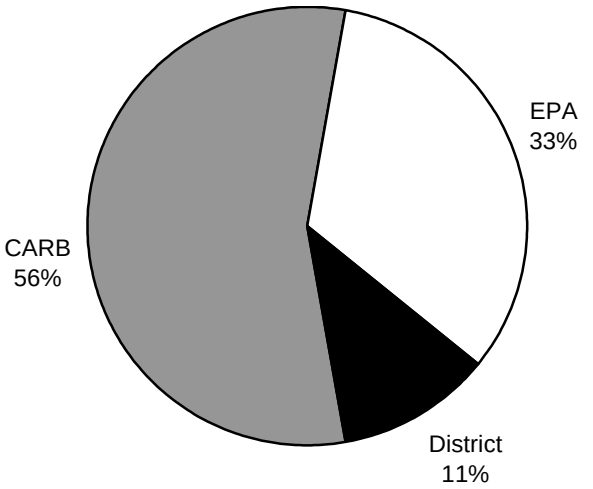
Contributions by Responsible Agencies

Figures 3-5A and 3-5B illustrate relative emission contributions by agency responsibility. Figure 3-5A shows that sources under CARB and U.S. EPA jurisdictions account for about 80% of ozone precursors (i.e., total of VOC and NO_x) for year 2010. Figure 3-5B indicates that District and CARB are equally responsible for PM_{10} and $PM_{2.5}$ emissions. Figures 3-5C and 3-5D illustrate source categories in VOC and NOx by responsible agencies. For VOC, light- & medium-duty vehicles and consumer products constitute the largest sources under CARB jurisdiction; while cleaning and surface coatings are the largest contributor (11 %) to emissions under the District's jurisdiction.

For NOx emissions, the transportation sector contributes to the largest portion of emissions under CARB and U.S. EPA jurisdictions; while RECLAIM facilities constitute the largest portion under the District jurisdiction.

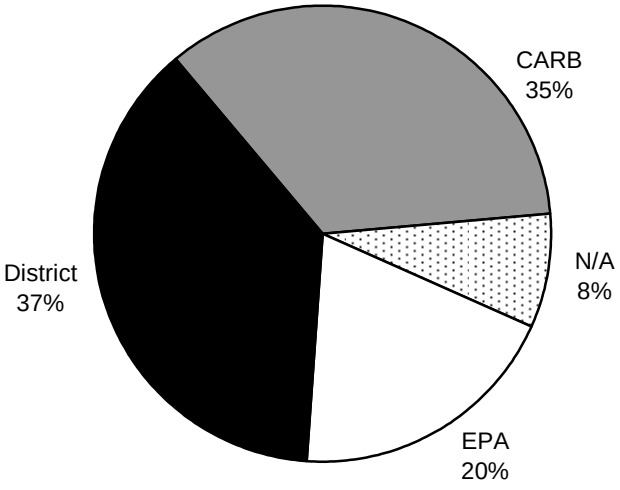


2010 VOC Emissions = 659 Tons/Day



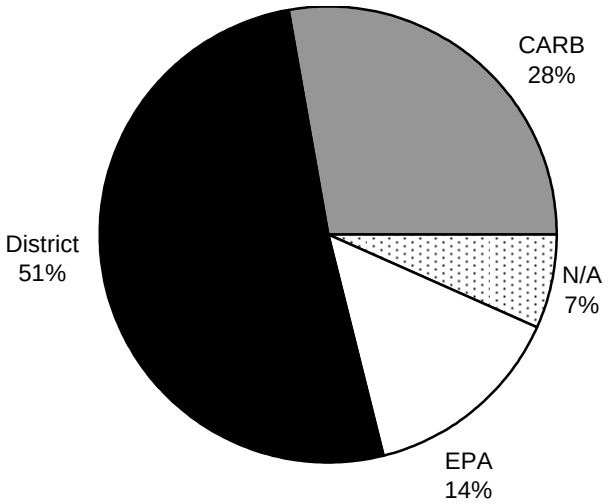
2010 NOx Emissions = 764 Tons/Day

FIGURE 3-5A – Relative Contribution by Agency to 2010 VOC and NOx Planning Inventory



