Chapter 3

Base Year and Future Emissions

South Coast Air Quality Management District
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CHAPTER 3

BASE YEAR AND FUTURE EMISSIONS

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INTRODUCTION

This chapter summarizes emissions that occurred in the Basin during the 2008 base year, and projected emissions in the years 2014, 2019, 2023, and 2030. More detailed emission data analyses are presented in Appendix III of the Final 2012 AQMP. The 2008 base year emissions inventory reflects adopted air regulations with current compliance dates as of 2008; whereas future baseline emissions inventories are based on adopted air regulations with both current and future compliance dates. A list of the District and CARB's rules and regulations that are part of the base year and future-year baseline emissions inventories is presented in Appendix III of the Final 2012 AQMP. The District is committed to implement the District rules that are incorporated in the Final 2012 AQMP future baseline emissions inventories.

The emissions inventory is divided into four major classifications: point, area, on-road, and off-road sources. The 2008 base year point source emissions are based principally on reported data from facilities using the District's Annual Emissions Reporting Program. The area source emissions are estimated jointly by CARB and the District. The on-road emissions are calculated by applying CARB's EMFAC2011 emission factors to the transportation activity data provided by Southern California Association of Governments (SCAG) from their adopted 2012 Regional Transportation Plan (2012 RTP). CARB's 2011 In-Use Off-Road Fleet Inventory Model is used for the construction, mining, gardening and agricultural equipment. CARB also provides other off-road emissions, such as ocean-going vessels, commercial harbor craft, locomotives and cargo handling equipment. Aircraft emissions are based on an updated analysis by the District. The future emission forecasts are primarily based on demographic and economic growth projections provided by SCAG. In addition, emission reductions resulting from District regulations adopted by June, 2012 and CARB regulations adopted by August 2011 are included in the baseline.

This chapter summarizes the major components of developing the base year and future baseline inventories. More detailed information, such as CARB's and the District's emission reductions resulting from adopted rules and regulations since the 2007 AQMP, growth factors, and demographic trends, are presented in Appendix III of the Final 2012 AQMP. In addition, the top ten source categories contributing to the 2008, 2014, and 2023 emission inventories are identified in this chapter. Understanding information about the highest emitting source categories leads to the identification of potentially more effective and/or cost effective control strategies for improving air quality.

EMISSION INVENTORIES

Two inventories are prepared for the Final 2012 AQMP for the purpose of regulatory and SIP performance tracking and transportation conformity: an annual average inventory, and a summer 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 summer planning inventory emissions. The Final 2012 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 summer planning inventory emissions are developed to capture the emission levels during a poor air quality season, and are used to report emission reduction progress as required by the federal and California Clean Air Acts.

Detailed information regarding the emissions inventory development for the base year and future years, the emissions by major source category of the base year, and future baseline emission inventories are presented in Appendix III of the Final 2012 AQMP. Attachments A and B to Appendix III list the annual average and summer planning emissions by major source category for 2008, 2014, 2017, 2019, 2023 and 2030, respectively. Attachment C to Appendix III has the top VOC and NOx point sources which emitted greater than or equal to ten tons per year in 2008. Attachment D to the Appendix III contains the on-road emissions by vehicle class and by pollutant for 2008, 2014, 2019, 2023 and 2030. Attachment E to Appendix III shows emissions associated with the 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 large emitters with one or more emission sources at a permitted facility with an identified location (e.g., power plants, refineries). These facilities have annual emissions of 4 tons or more of either Volatile Organic Compounds (VOC), Nitrogen Oxide (NOx), Sulfur Oxide (SOx), or total Particulate Matter (PM), or annual emissions of over 100 tons of Carbon Monoxide (CO). Facilities are required to report their criteria pollutant emissions and selected toxics to the District on an annual basis, if any of these thresholds are exceeded.

Area sources consist of many small emission sources (e.g., residential water heaters, architectural coatings, consumer products as well as permitted sources smaller than the above thresholds) which are distributed across the region. There are about 400 area source categories for which emissions are jointly developed by CARB and the District.

The emissions from these sources are estimated using activity information and emission factors. Activity data are usually obtained from survey data or scientific reports (e.g., Energy Information Administration (EIA) reports for fuel consumption other than natural gas fuel, Southern California Gas Company for natural gas consumption, paint suppliers and, District databases). The emission factors are based on rule compliance factors, source tests, Material Safety Data Sheets (MSDS), default factors (mostly from AP-42, U.S. EPA's published emission factor compilation), or weighted emission factors derived from the point source facilities' annual emissions reports. Additionally, the emissions over a given area may be calculated using socioeconomic data.

Appendix III of the Final 2012 AQMP has more detail regarding emissions from specific source categories such as fuel combustion sources, landfills, composting waste, metal-coating operations, architectural coatings, and livestock waste. Since the 2007 AQMP was finalized, new area source categories, such as LPG transmission losses, storage tank and pipeline cleaning and degassing, and architectural colorants, were created and included in the emission inventories. These updates and new additions are listed below:

- Fuel combustion sources: The emissions from commercial and industrial internal combustion engines were updated to include the portable equipment emissions.
- Landfills: The emission estimation methodology for this area source category was revised to incorporate CARB's landfills greenhouse gas (GHG) emission inventory data.
- Composting waste category: The emission estimation methodology for this area source category was revised to include the emissions from green waste composting covered under District Rule 1133.3. The 2007 AQMP only included the emissions from co-composting, as it relates to District Rule 1133.2.
- Metal coating operations: This area source category in the 2007 AQMP only included the emissions from small permitted facilities with VOC emissions below 4 tons per year. As such, emissions from these sources maybe underreported in the 2007 AQMP. During the rule development process for amending Rule 1107, staff discovered numerous small shops using coating materials with compliant high solid concentrations, which are subsequently thinned beyond the allowable limits permitted by Rule 1107. The Final 2012 AQMP revised inventory adjusts the 2007 AQMP inventory to account for excess emissions from these coating activities.

