CHAPTER 3

BASE YEAR AND FUTURE EMISSIONS

INTRODUCTION

This chapter summarizes emissions that occurred in the Basin during the base year 2002, and projected emissions in the years 2014, 2020, and 2023. More detailed emission data analyses are presented in Appendix III of the Final 2007 AQMP. Additional emission inventories for other interim years (i.e., 2005, 2008, 2010, 2011, 2017, and 2030) are also developed. These inventory years are selected to comply with federal and state Clean Air Act requirements. The 2002 base year emissions inventory reflects adopted air regulations with current compliance dates as of 2002; whereas future baseline emissions inventories are based on adopted air regulations with both current and future compliance dates. A list of AQMD and CARB rules and regulations that are part of the base year and future-year baseline emissions inventories is presented in Appendix III of the Final 2007 AQMP. The District is committed to implement the AQMD rules that are incorporated in the Final 2007 AQMP baseline emissions inventories.

The emissions inventory is divided into four major classifications: point, area, off-road, and on-road sources. The 2002 base year point source emissions are based principally on reported data from facilities. The area source and off-road emissions are estimated jointly by CARB and the District. The on-road emissions are calculated using the CARB EMFAC2007 V2.3 emission factors and the transportation activity data provided by SCAG from their modified 2004 Regional Transportation Plan (2004 RTP). In this document Outer Continental Shelf (OCS) emissions (i.e. ships beyond the three-mile state waters line) are included in the ships emissions. 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 District regulations adopted by June 30, 2006 are included in the emission forecasts. CARB regulations adopted by June 2005 were included in the baseline.

Several additional adjustments were made to EMFAC2007 V2.3 to make additional technical corrections to the inventory. The most significant adjustment was the application of a factor (0.78) to the 2005 heavy heavy-duty diesel truck emissions to correct the population estimates previously assumed in the inventory. Other adjustments were made to on-road categories in order to account for CARB's adopted rules which are not included in EMFAC2007 V2.3. Categories affected by this change included light-duty passenger cars, light-, medium-, and heavy-duty trucks, buses, and motor homes.

Off-road emissions were updated using CARB's November 1, 2006 OFFROAD model. External adjustments were also made for inventory categories such as ships, dredging, industrial equipment, lawn and garden equipment, and others. Adjustments were made after the model was finalized to reflect information revising activity levels and patterns, and to include Carl Moyer benefits and CARB's adopted rules which are not included in the OFFRAD model.

This chapter also includes information on the top ten source categories that contribute to the majority of the emissions inventory in 2002, 2014, and 2023. The data for the year 2023 is being presented because the South Coast will need to request a "bump up" in attainment classification. Data for 2020 is included in portions of this Chapter and in Appendix III. Please see Chapter 12 for more information on the attainment status.

EMISSION INVENTORIES

Three inventories are prepared for the Final 2007 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. 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 Final 2007 AQMP uses annual average day emissions to estimate the cost-effectiveness of control measures, to rank control measure implementation, and to perform PM2.5 modeling and analysis. The planning inventory emissions developed to capture the emission levels during a poor air quality season are used to report emission reduction progress as required by the federal and state Clean Air Acts.

Detailed descriptions of the base year and future baseline emission inventories are presented in Appendix III of the Final 2007 AQMP.

Attachment F to Appendix III shows emissions associated with combustion of diesel fuel for various source categories.

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 2002, reported data are used for point sources emitting more than 4 tons per year of the following criteria air contaminants: VOC, NOx, SOx, and PM2.5. For CO, facilities report if they are over 100 tons per year. If any of these thresholds are triggered, all pollutants are reported by the facility.

Area source emissions were jointly developed by CARB and the District for approximately 350 categories. Several special studies were conducted to improve the area source inventory. Specific source categories such as gasoline dispensing, consumer products, architectural coatings, fugitive dust, and ammonia sources were updated (see Appendix III). For consumer products and architectural coatings, revised and updated survey data were used. For fugitive dust, the PM10 to PM2.5 ratio was changed based on a study by the Western Regional Air Partnership (WRAP).

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 EMFAC2007 V2.3 inventories obtained from CARB. The EMFAC2007 V2.3 reflects SCAG's revised baseline activity data from the modified 2004 RTP. The 2000 Census data, combined with SCAG's 2001 origin and destination survey data, are used in SCAG's modified 2004 RTP and in this AQMP. Major improvements made to the EMFAC2007 V2.3 include:

1. Heavy heavy-duty diesel vehicles population redistribution;
2. Vehicle miles traveled updates;
3. Heavy heavy-duty diesel factors updates;
4. Pending vehicles updates;
5. Fuel correcting factors updates;
6. Ethanol permeation effects;
7. New population data; and
8. New temperature and relative humidity profiles corresponding to the federal 8-hour ozone standard.

Figure 3-1A compares the on-road baseline emissions between EMFAC2002 and the EMFAC2007 V2.3 used in the 2003 AQMP and Final 2007 AQMP, respectively. It should be noted that the comparison for 2002 reflects changes in methodology, but 2020 also includes adopted rules, and updated growth projections since the release of EMFAC2002.

Emissions from off-road vehicle categories (e.g., trains, ships, construction equipment, ports and rail cargo handling equipment) were developed primarily based on estimated activity levels and emission factors. The major changes made to the off-road model include:

1. Off-road equipment population, activity, and emission factor updates;
2. Locomotive inventory reflecting the 1998 South Coast Locomotive MOU and the 2005 CARB/Railroad MOU;

3. Cargo handling equipment updates;

4. Portable fuel containers updates;

5. Marine vessel updates; and

6. Commercial harbor craft updates.

The inventory for trains was revised from the 2003 AQMP to reflect projected emission reductions based on the 1998 South Coast MOU and the 2005 CARB/Railroad MOU. Significant inventory improvements have been made to the marine vessel category, which includes ocean-going vessels, commercial harbor craft, and other ships. For both the Port of Los Angeles and Port of Long Beach, more recent and comprehensive emission inventories and projections have been included in the Final 2007 AQMP. New surveys and data sources for marine vessels have been used, as described in Appendix III.

Figure 3-1B shows a comparison of the off-road baseline emissions based on the OFFROAD model revisions used for the 2003 AQMP and Final 2007 AQMP. As the inventory methodology has improved, more emissions have been quantified, resulting in equal or higher emissions than previously anticipated in spite of more rules being adopted. This creates a greater challenge for attainment.

Uncertainty in the Inventory

An effective AQMP relies on an adequate emission inventory. Over the years, significant improvements have been made to quantify emission sources upon which control measures are developed. Increased use of continuous monitoring and source tests has contributed to the improvement in point source inventories. Technical assistance to facilities and auditing of reported emissions by the District also have improved the accuracy of the emissions inventory. Area source inventories that rely on average emission factors and regional activities have inherent uncertainty. Industry-specific surveys or source-specific studies during rule development have provided much-needed refinement to the emissions estimates.

Mobile source inventories remain the greatest challenge due to the high number and types of equipment and engines involved, in-use performance variables, and complex emission characteristics. Every AQMP revision provides an opportunity to further improve the current knowledge of mobile source inventories. There is no exception to the Final 2007 AQMP. As described earlier, many improvements were made to the EMFAC2007 V2.3 and such work is still ongoing. However, it should be acknowledged that there are still areas that may not have been adequately addressed. For example, ethanol permeation not accounted for in the stationary source inventory for gasoline-powered equipment or gas stations, how best to reflect heavy heavy-duty truck in-use emissions with limited test data, and appropriate spatial and temporal distribution of recreational boats need to be examined further. The best available science should be followed to support the AQMP development.

Relative to future growth, there are many challenges with making accurate projections. For example, where vehicle trips will occur, the distribution between various modes of transportation (such as trucks and trains), as well as estimates for population growth and changes to the number and type of jobs – although they are forecast with the best information available; nevertheless, they contribute to the overall uncertainty in emission projections.

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 source 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 Final 2007 AQMP, gridded inventories associated with selected ozone episodes have been prepared for air quality modeling analyses. In addition, gridded emissions for 2005 and 2014 were developed to calculate annual average PM2.5 concentrations.

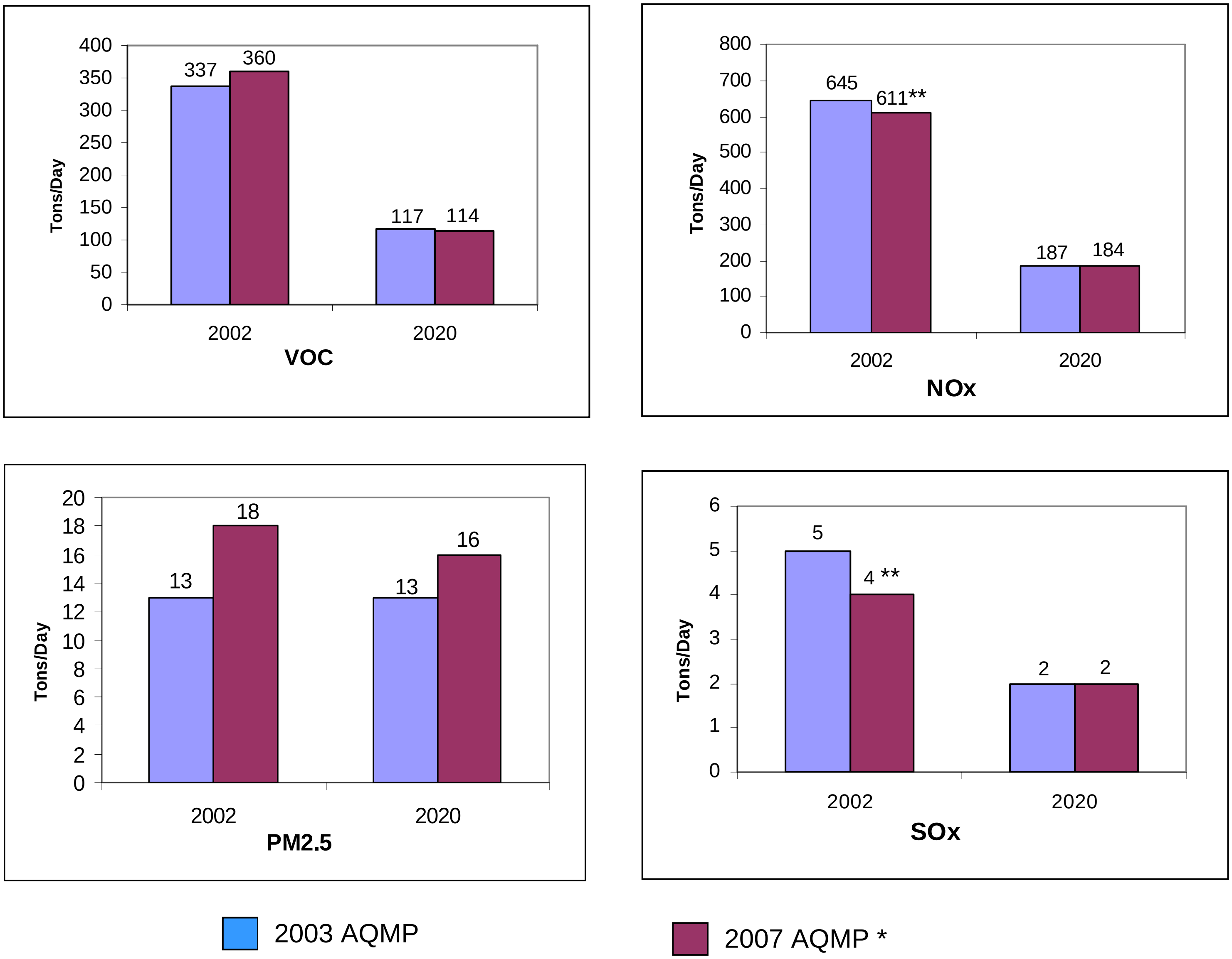


FIGURE 3-1A

Comparison of On-Road Emissions Between EMFAC2002 (2003 AQMP) and EMFAC2007 V2.3 (Final 2007 AQMP)
(VOC & NOx – Summer Planning; SOx & PM2.5 – Annual Average Inventory)

* Year 2020 inventories incorporate rules adopted since the release of EMFAC2002.
** Redistribution of the heavy-duty truck VMT in the EMFAC2007 V2.3 causes heavy duty truck VMT reduction in the SCAB. As a result, NOx and SOx emissions are relatively lower in the Final 2007 AQMP than in the 2003 AQMP.
Note: External adjustments to the EMFA2007 V2.3 are included.