PM2.5

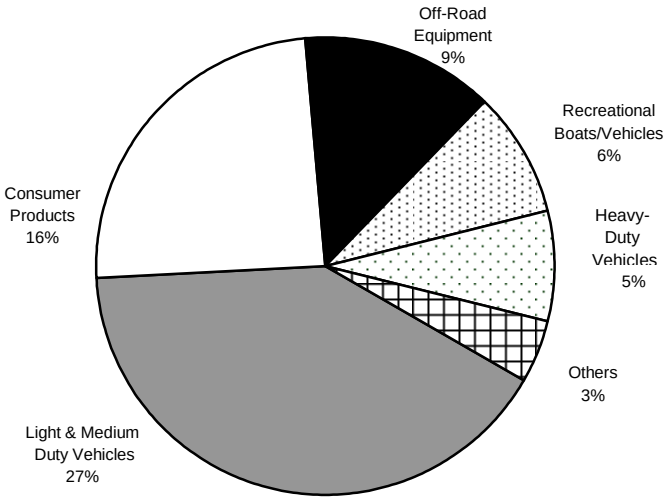
N/A: salt and soil/misc. ammonia



PM10

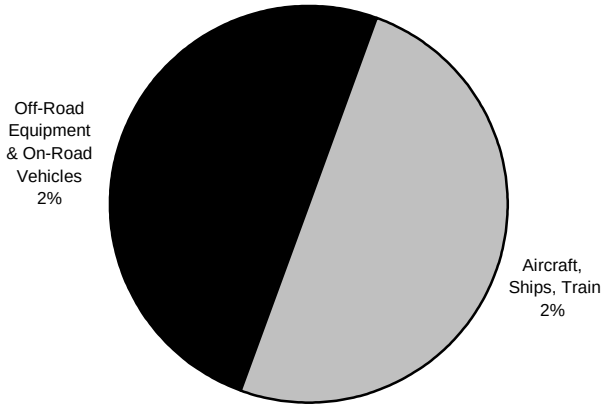
N/A: salt and soil/misc. ammonia

FIGURE 3-5B – Relative Contribution by Agency to PM2.5 and PM10 Annual Average Inventory



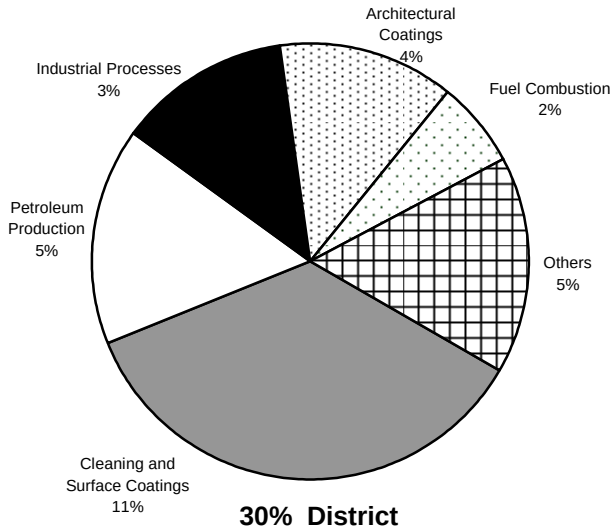
66% CARB

(432 tons)



4% EPA

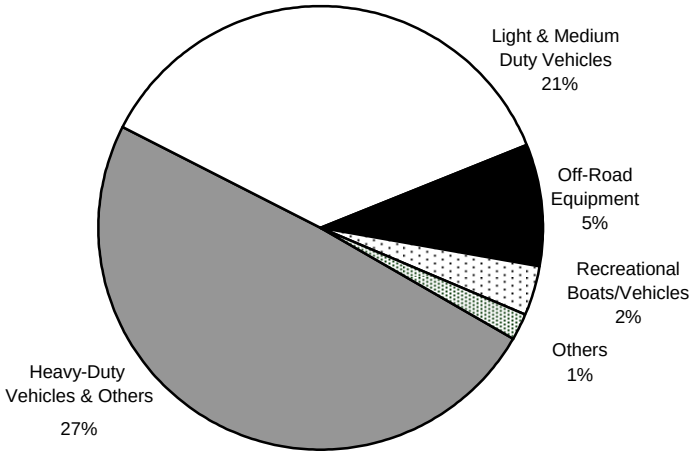
(32 tons)



30% District

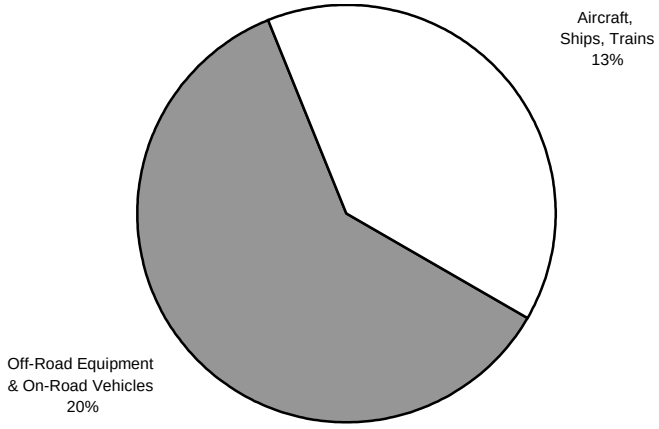
(195 tons)

FIGURE 3-5C - 2010 VOC Emissions by Major Source Categories by Agency and Category