- Architectural coating category: Three new area source categories were added under this category to accurately track the emissions from colorants.
- LPG transmission losses: This newly added area source category was created to include the emissions from LPG storage and fueling losses.
- Livestock waste sources: This inventory was updated to reflect the difference amongst dairy cattle based on the fraction of milking cows, dry cows, calves, and heifers as each has different VOC and NH3 emission factors based on the quantity of manure production.
- Storage tanks and pipeline cleaning: This new area source category was added to include the emissions from these types of operations.

Mobile Sources

Mobile sources consist of two subcategories: on-road and off-road sources. On-road vehicle emissions are calculated by applying CARB's EMFAC2011 emissions factors to the transportation activity data provided by SCAG from their adopted 2012 RTP. Spatial distribution data from Caltrans' Direct Travel Impact Model (DTIM4) are used to generate the gridded emissions. Off-road emissions are calculated using CARB's 2011 In-Use Off-Road Fleet Inventory model for construction, mining, gardening, and agricultural equipment. Ship, locomotive, and aircraft emissions are excluded from CARB's In-Use Off-Road Fleet Inventory model. Their emissions for 2008 and future years were revised separately based on the most recently available data.

<u>On-Road</u>

CARB's EMFAC2011 has been updated to reflect more recent vehicle population, activity, and emissions data. Light-duty motor vehicle fleet age, vehicle type, and vehicle population are updated based on 2009 California Department of Motor Vehicles data. The model also reflects recently adopted rules and benefits that were not reflected in EMFAC2007. The rules and benefits include on-road diesel fleet rules, the Pavley Clean Car Standards, and the Low Carbon Fuel standard. The most important improvement in the model is the integration of new data and methods to estimate emissions from diesel trucks and buses. CARB's Truck and Bus Regulation for the on-road heavy-duty in-use diesel vehicles applies to nearly all privately owned diesel fueled trucks and privately and publicly owned school buses with a gross vehicle weight rating (GVWR) greater than 14,000 pounds. EMFAC2011 includes the emissions benefits of the Truck and Bus Rule and previously adopted rules for other on-

road diesel equipment. The impacts of the recent recession on emissions, quantified as part of the truck and bus rulemaking, are also included.

EMFAC2011 uses a modular emissions modeling approach that departs from past EMFAC versions. The first module, named EMFAC-LDV, is used as the basis for estimating emissions from gasoline powered on-road vehicles, diesel vehicles below 14,000 pounds GVWR, and urban transit buses. The second module, called EMFAC-HD, is the basis for emissions estimates for diesel trucks and buses with a GVWR greater than 14,000 pounds operating in California. This module is based on the Statewide Truck and Bus Rule emissions inventory that was developed between 2007 and 2010 and approved by the CARB Board in December 2010. The third module is called EMFAC2011SG. It takes the output from EMFAC-LDV and EMFAC-HD and applies scaling factors to estimate emissions consistent with user-defined vehicle miles of travel and vehicle speeds. Together the three modules comprise EMFAC2011.

Several external adjustments were made to EMFAC2011 in the Final 2012 AQMP to reflect CARB's rules and regulations which were adopted after the development of EMFAC2011. The adjustments include the advanced clean cars regulations, reformulated gasoline, and smog check improvement.

Figure 3-1 compares the on-road emissions between EMFAC2007 V2.3 used in the 2007 AQMP and EMFAC2011 used in the Final 2012 AQMP, respectively. It should be noted that the comparison for 2008 reflects changes in methodology whereas the comparison for 2023 includes adopted rules and updated growth projections since the release of EMFAC2007. In general, the emissions are lower in EMFAC2011 as compared to EMFAC2007. The lower emissions can be attributed to additional rules and regulations which result in reduced emissions, revisions to growth projections, and the economic impacts of the recent recession.