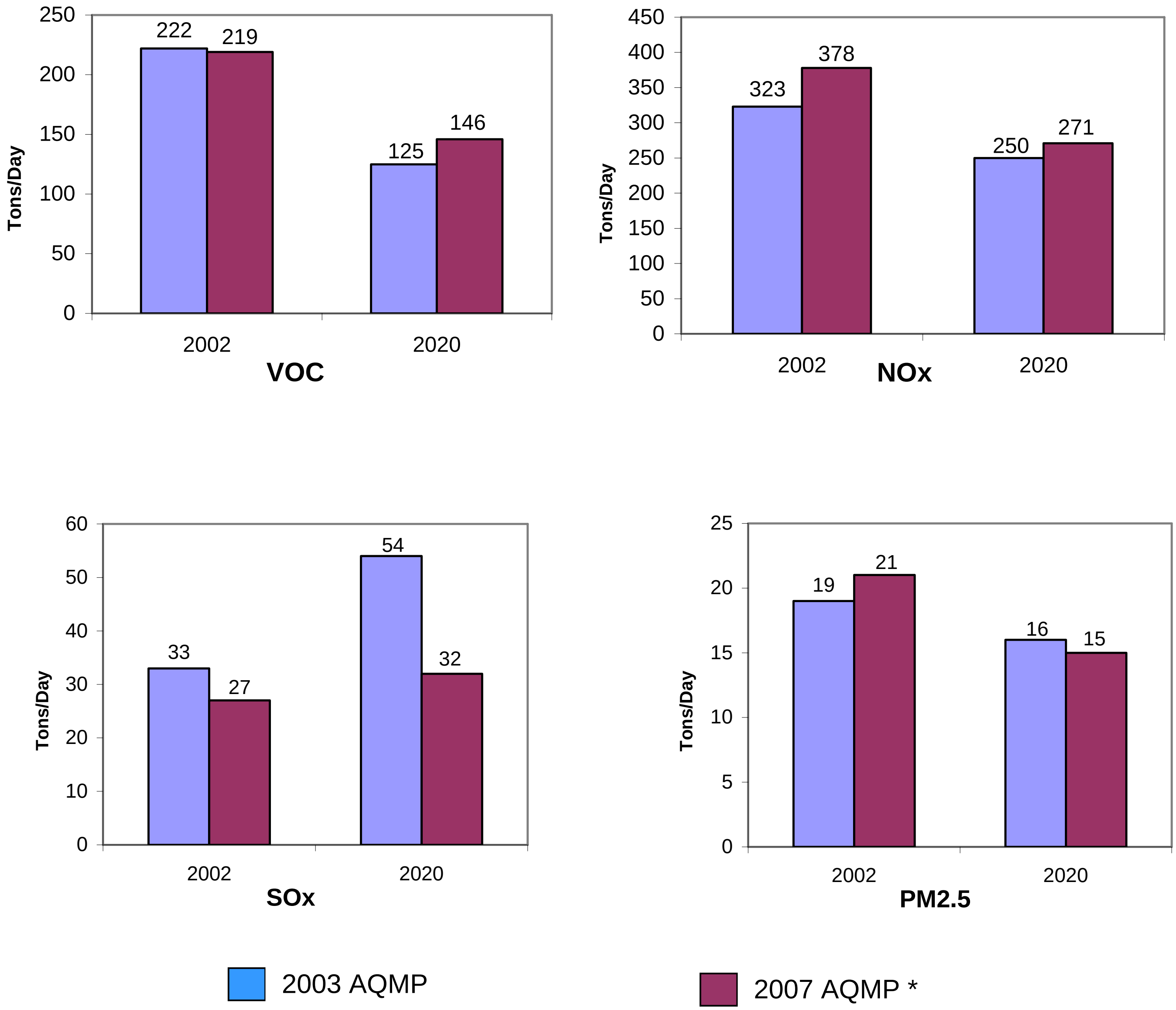


FIGURE 3-1B

Comparison of Off-Road Emissions Between 2003 AQMP and Final 2007 AQMP
(VOC & NOx – Summer Planning; SOx & PM2.5 – Annual Average Inventory)

* Year 2020 inventories incorporate rules adopted since the release of EMFAC2002

BASE YEAR EMISSIONS

2002 Emission Inventory

Tables 3-1A and 3-1B shows the 2002 emissions inventory by major source category. Table 3-1A shows annual average emissions, while Table 3-1B shows the planning inventories for summer and winter.

Overall, total mobile source emissions account for 64 percent of the VOC and 91 percent of the NOx emissions for these two ozone-forming pollutants, based on the annual average inventory. The on-road mobile category alone contributes about 43 and 57 percent of the VOC and NOx emissions, respectively, and approximately 76 percent of the CO for the annual average 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). Entrained road dust is also included in Figure 3-2.

On- and off-road sources continue to be the major contributors for each of the 5 pollutants, as seen in Figure 3-2. For example, mobile sources represent 64 percent of VOC emissions, 92 percent of NOx emissions, and 98 percent of CO emissions. For directly emitted PM2.5, mobile sources represent 39 percent of the emissions with another 20 percent due to vehicle-related entrained road dust.

Within the category of stationary sources, point sources contribute more SOx emissions than area sources. Area sources play a major role in VOC emissions, emitting about five times more than point sources. Area sources are the predominant source (32 percent) of directly emitted PM2.5 emissions, including sources such as cooking.

TABLE 3-1A

Summary of Emissions By Major Source Category: 2002 Base Year
Average Annual Day (tons/day[1])

Source Category	VOC	NOx	CO	SOx	PM2.5
Stationary Sources					
Fuel Combustion	7	35	52	2	6
Waste Disposal	7	2	1	0	0
Cleaning and Surface Coatings	54	0	0	0	1
Petroleum Production and Marketing	35	0	9	7	1
Industrial Processes	21	0	2	0	5
Solvent Evaporation					
Consumer Products	110	0	0	0	0
Architectural Coatings	49	0	0	0	0
Others	3	0	0	0	0
Misc. Processes *	16	27	62	0	47
RECLAIM Sources	0	29	0	12	0
Total Stationary Sources	**302**	**93**	**126**	**22**	**60**
Mobile Sources					
On-Road Vehicles	362	628	3677	4	18
Off-Road Vehicles	180	372	1016	27	21
Total Mobile Sources	**542**	**1000**	**4693**	**31**	**39**
TOTAL	**844**	**1093**	**4819**	**53**	**99**

TABLE 3-1B

Summary of Emissions By Major Source Category: 2002 Base Year
Planning Inventory** (tons/day[1])

	SUMMER OZONE PRECURSORS		WINTER INVENTORY	
Source Category	VOC	NOx	NOx	CO
Stationary Sources				
Fuel Combustion	7	36	35	54
Waste Disposal	8	2	2	1
Cleaning and Surface Coatings	60	0	0	0
Petroleum Production and Marketing	35	1	1	9
Industrial Processes	22	0	0	2
Solvent Evaporation				
Consumer Products	110	0	0	0
Architectural Coatings	57	0	0	0
Others	4	0	0	0
Misc. Processes	14	21	33	102
RECLAIM SOURCES	0	29	29	0
Total Stationary Sources	**317**	**89**	**100**	**168**
Mobile Sources				
On-Road Vehicles	360	611	680	3630
Off-Road Vehicles	220	378	367	844
Total Mobile Sources	**580**	**989**	**1047**	**4474**
TOTAL	**897**	**1078**	**1147**	**4642**

* Travel-related road dust included.

**Planning inventories are not used for PM2.5 analysis.

[1] Values are rounded to nearest integer.

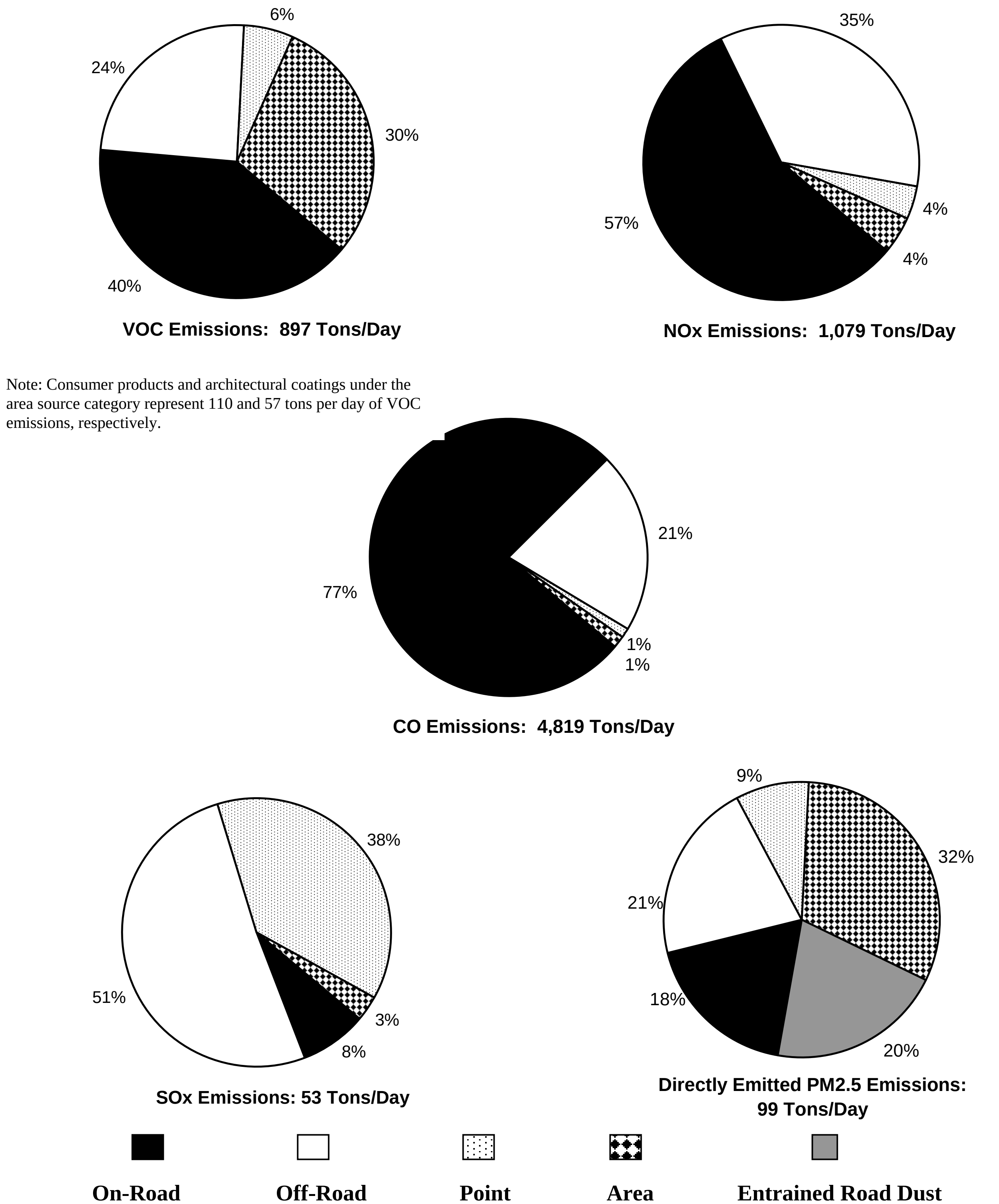


FIGURE 3-2

Relative Contribution by Source Category to 2002 Emission Inventory
(VOC & NOx – Summer Planning; CO, SOx & PM2.5 – Annual Average 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 SOx and PM2.5. 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, and commercial/industrial off-road equipment generates high levels of PM2.5.