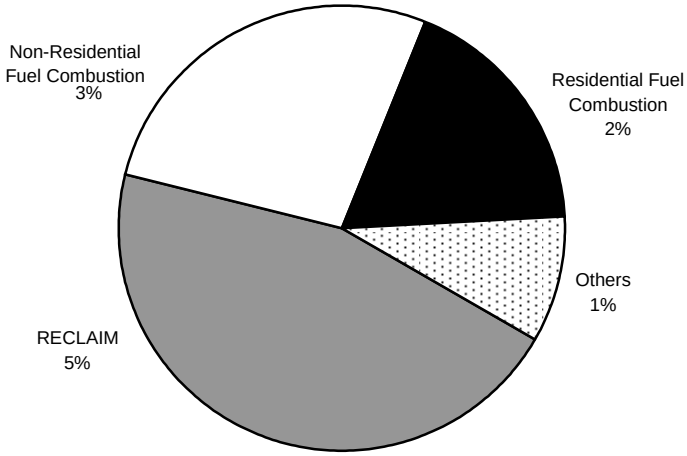
56% CARB

(424 tons)



33% EPA

(254 tons)



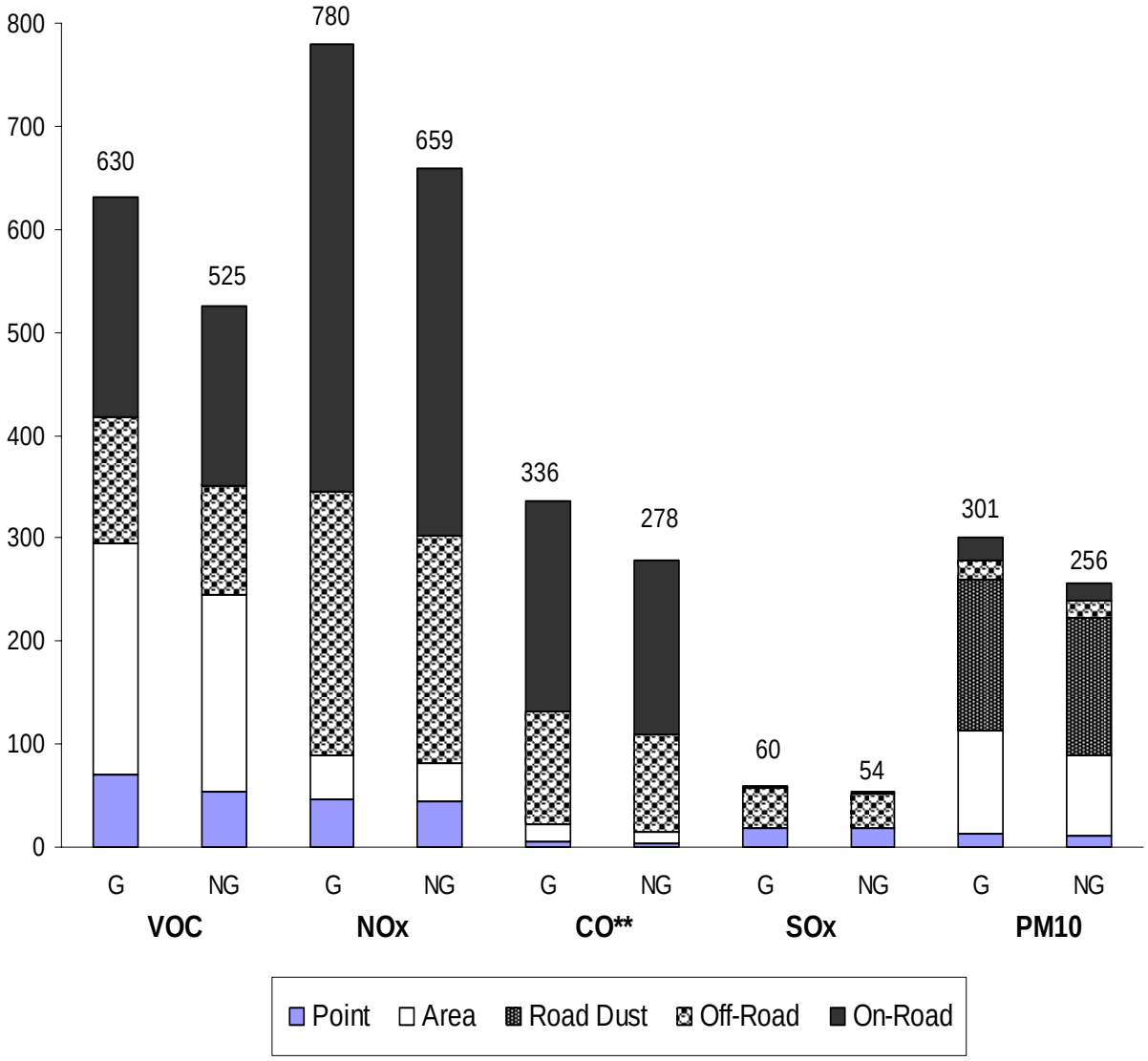
11% District

(86 tons)

FIGURE 3-5D - 2010 NOx Emissions by Major Source Categories by Agency and Category

The Impact of Growth

To illustrate the impact of growth, year 2010 no-growth emissions were estimated by removing the growth factors from the 2010 baseline emissions. Figure 3-6 presents the comparison of the 2010 projected emissions with and without growth.



*G = Emissions with growth; NG = Emissions without growth

** CO emissions are divided by 10

FIGURE 3-6

2010 Emissions Forecast With and Without Growth

Annual Average Day