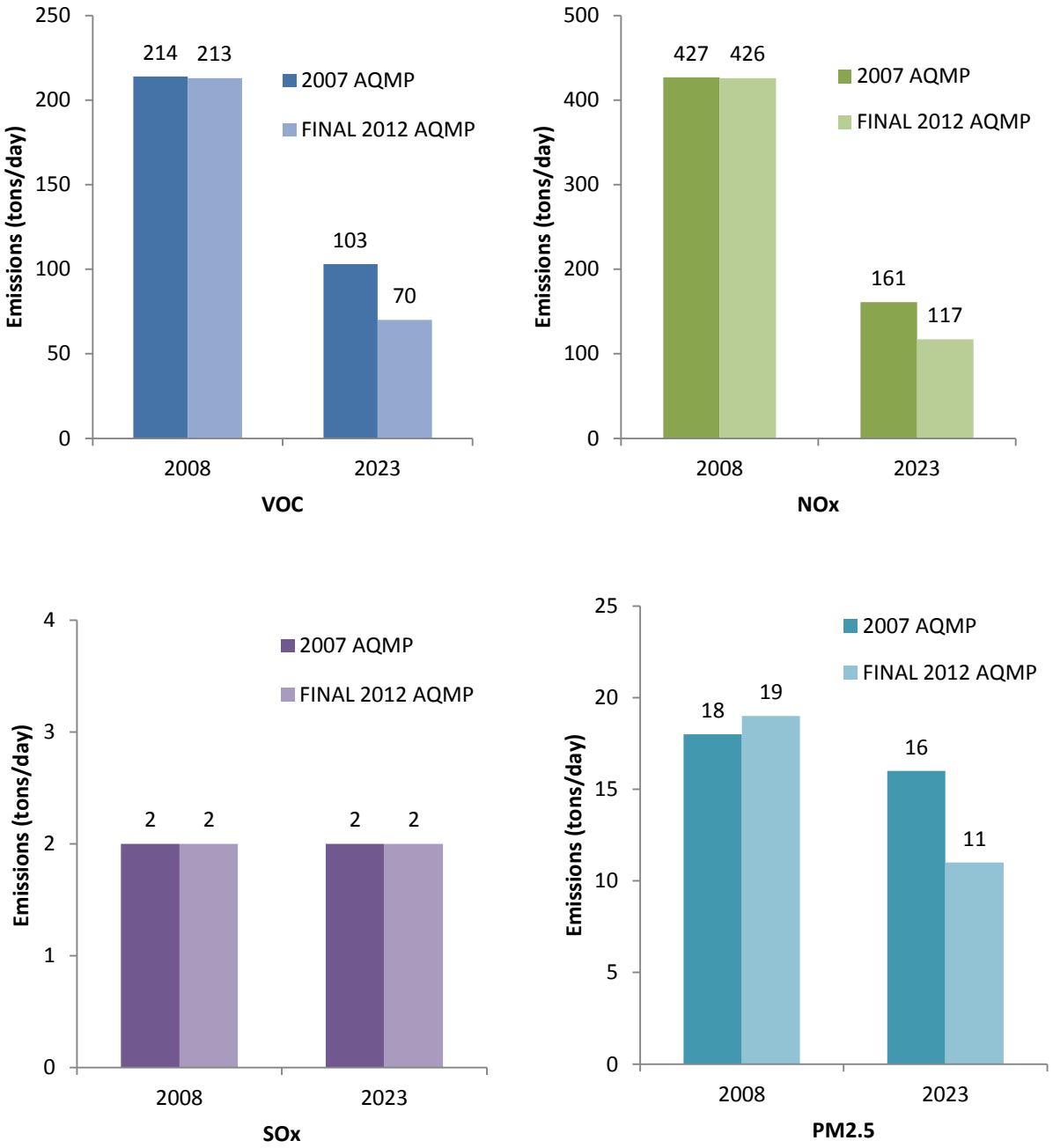


FIGURE 3-1

Comparison of On-Road Emissions Between EMFAC2007 V2.3 (2007 AQMP) and EMFAC2011 (Final 2012 AQMP)

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

Off-Road

Emissions from off-road vehicle categories (construction & mining equipment, lawn & gardening equipment, ground support equipment, agricultural equipment) in CARB's In-Use Off-Road Model were developed primarily based on estimated activity levels and emission factors. Ships, commercial harbor crafts, locomotives, aircrafts, and cargo handling equipment emissions are not included in CARB's In-Use Off-Road Fleet Inventory Model. Separate models or estimations were used for these emissions sources. The off-road source population, activities, and emission factors were re-evaluated and re-estimated since the last AQMP. Consequently, the emissions are modified accordingly.

The major updates and/or improvements to the off-road inventory include:

1. The equipment population in CARB's In-Use Off-Road Fleet Inventory model is updated by using the equipment population reported to CARB for rule compliance. Based on information from CARB, the total population in 2009 was 26% lower than had been anticipated in 2007 due to fleet downsizing during the recent recession.

2. The equipment hours of use in CARB's In-Use Off-Road Fleet Inventory model are updated based on the reported activity data between 2007 and 2009. According to CARB, the new data indicates a 30% or more reduced activity in most cased for 2009 as compared to 2007 due to recession.

3. The equipment load factor in CARB's In-Use Off-Road Fleet Inventory model is updated using a 2009 academic study and information from engine manufacturers. According to CARB, the new data suggests that the load factors should be reduced by 33%.

4. According to CARB, construction activity and emissions have dropped by more than 50% between 2005 and 2011. Future emissions are uncertain and depend on the pace of economic recovery. The future growth in CARB's In-Use Off-Road Fleet Inventory model is projected based on the average of the future forecast scenarios. CARB's data suggest off-road activity and emissions will recover slowly from the recessionary lows.

5. Locomotive inventories reflect the 2008 U.S. EPA Locomotive regulations and adjustments due to economic activity.

6. Cargo handling equipment has been updated for population, activity, recessionary impacts on growth, and engine load. The updates are based on new information collected since 2005. The new information includes CARB's regulatory reporting data which provides an accounting of all the cargo handling equipment in the state including their model year, horsepower and activity. In addition, the Ports of Los Angeles and Long Beach have developed annual emissions inventories and a number of the major rail yards and other ports in the state have completed individual emission inventories.

7. Ocean-going vessel emissions in the Final 2012 AQMP include CARB's fuel regulation for ocean-going vessels and the 2007 shore power regulation. In addition, the improvements and corrections include recoding the model for speed, updating auxiliary engine information, updating ship routing, revising vessel speed reduction compliance rates, and an adjustment factor to estimate the effects of the recession. In March 2010, the International Maritime Organization (IMO) officially designated the waters within 200 miles of the North American Coast as an Emissions Control Area (ECA). Beginning August 2012, IMO requires ships that travel these waters to use fuel with a sulfur content of less than or equal to 1.0% and in 2015 the sulfur limit will be further reduced to 0.1%. Additionally, vessels built after January 1, 2016 will be required to meet the most stringent IMO Tier 3 NOx emission levels while transiting within the 200 mile ECA zone. Outer Continental Shelf (OCS) emissions (i.e. emissions from vessels beyond the three-mile state waters line) are included in the ships emissions as well.

8. Another improvement is the development of a separate emission category for the commercial harbor craft from a new commercial harbor craft database. CARB approved a regulation to significantly reduce diesel PM and NOx emissions from diesel-fueled engines on commercial harbor craft vessels. These vessels emit an estimated 3 tons per day of diesel PM and 70 tons per day of NOx statewide in 2007. The harbor craft database includes emissions from crew & supply, excursion, fishing, pilot, tow boats, barge, and dredge vessels.

9. The aircraft emissions inventory is updated for the 2008 base year and the 2035 forecast year based on the latest available activity data and calculation methodologies. A total of 43 airports were identified as having aircraft operations within the District boundaries including commercial air carrier, air

taxi, general aviation, and military aircraft operations. The sources of activity data include airport operators (for several commercial and military airports), FAA's databases (i.e., Bureau of Transportation Statistics, Air Traffic Activity Data System, Terminal Area Forecast), and SCAG. For commercial air carrier operations, SCAG's 2035 forecast, which is consistent with the forecast adopted for the 2012 RTP, reflects the future aircraft fleet mix. The emissions calculation methodology is primarily based on the application of FAA's Emissions and Dispersion Modeling System (EDMS) model for airports with detailed activity data for commercial air carrier operations (by aircraft make and model). For other airports and aircraft types (i.e., general aviation, air taxi, military), the total number of landing and takeoff activity data is used in conjunction with the U.S. EPA's average emission factors for major aircraft types (e.g., general aviation, air taxi, military). For the intermediate milestone years, the emissions inventories are linearly interpolated between 2008 and 2035.