FUTURE EMISSIONS

Data Development

The milestone years 2002, 2005, 2008, 2010, 2011, 2014, 2017, 2020, 2023, and 2030 are the target years for emissions rate-of-progress estimates under the federal Clean Air Act and the state Clean Air Act. Future emissions are divided into RECLAIM and non-RECLAIM emissions. Future NOx and SOx emissions from RECLAIM sources are estimated based on their allocations as specified by AQMD Rule 2002 –Allocations for NOx and SOx. The forecasts for non-RECLAIM emissions were derived using: 1) emissions from the 2002 base year; 2) expected controls after implementation of District rules adopted by June 30, 2006, and most CARB rules adopted as of June 2005; and 3) emissions growth in various source categories between the base and future years. AQMD rules adopted after June 30, 2006 are treated as baseline adjustments for emissions reduction accounting purposes. From efforts currently underway for amending Rule 1110.2, staff has estimated additional emissions of 1.26 tons per day of NOx; 42.07 tons per day of CO; and 7.39 tons per day of VOC in 2005 due to unanticipated non compliance. These emissions are expected to be totally controlled by year 2008 if the proposed rule amendment, which is scheduled to be brought to the Governing Board this year, is adopted. Therefore, these emissions were not added to the 2007 AQMP inventories.

Demographic growth forecasts for various socioeconomic categories (e.g., population, housing, employment by industry), developed by SCAG for their interim 2007 RTP, were used in the modified 2004 RTP to estimate future emissions. Industry growth factors for 2002, 2005, 2010, 2015, 2020, 2025, and 2030 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 Final 2007 AQMP for emissions inventory development.

TABLE 3-2

Baseline Demographic Forecasts in the Final 2007 AQMP

Category	2002	2020	(% Growth)	2030	(% Growth)
Population (Millions)	15.1	18.4	22%	19.6	30%
Housing Units (Millions)	4.8	5.9	23%	6.4	33%
Total Employment (Millions)	6.8	8.2	21%	9.0	32%
Daily VMT (Millions)	349	414	19%	453	30%

Current forecasts indicate that this region will experience a population growth of 22 percent by the year 2020 with a 19 percent increase in vehicle miles traveled (VMT).

As compared to the projection from the 2003 AQMP, the current projection for the year 2020 shows about a 200,000 (1%) increase in population, 300,000 (3.5%) decrease in total employment and 40.7 million mile (9%) decrease in the daily VMT forecast. The decrease in VMT forecast is primarily due to the redistribution of VMT to the eastern portion of the region outside of the SCAB.

CARB staff revised assumptions related to pending vehicle registrations, which affects emissions as well. EMFAC2007 includes an assumption that 25 percent of these vehicles are on the road, rather than the 100 percent estimate used in the EMFAC2007 Working Draft.

Comparing EMFAC2007 VMT to projections from SCAG shows a significant "blip" or increase in VMT between 2002 and 2005, although 2010 VMT decreases and projections for 2010 and beyond are very close between EMFAC2007 and SCAG estimates. The District staff retained two technical experts in the area of transportation analysis to review the VMT estimates for 2005. The consultants reviewed CARB's assumptions and, to the extent possible, some of the DMV and BAR data used to produce the 2005 VMT estimates. They concluded that there is no independent evidence to support a decline in VMT between 2005 and 2010, and recommended conducting a sensitivity analysis in the near term, to determine the magnitude of the differences. Detailed discussions on the VMT sensitivity analysis is contained in Appendix-V of the Final 2007 AQMP. Based on the analysis, the District staff recommends that for purposes of attainment demonstration VMT estimates provided by SCAG be used instead of EMFAC2007.

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 2014, 2020, and 2023. The tables provide annual average, and summer and winter planning inventories.

Without any additional controls, VOC, NOx, and CO emissions are expected to decrease due to existing regulations, such as controls on off-road equipment, new vehicle standards, and the RECLAIM program. Figure 3-3 illustrates the relative contribution to the 2023 inventory by source category. A comparison between Figures 3-2 and 3-3 indicates that the on-road mobile category continues to be a major contributor to CO and NOx emissions. However, due to the adopted regulations, by 2023 on-road mobile accounts for about 19 percent of total VOC emissions compared to 40 percent in 2002. Meanwhile, area sources become the major contributor to VOC emissions from 30 percent in 2002 to 44 percent in 2023. See Figures 3-7 through 3-18 for the top ten ranking by source category for 2002, 2014, and 2020.

TABLE 3-3A

Summary of Emissions By Major Source Category: 2014 Base Year
Average Annual Day (tons/day[1])

Source Category	VOC	NOx	CO	SOx	PM2.5
Stationary Sources					
Fuel Combustion	7	24	51	3	6
Waste Disposal	8	2	1	0	1
Cleaning and Surface Coatings	41	0	0	0	1
Petroleum Production and Marketing	32	0	8	1	1
Industrial Processes	21	0	3	0	5
Solvent Evaporation					
Consumer Products	107	0	0	0	0
Architectural Coatings	24	0	0	0	0
Others	3	0	0	0	0
Misc. Processes*	14	23	115	0	55
RECLAIM Sources	0	27	0	12	0
Total Stationary Sources	**257**	**76**	**178**	**16**	**69**
Mobile Sources					
On-Road Vehicles	144	293	1393	2	17
Off-Road Vehicles	127	285	1006	25	16
Total Mobile Sources	**271**	**578**	**2399**	**27**	**33**
TOTAL	**528**	**654**	**2577**	**43**	**102**

TABLE 3-3B

Summary of Emissions By Major Source Category: 2014 Base Year
Planning Inventory** (tons/day[1])

	SUMMER OZONE PRECURSORS		WINTER INVENTORY	
Source Category	VOC	NOx	NOx	CO
Stationary Sources				
Fuel Combustion	7	25	24	53
Waste Disposal	8	2	2	1
Cleaning and Surface Coatings	45	0	0	0
Petroleum Production and Marketing	33	0	0	8
Industrial Processes	23	0	1	3
Solvent Evaporation				
Consumer Products	107	0	0	0
Architectural Coatings	29	0	0	0
Others	3	0	0	0
Misc. Processes	9	17	32	220
RECLAIM Sources	0	27	27	0
Total Stationary Sources	**264**	**71**	**86**	**285**
Mobile Sources				
On-Road Vehicles	148	287	312	1373
Off-Road Vehicles	157	292	278	839
Total Mobile Sources	**305**	**579**	**590**	**2212**
TOTAL	**569**	**650**	**676**	**2497**

* Travel-related road dust included.
**Planning inventories are not used for PM2.5 analysis.
[1] Values are rounded to nearest integer.

TABLE 3-4A

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

Source Category	VOC	NOx	CO	SOx	PM2.5
Stationary Sources					
Fuel Combustion	7	22	53	3	6
Waste Disposal	8	2	1	0	0
Cleaning and Surface Coatings	43	0	0	0	1
Petroleum Production and Marketing	34	0	8	1	1
Industrial Processes	23	1	3	0	6
Solvent Evaporation					
Consumer Products	112	0	0	0	0
Architectural Coatings	26	0	0	0	0
Others	3	0	0	0	0
Misc. Processes*	14	22	119	0	58
RECLAIM Sources	0	27	0	12	0
Total Stationary Sources	**270**	**74**	**184**	**16**	**72**
Mobile Sources					
On-Road Vehicles	110	187	973	2	16
Off-Road Vehicles	119	264	1071	32	15
Total Mobile Sources	**229**	**451**	**2044**	**34**	**31**
TOTAL	**499**	**525**	**2228**	**50**	**108**

TABLE 3-4B

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

	SUMMER OZONE PRECURSORS		WINTER INVENTORY	
Source Category	VOC	NOx	NOx	CO
Stationary Sources				
Fuel Combustion	7	24	23	55
Waste Disposal	8	2	2	1
Cleaning and Surface Coatings	49	0	0	0
Petroleum Production and Marketing	34	0	0	8
Industrial Processes	25	0	0	4
Solvent Evaporation				
Consumer Products	112	0	0	0
Architectural Coatings	30	0	0	0
Others	3	0	0	0
Misc. Processes	9	15	32	226
RECLAIM Sources	0	27	27	0
Total Stationary Sources	**277**	**68**	**84**	**294**
Mobile Sources				
On-Road Vehicles	114	184	199	958
Off-Road Vehicles	147	272	257	895
Total Mobile Sources	**261**	**456**	**456**	**1853**
TOTAL	**538**	**524**	**540**	**2147**

* Travel-related road dust included.
**Planning inventories are not used for PM2.5 analysis.
[1] Values are rounded to nearest integer.

TABLE 3-5A

Summary of Emissions By Major Source Category: 2023 Base Year
Average Annual Day (tons/day[1])

Source Category	VOC	NOx	CO	SOx	PM2.5
Stationary Sources					
Fuel Combustion	7	22	54	3	6
Waste Disposal	9	2	1	0	0
Cleaning and Surface Coatings	45	0	0	0	1
Petroleum Production and Marketing	35	0	8	1	1
Industrial Processes	24	0	3	0	6
Solvent Evaporation					
Consumer Products	114	0	0	0	0
Architectural	26	0	0	0	0
Others	2	0	0	0	0
Misc. Processes*	14	23	120	1	59
RECLAIM Sources	0	27	0	12	0
Total Stationary Sources	**276**	**74**	**186**	**17**	**73**
Mobile Sources					
On-Road Vehicles	99	164	838	2	16
Off-Road Vehicles	120	268	1119	36	16
Total Mobile Sources	**219**	**432**	**1957**	**38**	**32**
TOTAL	**495**	**506**	**2143**	**55**	**105**

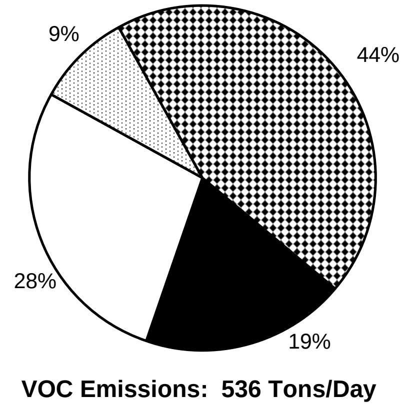
TABLE 3-5B

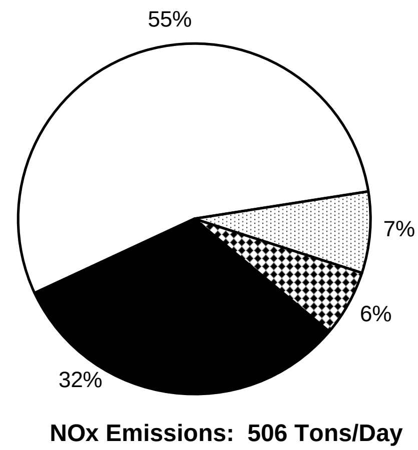
Summary of Emissions By Major Source Category: 2023 Base Year
Planning Inventory** (tons/day[1])

	SUMMER OZONE PRECURSORS		WINTER INVENTORY	
Source Category	VOC	NOx	NOx	CO
Stationary Sources				
Fuel Combustion	7	24	23	55
Waste Disposal	9	2	2	1
Cleaning and Surface Coatings	50	0	0	0
Petroleum Production and Marketing	35	0	0	8
Industrial Processes	26	0	1	4
Solvent Evaporation				
Consumer Products	114	0	0	0
Architectural	31	0	0	0
Others	3	0	0	0
Misc. Processes	9	16	32	229
RECLAIM Sources	0	27	27	0
Total Stationary Sources	**285**	**69**	**85**	**297**
Mobile Sources				
On-Road Vehicles	103	161	174	824
Off-Road Vehicles	148	276	261	936
Total Mobile Sources	**251**	**437**	**435**	**1760**
TOTAL	**536**	**506**	**520**	**2057**

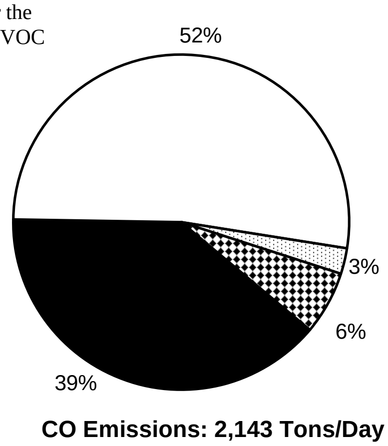
* Travel-related road dust included.
[1] Values are rounded to nearest integer.

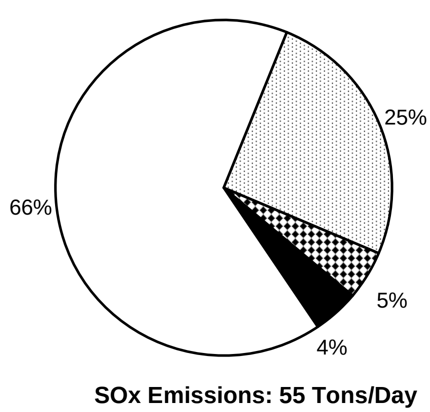
**Planning inventories are not used for PM2.5 analysis.

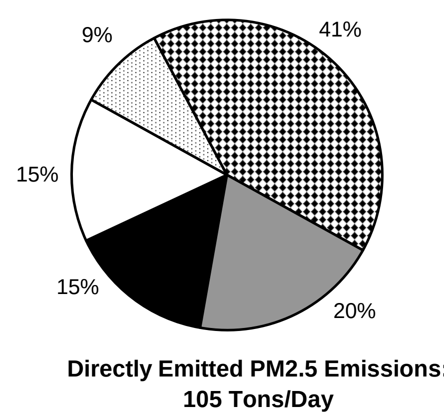




Note: Consumer products and architectural coatings under the area source category represent 114 and 31 tons per day of VOC emissions, respectively.







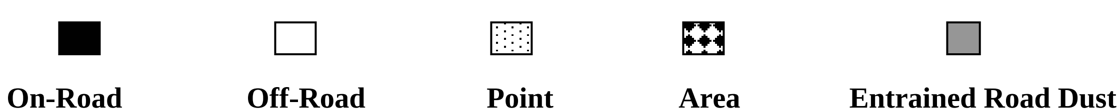


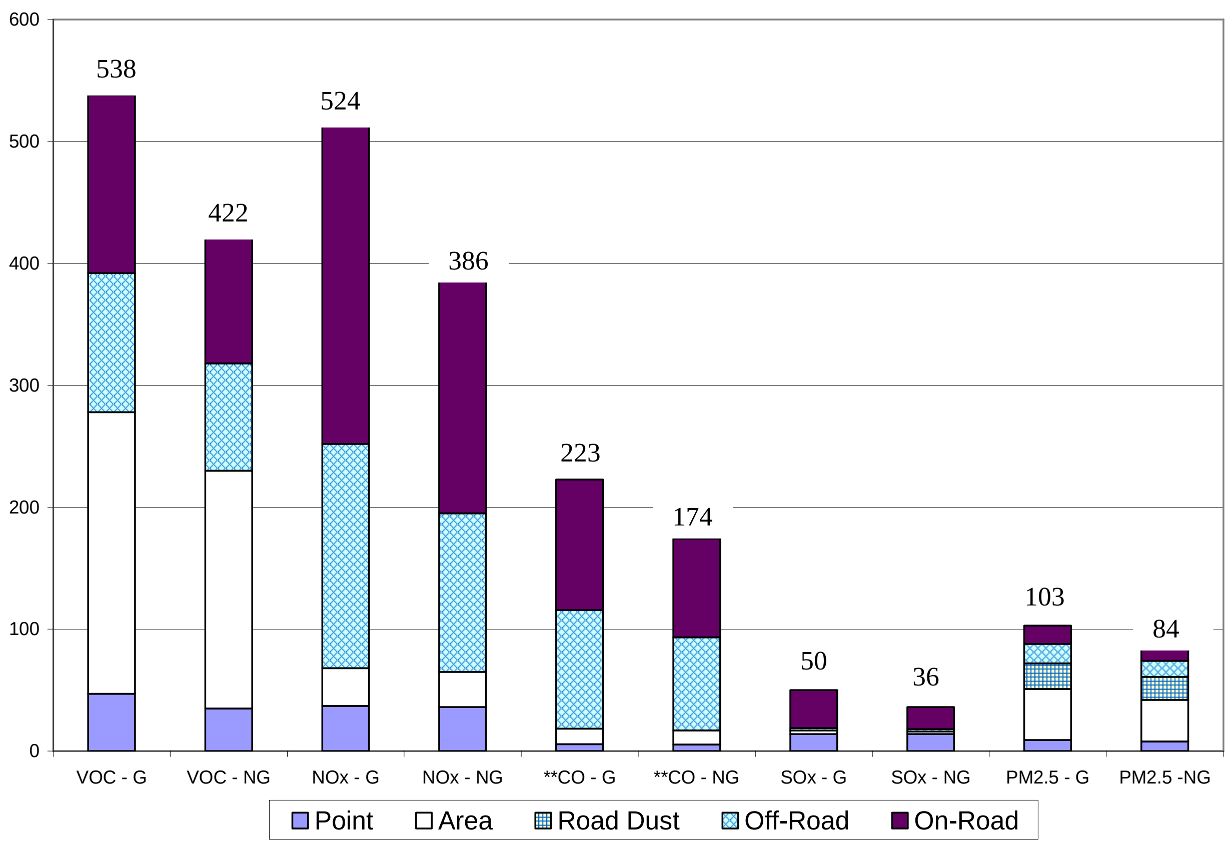
FIGURE 3-3

Relative Contribution by Source Category to 2023 Emission Inventory

(VOC & NOx – Summer Planning; CO, SOx & PM2.5 – Annual Average Inventory)

Impact of Growth

To illustrate the impact of growth, year 2020 no-growth emissions were estimated by removing the growth factors from the 2020 baseline emissions. Figure 3-4 presents the comparison of the 2020 projected emissions with and without growth. It should be noted that in this analysis the benefit of New Source Review is not included. As shown in Table 3-2, the growth from year 2002 to 2020 is significant and presents a formidable challenge to our air quality improvement efforts. We are expecting 22% growth in population; 23% growth in housing units; 21% growth in employment; and 19% growth in vehicle miles traveled. The projected growth will offset the impressive progress made in reducing VOC and NOx emissions through adopted regulations. To overcome such challenges and meet EPA's more stringent standards necessitates continuing aggressive clean-up efforts from all air quality agencies.



* G = Emissions with growth; NG = Emissions without growth
** CO emissions are divided by 10

FIGURE 3-4
2020 Emissions Forecast With and Without Growth
(VOC & NOx – Summer Planning; CO, SOx & PM2.5 – Annual Average Inventory)

Locomotive Emissions

To illustrate the impact of growth on future emissions, the following information on locomotive emissions is provided. As part of the emissions inventory development, all adopted regulatory actions affecting future emissions limits are built into the baseline emissions inventory estimates. Relative to locomotive emissions, emission reductions associated with the current federal emissions standards, fuel standards, and the state MOU with the two major locomotive operators have been incorporated into the future projected baseline emissions inventory out to 2030. In addition, projected future economic growth has been incorporated into the baseline inventories.