Several external adjustments to the off-road emissions are made to reflect CARB's rules and regulations and new estimates of activity. The adjustments include locomotives, large spark ignition engines and non-agricultural internal combustion engines.

Figure 3-2 shows a comparison between the off-road baseline emissions in the 2007 AQMP and the Final 2012 AQMP. In general, the emissions are lower in the 2011 In-Use Off-Road Fleet Inventory model, except for 2008 SOx emissions. The projected 2008 off-road NOx emissions in the 2007 AQMP were 339 tons per day, while the 2008 base year off-road NOx emissions in the Final 2012 AQMP are 207 tons per day. The 2011 In-Use Off-Road Fleet Inventory emissions are lower because of the rules and regulations adopted since 2007 OFFROAD model, updated data, future growth corrections and recessionary impacts to commercial and industrial mobile equipment. The higher 2008 estimated SOx emissions reflect a temporary stay in the implementation of the lower sulfur content marine fuel regulation for a portion of 2008.

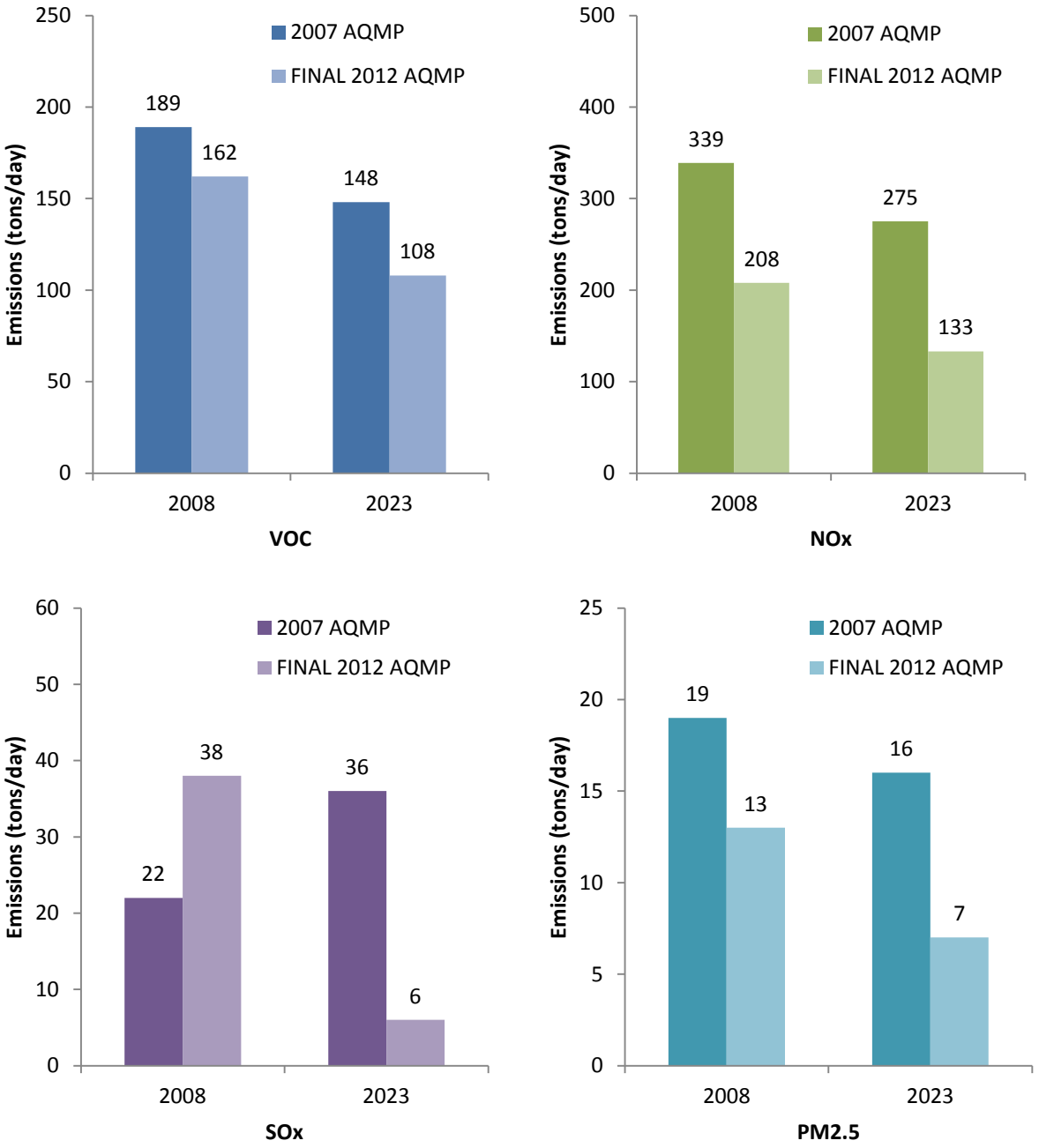


FIGURE 3-2

Comparison of Off-Road Emissions Between 2007 AQMP and Final 2012 AQMP

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

Uncertainty in the Inventory

An effective AQMP relies on a complete and accurate emission inventory. Over the years, significant improvements have been made to quantify emission sources for 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 have also 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 and source-specific studies during rule development have provided much-needed refinement to the emissions estimates.

Mobile source inventories remain the greatest challenge due to continuously collected new information from the large number and types of equipment and engines. Every AQMP revision provides an opportunity to further improve the current knowledge of mobile source inventories. The Final 2012 AQMP is not an exception. As described earlier, many improvements were included in EMFAC2011 and such work is still ongoing. However, it should be acknowledged that there are still areas that could be significantly improved if better data were available. Technological changes and advancement in the area of electric, hybrid, flexible fuel, fuel cell vehicles coupled with changes in future gasoline prices, all add uncertainty to the on-road emissions inventory.