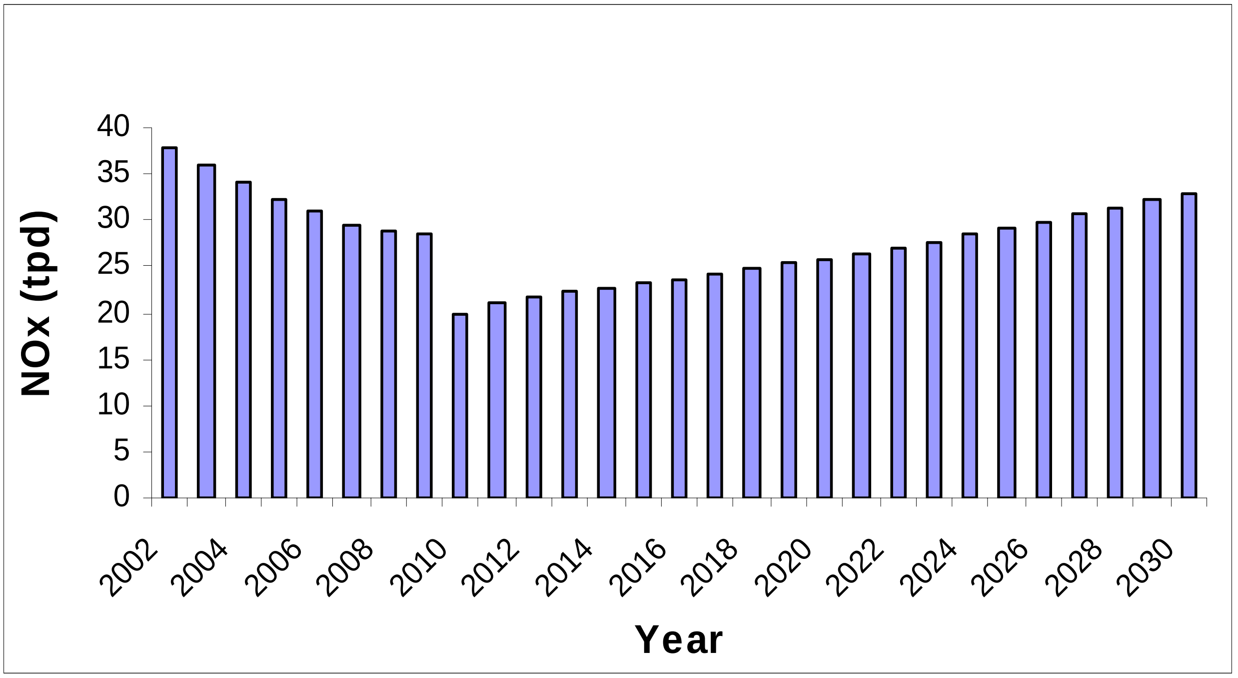


FIGURE 3-5A
Locomotive NOx
Baseline Emissions Trend

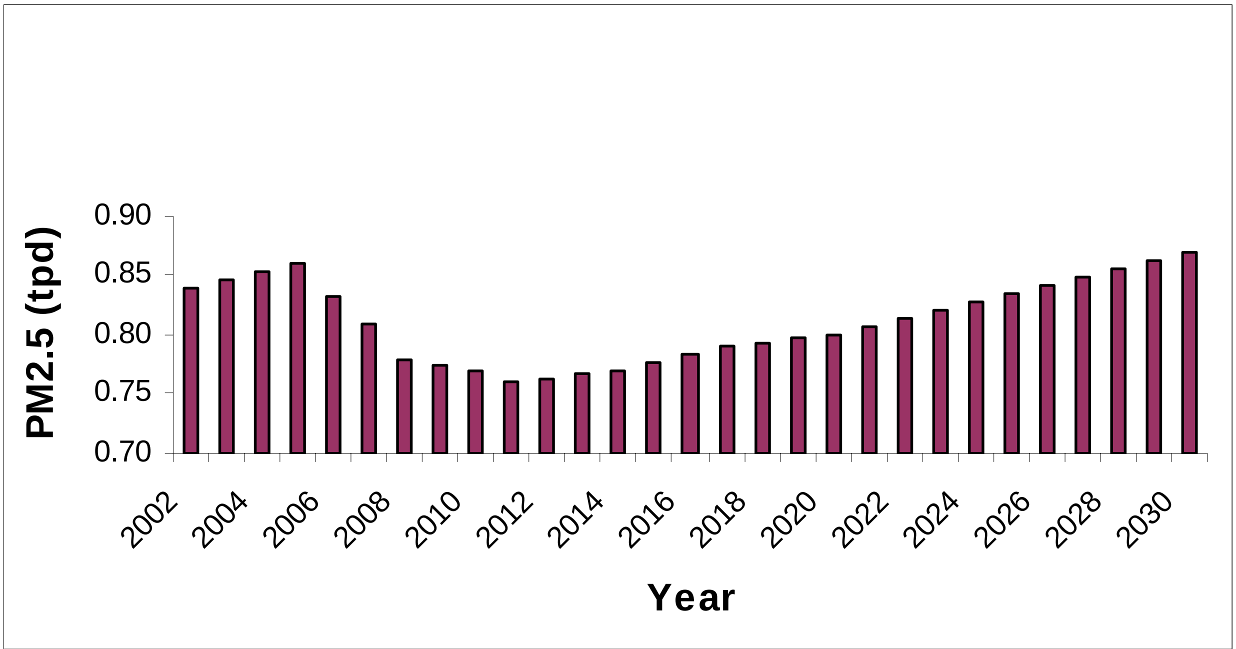


FIGURE 3-5B
Locomotive PM2.5
Baseline Emissions Trend

The 1998 California MOU with the locomotive industry would require that the railroads meet a fleetwide Tier 2 locomotive emission standard on average to operate in the South Coast Air Basin. As shown in Figures 3-5 and 3-6, the South Coast would show a somewhat greater benefit in having cleaner engines earlier. In addition, the use of lower sulfur diesel fuel is expected to have a measurable benefit in NOx and PM emission reductions beginning in 2010. However, after 2012 there is a steady increase in emissions due to future growth projected for the rail industry. This growth is expected to overtake the benefits of the cleaner Tier 2 locomotives and low sulfur fuel standards. There is also significant uncertainty that the MOU will deliver the promised emission reductions. This AQMP seeks to provide the cleanest technologically feasible locomotives to accelerate emission reductions as early as possible.

Recently, the U.S. EPA provided preliminary estimates of locomotive emissions of NOx and PM projected out to the year 2040. Figures 3-6A and 3-6B provide the emission projections from the various types of locomotives operating in the future. As older, uncontrolled locomotives (depicted in the figures as Uncontrolled and Tier 0 fleets) are turned over to newer, lower emission locomotives (depicted as Tier 1 and Tier 2 fleets), it is anticipated that the locomotive fleet will be cleaner in the future due to changes in the emission standards for new locomotives. Figures 3-6A and 3-6B show draft EPA model results for locomotives from 2006 to 2040 for NOx and PM, respectively. The national emission trends shown in these figures are similar to those for the South Coast

Air Basin; that the anticipated growth will overtake the benefits of the cleaner Tier 2 locomotives.

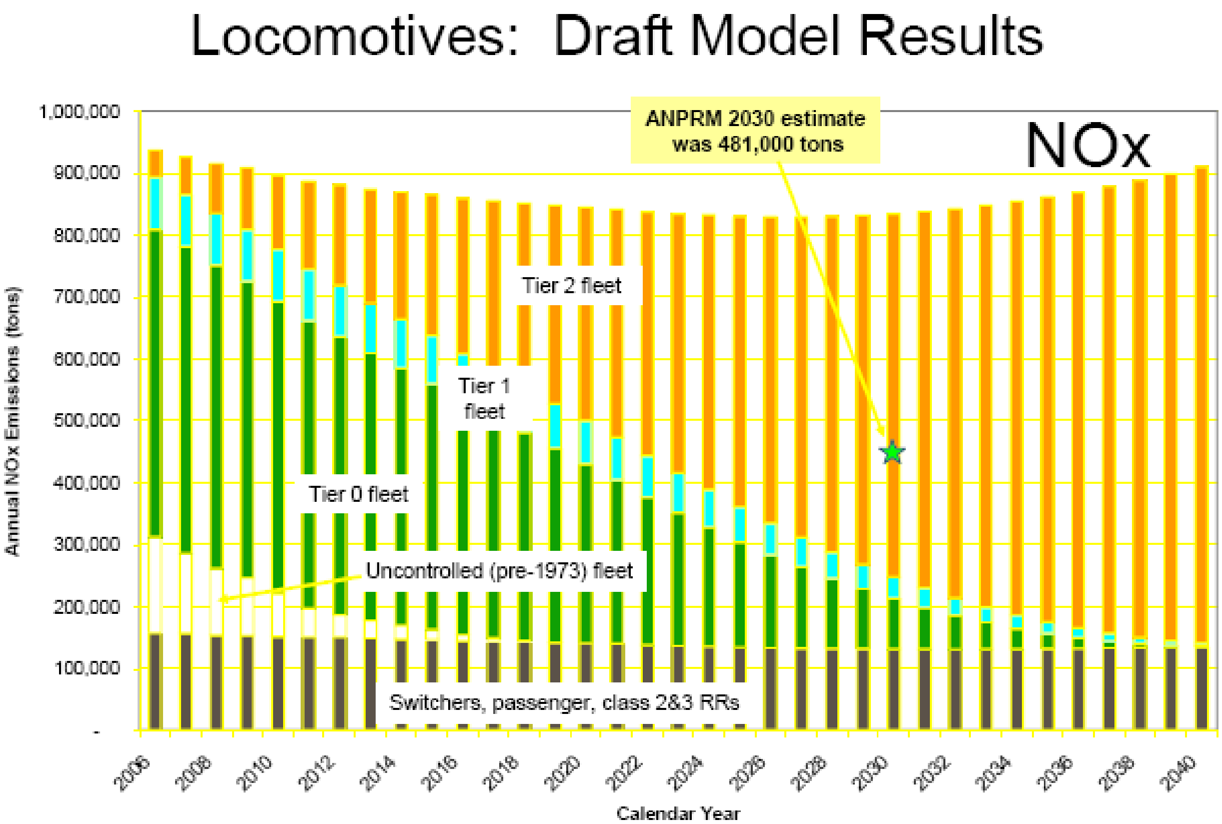
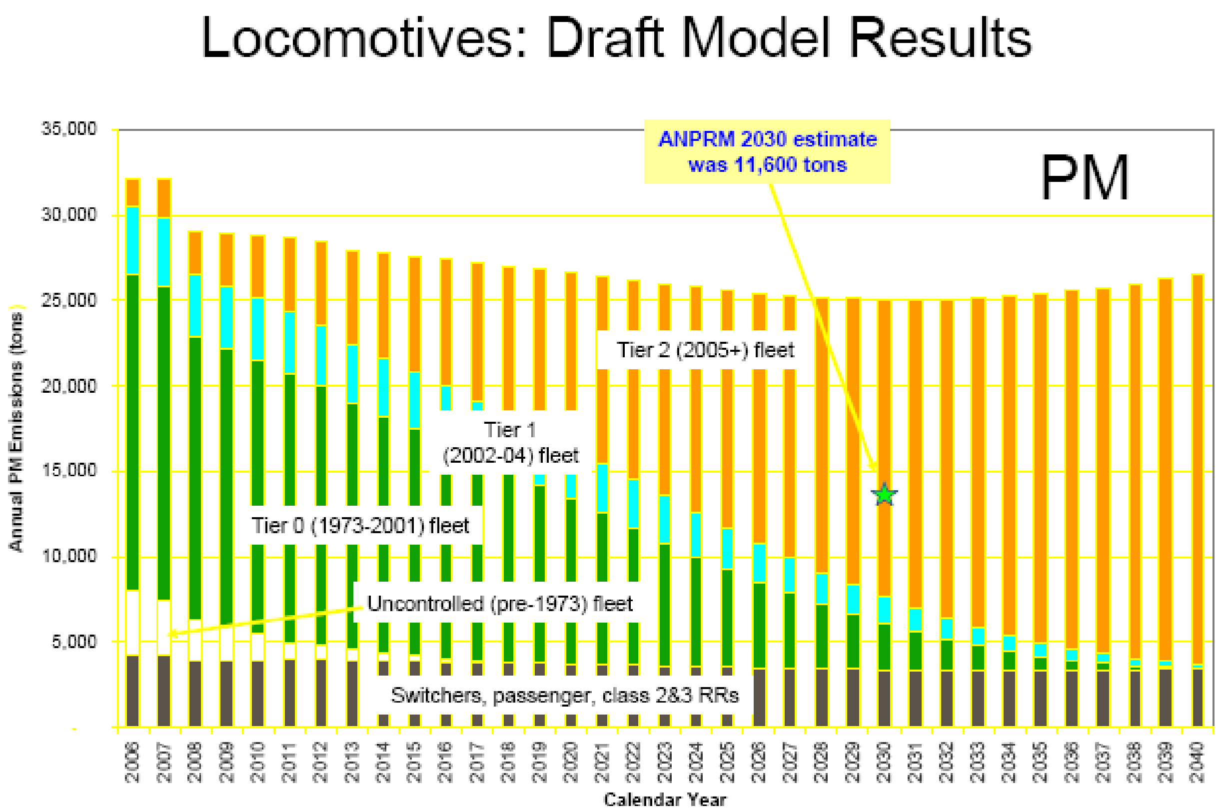


FIGURE 3-6A

Projected Nationwide NOx Emissions from Locomotives



Source: U.S. EPA, Presentation at the Second Public Meeting to Discuss Future Locomotive Emissions Control Factors, CARB (July 13, 2006).

FIGURE 3-6B

Projected Nationwide Particulate Matter Emissions from Locomotives

TOP TEN SOURCE CATEGORIES (2002, 2014, 2023)

This portion of Chapter 3 provides the ranking of the top 10 contributors to the inventory for the years 2002, 2014, and 2023. The annual average inventory for VOC, NOx, SOx and PM2.5 are shown in the following figures. VOC and NOx inventories are usually presented with a planning inventory, but the ranking would not change between planning and annual average. The categorization can be done several ways. These categories are fairly broad, intended for illustration purposes.

Table 3-6 lists the top 10 categories for each of the three years for VOCs. The top five categories in each year are fairly consistent, although the ranking changes slightly for some categories. Mobile source categories and consumer products are responsible for a large portion of the emissions; the top 10 categories account for 82 percent of the total VOC inventory in 2002.

TABLE 3–6

Top Ten Ranking for VOC Emissions (2002, 2014, 2023), from Highest to Lowest

	2002*	**2014***	**2023***
1	Light-Duty Passenger Cars	Consumer Products	Consumer Products
2	Consumer Products	Off-Road Equipment	Off-Road Equipment
3	Off-Road Equipment	Light-Duty Passenger Cars	Recreational Boats
4	Light-Duty Trucks	Light-Duty Trucks	Light-Duty Trucks
5	Architectural Coatings	Recreational Boats	Petroleum Marketing
6	Recreational Boats	Petroleum Marketing	Light Duty Passenger Cars
7	Heavy-Duty Gasoline Trucks	Architectural Coatings	Architectural Coatings
8	Medium-Duty Trucks	Coatings & Related Processes	Coatings & Related Processes
9	Petroleum Marketing	Medium-Duty Trucks	Aircraft
10	Coatings & Related Processes	Heavy-Duty Gasoline Trucks	Medium-Duty Trucks

* Refer to Figures 3-7 to 3-18 for the annual average emissions totals.

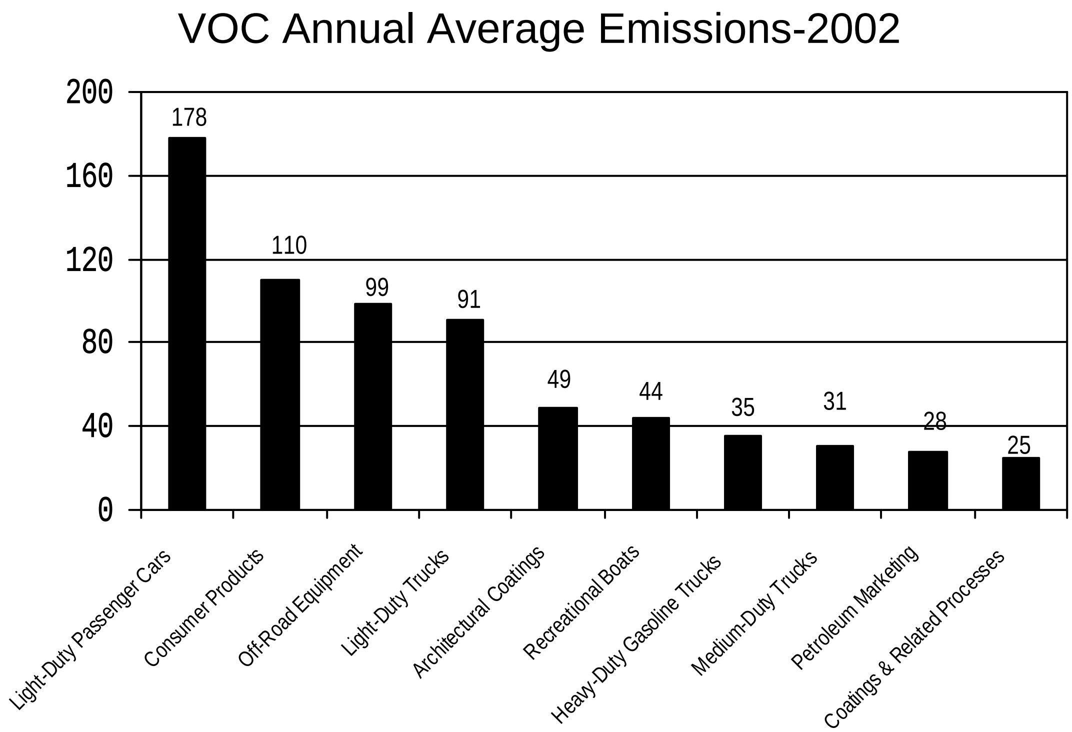


FIGURE 3-7
Top Ten Categories for VOC 2002

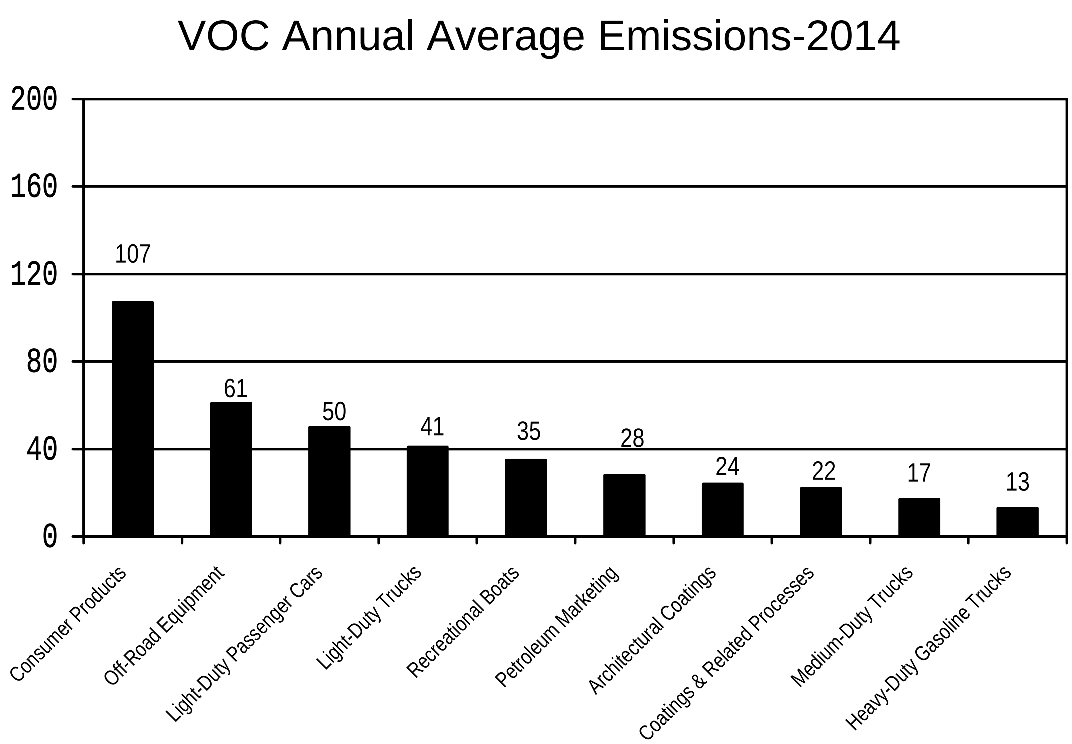


FIGURE 3-8
Top Ten Categories for VOC 2014

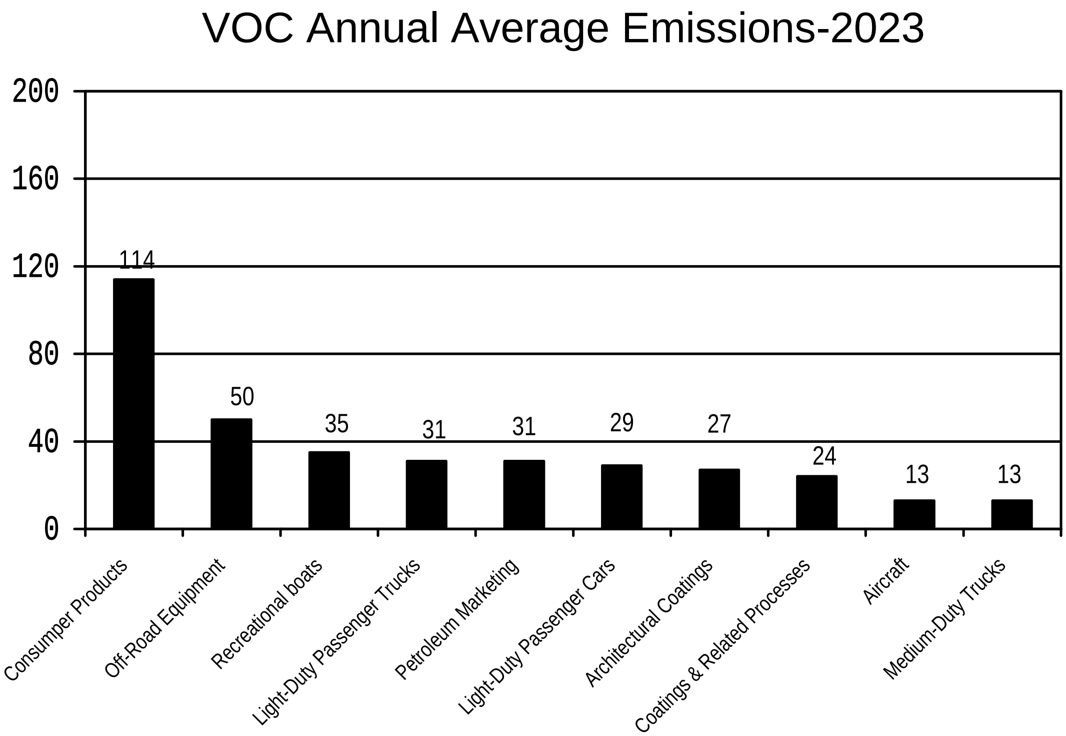


FIGURE 3-9

Top Ten Categories for VOC 2023

Table 3-7 shows the top 10 categories for each of the three years for NOx. As with their predominant contribution to VOC emissions, mobile source categories are the predominant contributor to NOx emissions. For NOx, RECLAIM and residential fuel combustion are the stationary and area source categories that are in the top 10 list. The top 10 categories account for 91 percent of the total NOx inventory in 2002.

TABLE 3-7

Top Ten Ranking for NOx Emissions (2002, 2014, 2023), from Highest to Lowest

	2002*	2014*	2023*
1	Off-Road Equipment	Heavy-Duty Diesel Trucks	Ships & Commercial Boats
2	Heavy-Duty Diesel Trucks	Off-Road Equipment	Off-Road Equipment
3	Light-Duty Passenger Cars	Ships & Commercial Boats	Heavy-Duty Diesel Trucks
4	Light-Duty Trucks	Light-Duty Trucks	Aircraft
5	Ships & Commercial Boats	Light-Duty Passenger Cars	Trains
6	Medium-Duty Trucks	RECLAIM	RECLAIM
7	Heavy-Duty Gasoline Trucks	Heavy-Duty Gasoline Trucks	Light-Duty Trucks
8	Trains **	Trains **	Residential Fuel Combustion
9	RECLAIM	Residential Fuel Combustion	Light-Duty Passenger Cars
10	Residential Fuel Combustion	Aircraft	Heavy-Duty Gasoline Trucks

* Refer to Figures 3-7 to 3-18 for the annual average emissions totals.

** This assumes that the CARB railroad MOU is fully effective. It is likely that this may not occur because there are broadly worded exemptions in the MOU that could result in less emission reductions. However, if AQMD Rules 3501 - Recordkeeping for Locomotive Idling and 3502 - Minimization of Emissions from Locomotive Idling are implemented, more certainty in achieving emission reductions will occur. Recently, these rules were held invalid by a court, if this decision is ultimately reversed and the rules are upheld, AQMD staff intends to submit these rules into the State Implementation Plan (SIP).