It is important to note that the recent recession began in 2007, and being unforeseen, its impacts were not included in the 2007 AQMP. As the Final 2012 AQMP is being developed, Southern California is still in the midst of a slow economic recovery. The impact of the recession is deep and is still being felt, and thus adds to the uncertainty in the emissions provided here. Relative to future growth, there are many challenges with making accurate projections, such as 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. Forecasts are made with the best information available; nevertheless, they contribute to the overall uncertainty in emissions projections. Fortunately, AQMP updates are generally developed every three to four years; thereby allowing for frequent improvements to the inventories.

Gridded Emissions

For air quality modeling purposes, the region extends to Southern Kern County in the north, the Arizona border in the east, northern Mexico in the south and more than 100

miles offshore to the west. The modeling area is divided into a grid system comprised of 4 km by 4 km grid cells defined by Lambert Conformal coordinates. Both stationary and mobile source emissions are allocated to individual grid cells within this system. In general, the modeling emissions data features daily emissions. Variations in temperature, hours of operation, speed of motor vehicles, or other factors are considered in developing gridded motor vehicle emissions. The "gridded" emissions data used for both PM2.5 and ozone modeling applications 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. Summary of emissions inventories are generated for the PM2.5 and ozone modeling applications. For PM2.5, the annual average day is used, which represents the characteristic of emissions that contribute to year-round particulate impacts. The summer planning inventory focuses on the warmer months (May through October) when evaporative VOC emissions play an important role in ozone formation.

BASE YEAR EMISSIONS

2008 Emission Inventory

Table 3-1A compares the annual average emissions between the 2008 base year in the Final 2012 AQMP and the projected 2008 emissions in the 2007 AQMP by major source category for VOC and NOx. Table 3-1B compares the annual average emissions between the 2008 base year in the Final 2012 AQMP and the projected 2008 emissions in the 2007 AQMP for SOx and PM2.5. Due to the economic recession which began in 2007, it is expected that the more recent 2008 base year emissions estimates should be lower than the previously projected 2008 emissions. Yet, several categories show higher emissions in the 2008 base year in the Final 2012 AQMP, such as fuel consumption, waste disposal, petroleum production and marketing for VOC; fuel consumption for NOx; off-road emissions for SOx; and industrial processes for PM2.5. The reasons are as follows:

1. Fuel consumption – The emissions from commercial and industrial internal combustion engines were updated to include portable equipment emissions which were overlooked in the 2007 AQMP. The update causes increases in emissions for this category.

2. Waste disposal – Due to erroneous activity data reported by point sources in the 2007 AQMP, landfill emissions increased drastically. In addition, landfill

emission estimation methodology was revised to incorporate CARB's GHG Emission Inventory data to calculate the amount of methane being generated in 2008. Industry stakeholders have requested further evaluation of the emission factors currently used. As a result, the District staff will initiate a working group to undertake this effort.

3. Petroleum production and marketing – Two new area source categories (LPG transmission, storage tanks and pipeline cleaning and degassing) were added to the Final 2012 AQMP. LPG transmission source category tracks the fugitive emissions associated with transfer and dispensing of LPG and is based on emission rates derived from the District source tests conducted in 2008 and 2011, sale volumes provided by the industry association, and category breakdowns. A total of 8.4 tons per day VOC emissions were added to the 2008 inventory. Storage tanks and pipeline cleaning and degassing source category was updated based on Rule 1149 amendments to reflect more frequent degassing events as well as the effectiveness of control techniques. During the amendment, it was determined that the actual degassing events were more than triple the amount that was estimated when the rule was originally developed. It was also assumed that once the degassing rule requirements were fulfilled, there would be no more fugitive emissions; however, a review of degassing logs indicated that sludge and product residual in the storage tanks significantly increase the emissions emanating from the storage tanks. Finally, the source category was expanded to include previously exempted tanks and pipelines. The storage tanks and pipeline source adds 1.4 tons per day VOC to the 2008 base year.

4. Off-road SOx – CARB adopted a regulation in 2005 to set sulfur content limits on marine fuels for auxiliary diesel engines and diesel-electric engines operated on ocean-going vessels within California waters and 24 nautical miles of the California coastline. The regulation became effective January 1, 2007, and as a result the SOx reductions were accounted for in the 2007 AQMP. However, pursuant to an injunction issued by a federal district court (district court), CARB ceased enforcing the regulation in the fall of 2007. See *Pacific Merchant Shipping Ass'n v. Thomas A. Cackette* (E.D. Cal. Aug. 30, 2007), No. Civ. S-06 2791-WBS-KJM. CARB filed an appeal with the Ninth Circuit and requested a stay of the injunction pending the appeal. As permitted under the appellate court stay, CARB decided to continue to enforce the regulation while litigation involving the regulation remained active. On May 7, 2008,

CARB issued another announcement to discontinue enforcement of the regulation pursuant to the same injunction after the Court of Appeals issued its decisions which invalidated the 2005 regulation. In the meantime, CARB staff prepared a new Ocean-Going Vessel Clean Fuel Regulation that was approved by its Board on July 24, 2008, and implementation began on July 1, 2009. The 2008 regulation includes the auxiliary engines and also the main engines and auxiliary boilers on ocean-going vessels within the same 24 nautical miles zone as the earlier auxiliary engine rule. The 2008 regulation achieves higher SOx reductions than the original auxiliary engine rule, primarily due to regulating the main engines and auxiliary boilers in addition to the auxiliary engines.

Tables 3-2A and 3-2B show the 2008 emissions inventory by major source category. Table 3-2A shows annual average emissions, while Table 3-2B shows the summer planning inventory. 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, consumer products, and permitted sources smaller than the emission reporting threshold – generally 4 tpy). 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.