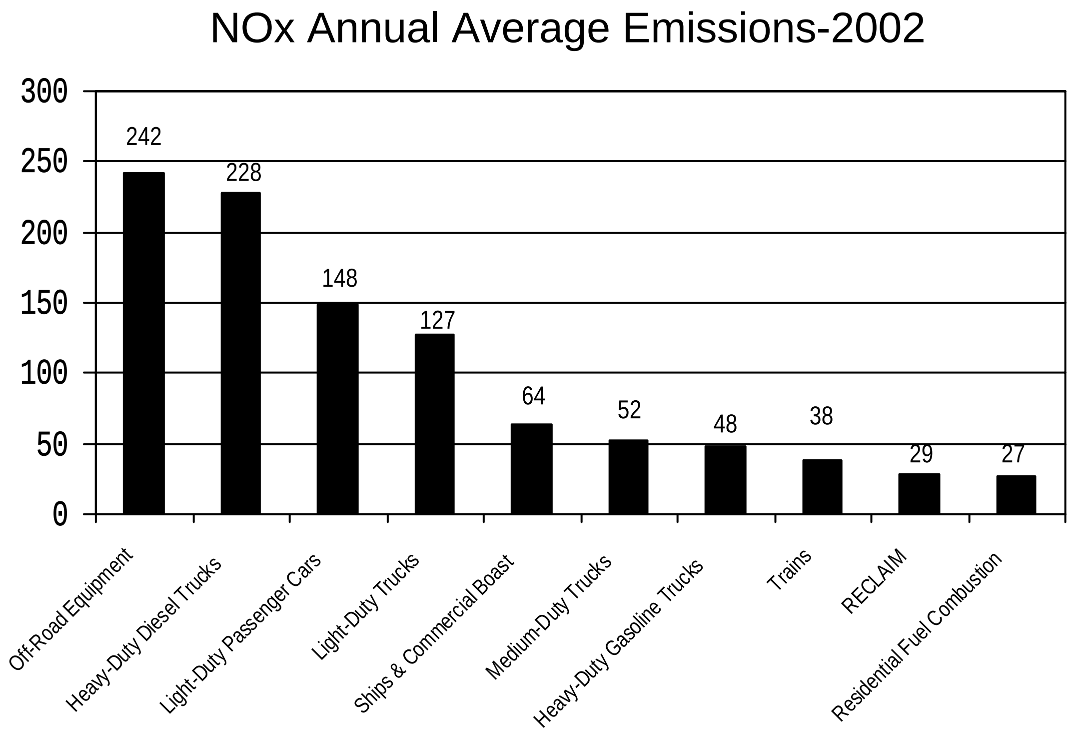


FIGURE 3-10
Top Ten Categories for NOx 2002

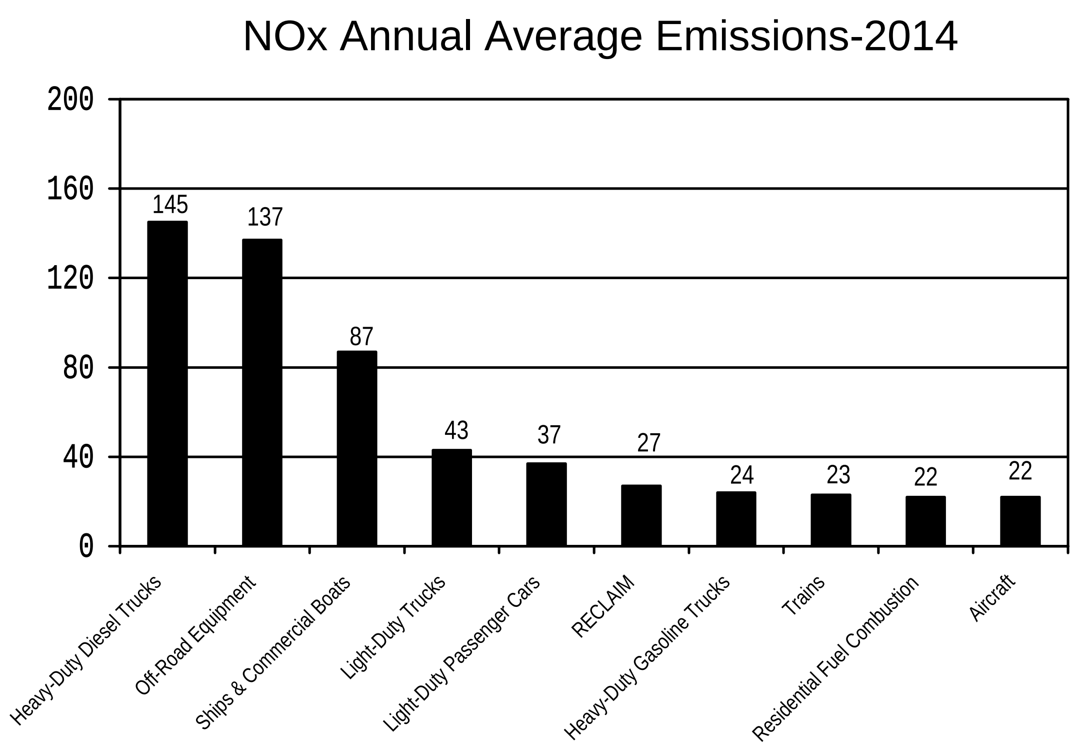


FIGURE 3-11
Top Ten Categories for NOx 2014

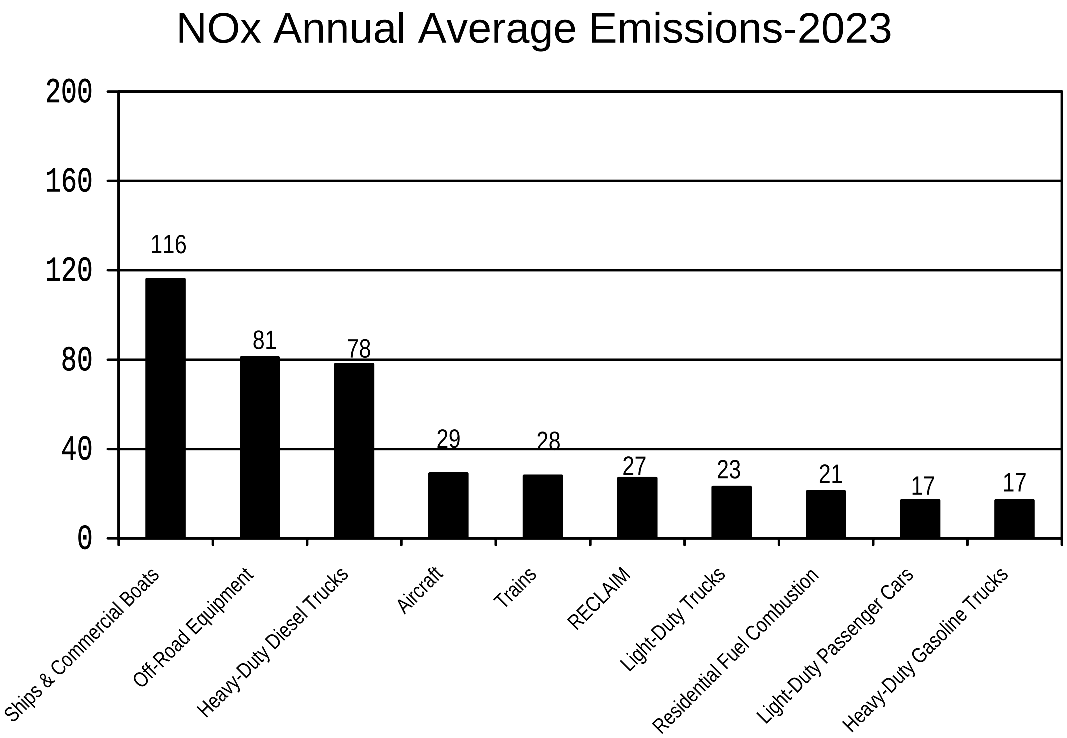


FIGURE 3-12
Top Ten Categories for NOx 2023

Table 3-8 shows the top 10 categories for each of the three years for SOx. Ship emissions are a more significant contributor for SOx than for the other three pollutants in this section. RECLAIM is consistently the second by ranking. Ships and commercial boats are consistently the highest emitting source category. The top ten categories represent 95 percent of the total SOx inventory in 2002.

TABLE 3-8

Top Ten Ranking for SOx Emissions (2002, 2014, 2023), from Highest to Lowest

	2002*	2014*	2023*
1	Ships & Commercial Boats	Ships & Commercial Boats	Ships & Commercial Boats
2	RECLAIM	RECLAIM	RECLAIM
3	Petroleum Refineries (non-RECLAIM)	Aircraft	Aircraft
4	Heavy-Duty Diesel Trucks	Manufacturing & Industrial Combustion	Manufacturing & Industrial Combustion
5	Aircraft	Light-Duty Passenger Cars	Light-Duty Passenger Cars
6	Trains **	Light-Duty Trucks	Light-Duty Trucks
7	Off-Road Equipment	Service & Commercial Combustion	Service & Commercial Combustion
8	Light-Duty Passenger Cars	Petroleum Refineries (non-RECLAIM)	Petroleum Refineries (non-RECLAIM)
9	Manufacturing & Industrial Combustion	Waste Burning & Disposal	Waste Burning & Disposal
10	Light-Duty Trucks	Residential Fuel Combustion	Residential Fuel Combustion

* Refer to Figures 3-7 to 3-18 for the annual average emissions totals.

** This assumes that the CARB railroad MOU is fully effective. It is likely that this may not occur because there are broadly worded exemptions in the MOU that could result in less emission reductions. However, if AQMD Rules 3501 - Recordkeeping for Locomotive Idling and 3502 - Minimization of Emissions from Locomotive Idling are implemented, more certainty in achieving emission reductions will occur. Recently, these rules were held invalid by a court. If this decision is ultimately reversed, and the rules are upheld, AQMD staff intends to submit these rules into the State implementation Plan (SIP).