Figure 3-3 characterizes relative contributions by stationary and mobile source categories. On- and off-road sources continue to be the major contributors for each of the five pollutants. Overall, total mobile source emissions account for 59% of the VOC and 88% of the NOx emissions for these two ozone-forming pollutants, based on the summer planning inventory. The on-road mobile category alone contributes about 33 and 59% of the VOC and NOx emissions, respectively, and approximately 68% of the CO for the annual average inventory. For directly emitted PM2.5, mobile sources represent 40% of the emissions with another 10% 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 seven times more than point sources. Area sources, including sources such as commercial cooking, are the predominant source of directly emitted PM2.5 emissions (39%).

TABLE 3-1A

Comparison of VOC and NOx Emissions By Major Source Category of
2008 Base Year in Final 2012 AQMP and Projected 2008 in 2007 AQMP
Annual Average Inventory (tpd[1])

SOURCE CATEGORY	2007 AQMP	Final 2012 AQMP	% Change	2007 AQMP	Final 2012 AQMP	% Change
	VOC			NOx		
STATIONARY SOURCES						
Fuel Combustion	7	14	+100%	30	41	+36%
Waste Disposal	8	12	+50%	2	2	0%
Cleaning and Surface Coatings	37	37	0%	0	0	0%
Petroleum Production and Marketing	32	41	+28%	0	0	0%
Industrial Processes	19	16	-16%	0	0	0%
Solvent Evaporation						
Consumer Products	97	98	+1%	0	0	0%
Architectural Coatings	23	22	-5%	0	0	0%
Others	3	2	-33%	0	0	0%
Misc. Processes	15	15	0%	26	26	0%
RECLAIM SOURCES	0	0	0%	29	23	-21%
Total Stationary Sources	**241**	**257**	**+7%**	**87**	**92**	**+6%**
MOBILE SOURCES						
On-Road Vehicles	207	209	+1%	447	462	+3%
Off-Road Vehicles	150	127	-15%	325	204	-37%
Total Mobile Sources	**357**	**336**	**-6%**	**772**	**666**	**-14%**
TOTAL	**598**	**593**	**-1%**	**859**	**758**	**-12%**

[1] Values are rounded to nearest integer.

TABLE 3-1B

Comparison of SOx and PM2.5 Emissions By Major Source Category of
2008 Base Year in Final 2012 AQMP and Projected 2008 in 2007 AQMP
Annual Average (tpd[1])

SOURCE CATEGORY	2007 AQMP	Final 2012 AQMP	% Change	2007 AQMP	Final 2012 AQMP	% Change
	SOx			PM2.5		
STATIONARY SOURCES						
Fuel Combustion	2	2	0%	6	6	0%
Waste Disposal	0	0	0%	0	0	0%
Cleaning and Surface Coatings	0	0	0%	1	1	0%
Petroleum Production and Marketing	1	1	0%	1	2	+100%
Industrial Processes	0	0	0%	5	7	+40%
Solvent Evaporation						
Consumer Products	0	0	0%	0	0	0%
Architectural Coatings	0	0	0%	0	0	0%
Others	0	0	0%	0	0	0%
Misc. Processes *	1	1	0%	52	32	-39%
RECLAIM SOURCES	12	10	-17%	0	0	0%
Total Stationary Sources	**16**	**14**	**-12%**	**65**	**48**	**-26%**
MOBILE SOURCES						
On-Road Vehicles	2	2	0%	18	19	+6%
Off-Road Vehicles	14	38[2]	+171%	18	13	-28%
Total Mobile Sources	**16**	**40**	**+150%**	**36**	**32**	**-11%**
TOTAL	**32**	**54**	**+69%**	**101**	**80**	**-21%**

[1] Values are rounded to nearest integer.

2 Refer to Base Year Emissions – Off-road-Sox.

TABLE 3-2A

Summary of Emissions By Major Source Category: 2008 Base Year
Average Annual Day (tpd[1])

SOURCE CATEGORY	VOC	NOx	CO	SOx	PM2.5
STATIONARY SOURCES					
Fuel Combustion	14	41	57	2	6
Waste Disposal	12	2	1	0	0
Cleaning and Surface Coatings	37	0	0	0	1
Petroleum Production and Marketing	41	0	5	1	2
Industrial Processes	16	0	2	0	7
Solvent Evaporation					
Consumer Products	98	0	0	0	0
Architectural Coatings	22	0	0	0	0
Others	2	0	0	0	0
Misc. Processes*	15	26	72	1	32
RECLAIM Sources	0	23	0	10	0
Total Stationary Sources	**257**	**92**	**137**	**14**	**48**
MOBILE SOURCES					
On-Road Vehicles	209	462	1966	2	19
Off-Road Vehicles	127	204	778	38	13
Total Mobile Sources	**336**	**666**	**2743**	**40**	**32**
TOTAL	**593**	**758**	**2881**	**54**	**80**

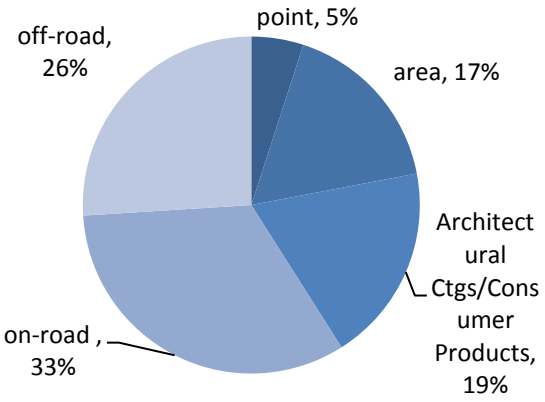
[1] Values are rounded to nearest integer.

TABLE 3-2B

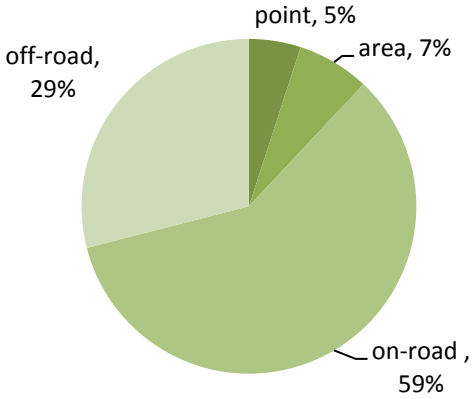
Summary of Emissions By Major Source Category: 2008 Base Year
Summer Planning Inventory (tpd[1])

SOURCE CATEGORY	SUMMER OZONE PRECURSORS	
	VOC	NOx
STATIONARY SOURCES		
Fuel Combustion	14	41
Waste Disposal	12	2
Cleaning and Surface Coatings	43	0
Petroleum Production and Marketing	41	0
Industrial Processes	19	0
Solvent Evaporation		
Consumer Products	99	0
Architectural Coatings	25	0
Others	2	0
Misc. Processes	9	20
RECLAIM Sources	0	24
Total Stationary Sources	**264**	**87**
MOBILE SOURCES		
On-Road Vehicles	213	426
Off-Road Vehicles	162	208
Total Mobile Sources	**375**	**634**
TOTAL	**639**	**721**

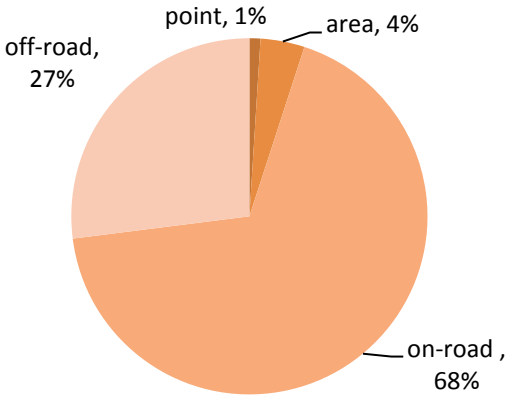
[1] Values are rounded to nearest integer.



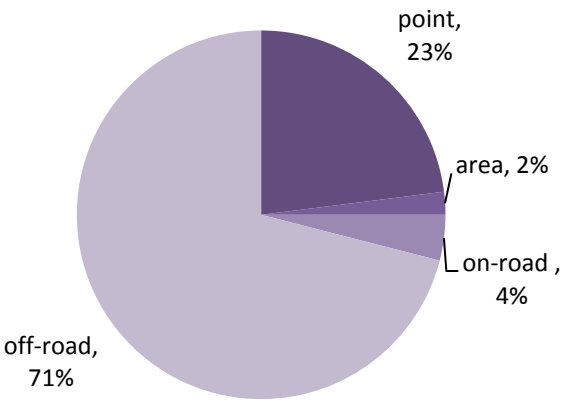
VOC Emissions: 639 tons/day



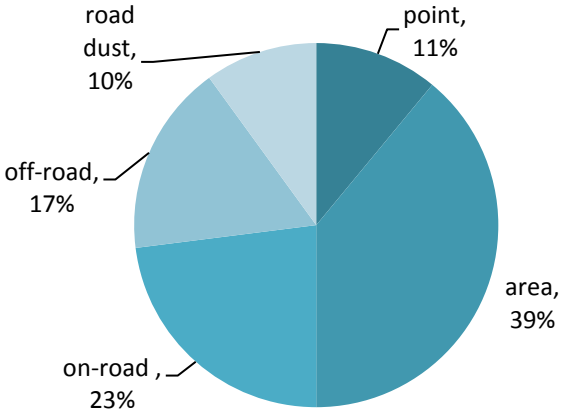
NOx Emissions: 721 tons/day



CO Emissions: 2881 tons/day



SOx Emissions: 54 tons/day



Directly Emitted PM2.5 Emissions: 80 tons/day

FIGURE 3-3

Relative Contribution by Source Category to 2008 Emission Inventory
(VOC & NOx – Summer Planning; CO, SOx, & PM2.5 – Annual Average Inventory)

FUTURE EMISSIONS

Data Development

The milestone years 2008, 2014, 2019, 2023, and 2030 are the years for which inventories were developed as they are relevant target years under the federal CAA and the CCAA. The base year for the attainment demonstration is 2008. 2014 is the attainment year for the federal 2006 24-hour PM2.5 standard without an extension, and 2019 represents the latest attainment date with a full five-year extension. The 80 ppb federal 8-hour ozone standard attainment deadline is 2023, and the new 75 ppb 8-hour ozone standard deadline is 2032. A 2030 inventory will be used to approximate this latter year.

Future stationary 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 District Rule 2002 –Allocations for NOx and SOx. The forecasts for non-RECLAIM emissions were derived using: (1) emissions from the 2008 base year; (2) expected controls after implementation of District rules adopted by June, 2012, and CARB rules adopted as of August 2011; and (3) activity growth in various source categories between the base and future years.

Demographic growth forecasts for various socioeconomic categories (e.g., population, housing, employment by industry), developed by SCAG for their 2012 RTP, are used in the Final 2012 AQMP. Industry growth factors for 2008, 2014, 2018, 2020, 2023, and 2030 are also provided by SCAG, and interim years are calculated by linear interpolation. Table 3-3 summarizes key socioeconomic parameters used in the Final 2012 AQMP for emissions inventory development.

TABLE 3-3

Baseline Demographic Forecasts in the Final 2012 AQMP

CATEGORY	2008	2023	2023 % GROWTH FROM 2008	2030	2030 % GROWTH FROM 2008
Population (Millions)	15.6	17.3	11%	18.1	16%
Housing Units (Millions)	5.1	5.7	12%	6.0	18%
Total Employment (Millions)	7.0	7.7	10%	8.1	16%
Daily VMT (Millions)	379	396	4%	421	11%

Current forecasts indicate that this region will experience a population growth of 11% between 2008 and 2023, with a 4% increase in vehicle miles traveled (VMT); and a population growth of 16% by the year 2030 with a 11% increase in VMT.

As compared to the projections in the 2007 AQMP, the current 2030 projections in the Final 2012 AQMP show about 1.5 million less population (7.6% less), 900,000 less total employment (10% less), and 32 million miles less in the daily VMT forecast (7.1% less).

Summary of Baseline Emissions

Emissions data by source categories (point, area, on-road mobile and off-road mobile sources) and by pollutants are presented in Tables 3-4 through 3-7 for the years 2014, 2019, 2023, and 2030. The tables provide annual average, as well as summer planning inventories.