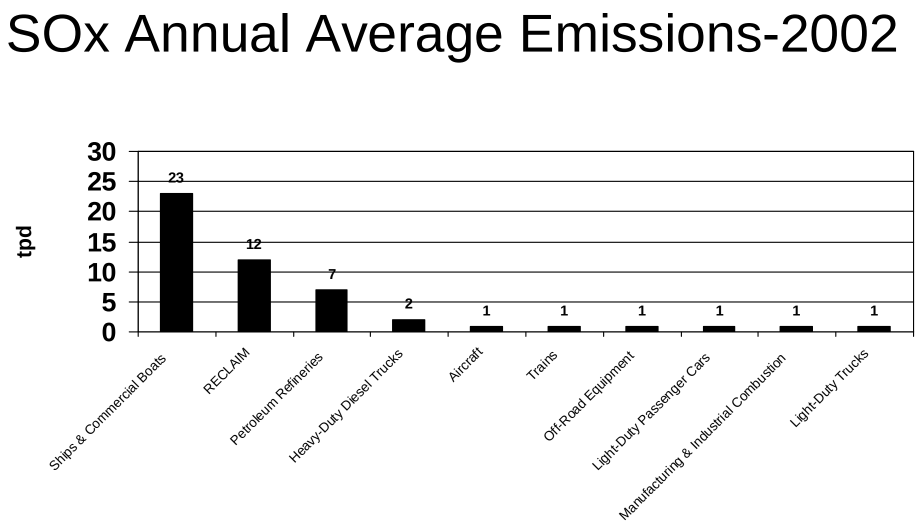


FIGURE 3-13
Top Ten Categories for SOx 2002

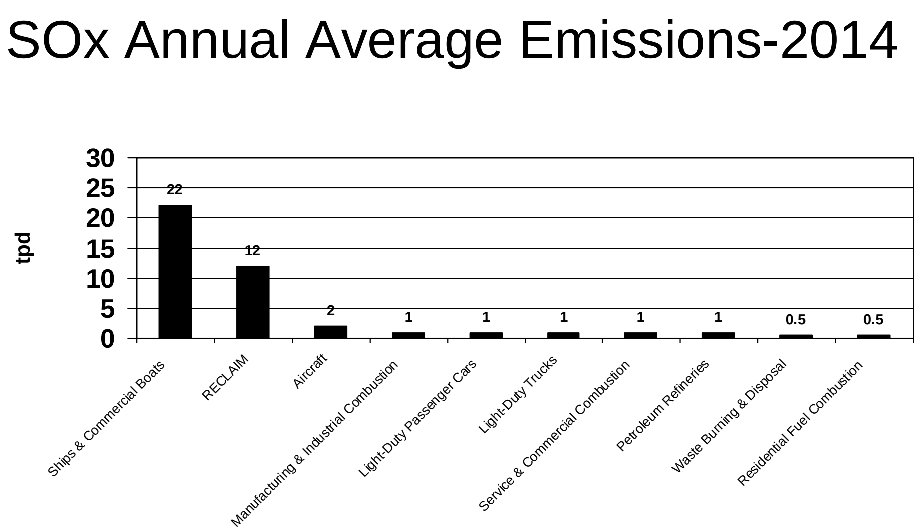


FIGURE 3-14
Top Ten Categories for SOx 2014

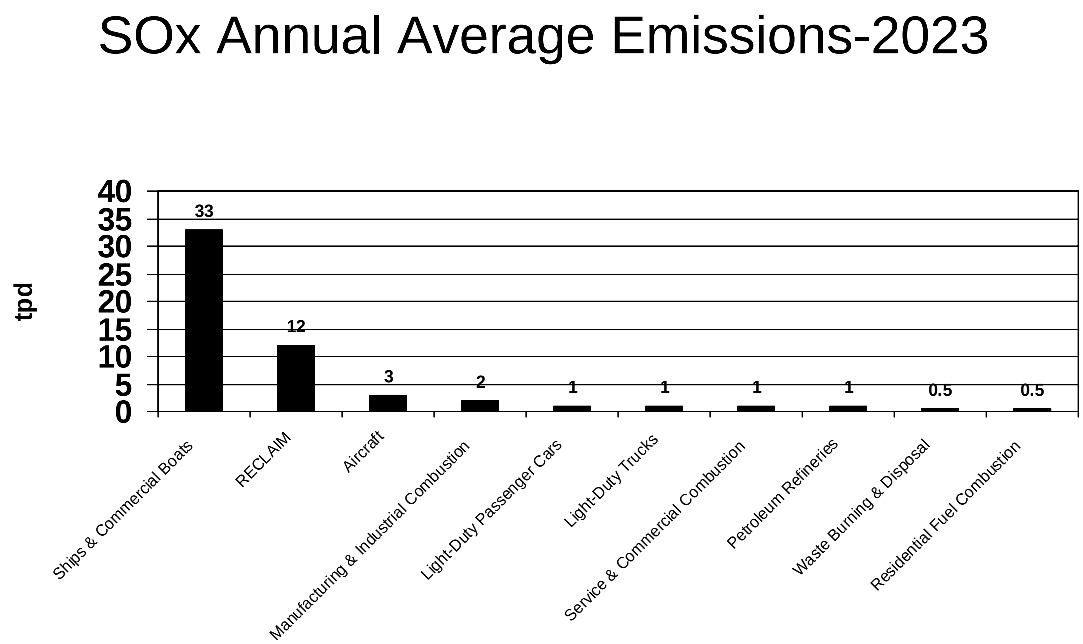


FIGURE 3-15
Top Ten Categories for SOx 2023

Table 3-9 shows the top 10 categories for each of the three years for directly emitted PM2.5. In contrast to the rankings for the other three pollutants in this section of the chapter, paved road dust and cooking are consistently at the top of the ranking for PM2.5 emissions. Each of these categories increases over time. The top ten categories represent 80 percent of the total directly emitted PM2.5 inventory in 2002, however, total directly emitted PM2.5 only accounts for about 25 percent of all ambient PM2.5.

TABLE 3-9
Top Ten Ranking for Directly Emitted PM2.5 Emissions (2002, 2014, 2023), from Highest to Lowest

	2002*	2014*	2023*
1	Paved Road Dust	Paved Road Dust	Paved Road Dust
2	Commercial Cooking	Commercial Cooking	Commercial Cooking
3	Off-Road Equipment	Residential Fuel Combustion	Residential Fuel Combustion
4	Heavy-Duty Diesel Trucks	Off-Road Equipment	Construction & Demolition Dust
5	Residential Fuel Combustion	Construction & Demolition Dust	Ships and Commercial Boats
6	Ships & Commercial Boats	Heavy-Duty Diesel Trucks	Light-Duty Trucks
7	Light-Duty Passenger Cars	Waste Burning & Disposal	Light-Duty Passenger Cars
8	Construction & Demolition Dust	Light-Duty Trucks	Waste Burning & Disposal
9	Light-Duty Trucks	Light-Duty Passenger Cars	Recreational Boats
10	Wood & Paper	Ships & Commercial Boats	Off-Road Equipment

* Refer to Figures 3-7 through 3-18 for the annual average emissions totals.

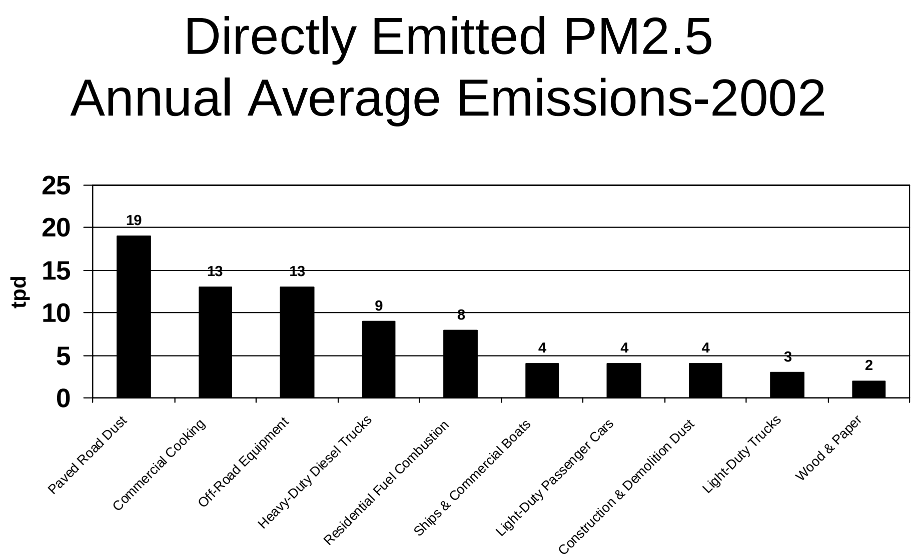


FIGURE 3-16
Top Ten Categories for PM2.5 2002

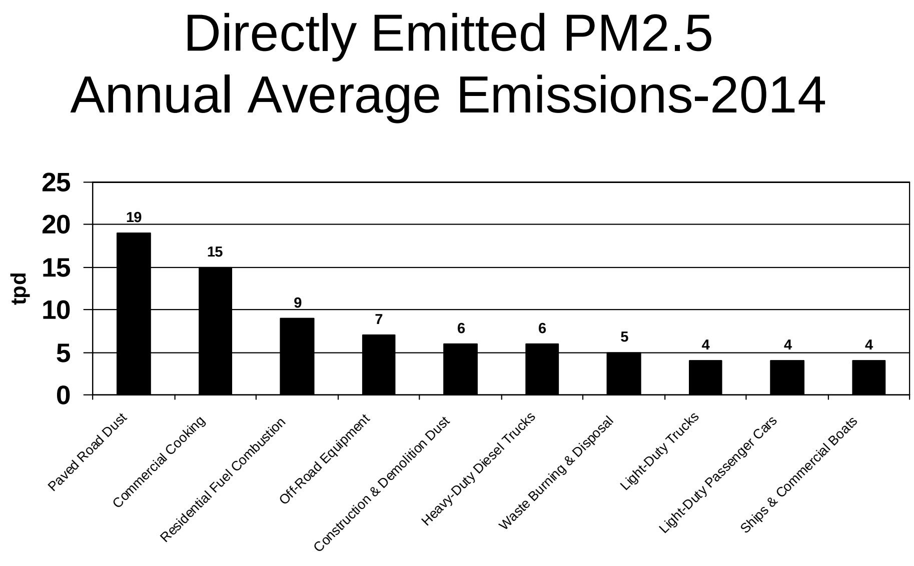


FIGURE 3-17
Top Ten Categories for PM2.5 2014

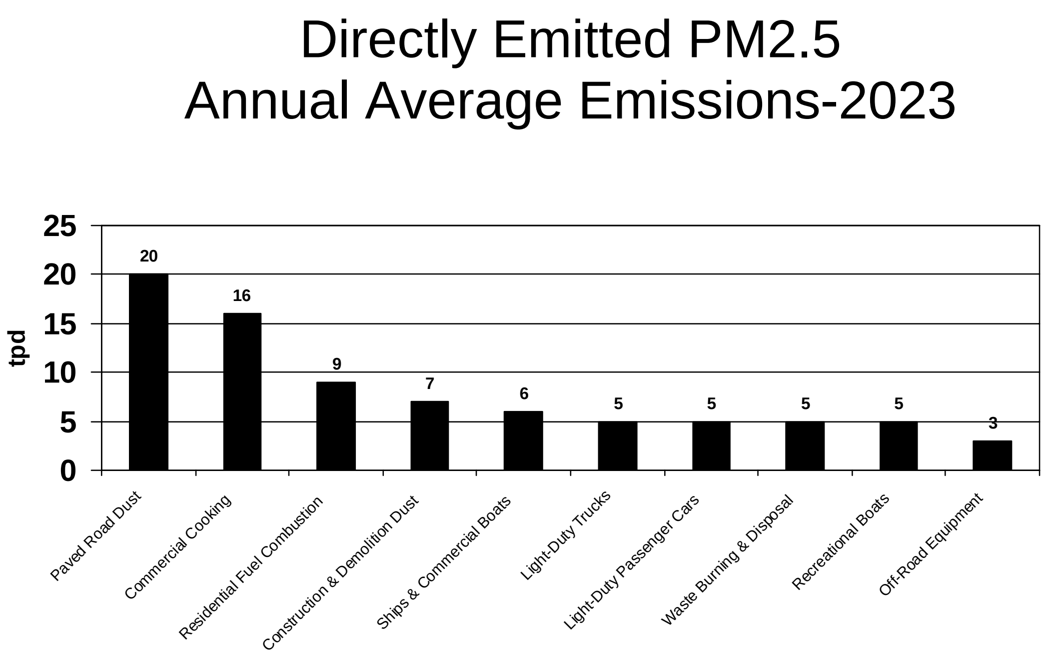


FIGURE 3-18
Top Ten Categories for PM2.5 2023