Without any additional controls, VOC, NOx, and SOx emissions are expected to decrease due to existing regulations, such as controls on off-road equipment, new vehicle standards, and the RECLAIM programs. Figure 3-4 illustrates the relative contribution to the 2023 inventory by source category. A comparison of Figures 3-3 and 3-4 indicates that the on-road mobile category continues to be a major contributor to CO and NOx emissions. However, due to already-adopted regulations, 2023 on-road mobile sources account for: about 16% of total VOC emissions compared to 33% in 2008; about 36% of total NOx emissions compared to 59% in 2008; and about 38% of total CO emissions compared to 68% in 2008. Meanwhile, area sources become the major

contributor to VOC emissions from 36% in 2008 to 50% in 2023. See Figures 3-5 through 3-16 for the top ten highest-ranking source categories for 2008, 2014, and 2023.

TABLE 3-4A

Summary of Emissions By Major Source Category: 2014 Baseline
Average Annual Day (tpd[1])

SOURCE CATEGORY	VOC	NOx	CO	SOx	PM2.5
STATIONARY SOURCES					
Fuel Combustion	13	27	54	2	6
Waste Disposal	12	2	1	0	0
Cleaning and Surface Coatings	39	0	0	0	2
Petroleum Production and Marketing	38	0	5	1	2
Industrial Processes	13	0	2	0	7
Solvent Evaporation					
Consumer Products	85	0	0	0	0
Architectural Coatings	15	0	0	0	0
Others	2	0	0	0	0
Misc. Processes*	17	21	102	1	33
RECLAIM Sources	0	27	0	8	0
Total Stationary Sources	**234**	**77**	**164**	**12**	**50**
MOBILE SOURCES					
On-Road Vehicles	117	272	1165	2	12
Off-Road Vehicles	100	157	766	4	8
Total Mobile Sources	**217**	**429**	**1931**	**6**	**20**
TOTAL	**451**	**506**	**2095**	**18**	**70**

[1] Values are rounded to nearest integer.

TABLE 3-4B

Summary of Emissions By Major Source Category: 2014 Baseline Summer Planning Inventory (tpd[1])

	Summer Ozone Precursors	
SOURCE CATEGORY	**VOC**	**NOx**
Stationary Sources		
Fuel Combustion	13	28
Waste Disposal	12	2
Cleaning and Surface Coatings	45	0
Petroleum Production and Marketing	38	1
Industrial Processes	15	0
Solvent Evaporation		
Consumer Products	86	0
Architectural Coatings	18	0
Others	2	0
Misc. Processes	10	15
RECLAIM Sources	0	27
Total Stationary Sources	**239**	**73**
Mobile Sources		
On-Road Vehicles	120	251
Off-Road Vehicles	128	161
Total Mobile Sources	**248**	**412**
TOTAL	**487**	**485**

[1] Values are rounded to nearest integer.

TABLE 3-5A

Summary of Emissions By Major Source Category: 2019 Baseline
Average Annual Day (tpd[1])

SOURCE CATEGORY	VOC	NOx	CO	SOx	PM2.5
Stationary Sources					
Fuel Combustion	14	27	56	2	6
Waste Disposal	13	2	1	1	0
Cleaning and Surface Coatings	46	0	0	0	2
Petroleum Production and Marketing	36	0	5	1	2
Industrial Processes	15	0	2	0	8
Solvent Evaporation					
Consumer Products	87	0	0	0	0
Architectural Coatings	16	0	0	0	0
Others	2	0	0	0	0
Misc. Processes*	16	18	102	1	34
RECLAIM Sources	0	27	0	6	0
Total Stationary Sources	**245**	**74**	**166**	**11**	**52**
Mobile Sources					
On-Road Vehicles	80	186	755	2	11
Off-Road Vehicles	90	145	795	5	7
Total Mobile Sources	**170**	**331**	**1550**	**7**	**18**
TOTAL	**415**	**405**	**1716**	**18**	**70**

[1] Values are rounded to nearest integer.

TABLE 3-5B

Summary of Emissions By Major Source Category: 2019 Baseline Summer Planning Inventory (tpd[1])

	Summer Ozone Precursors	
SOURCE CATEGORY	**VOC**	**NOx**
Stationary Sources		
Fuel Combustion	14	28
Waste Disposal	13	2
Cleaning and Surface Coatings	53	0
Petroleum Production and Marketing	36	0
Industrial Processes	17	0
Solvent Evaporation		
Consumer Products	88	0
Architectural Coatings	19	0
Others	2	0
Misc. Processes	9	13
RECLAIM Sources	0	27
Total Stationary Sources	**251**	**70**
Mobile Sources		
On-Road Vehicles	83	173
Off-Road Vehicles	114	148
Total Mobile Sources	**197**	**321**
TOTAL	**448**	**391**

[1] Values are rounded to nearest integer.

TABLE 3-6A

Summary of Emissions By Major Source Category: 2023 Baseline
Average Annual Day (tpd[1])

SOURCE CATEGORY	VOC	NOx	CO	SOx	PM2.5
Stationary Sources					
Fuel Combustion	14	27	56	2	6
Waste Disposal	14	2	1	0	0
Cleaning and Surface Coatings	49	0	0	0	2
Petroleum Production and Marketing	36	0	5	1	2
Industrial Processes	16	0	2	0	8
Solvent Evaporation					
Consumer Products	89	0	0	0	0
Architectural	17	0	0	0	0
Others	2	0	0	0	0
Misc. Processes*	16	17	102	1	35
RECLAIM Sources	0	27	0	6	0
Total Stationary Sources	**253**	**73**	**166**	**10**	**53**
Mobile Sources					
On-Road Vehicles	67	125	591	2	11
Off-Road Vehicles	86	130	826	6	7
Total Mobile Sources	**153**	**255**	**1417**	**8**	**18**
TOTAL	**406**	**328**	**1583**	**18**	**71**

[1] Values are rounded to nearest integer.

TABLE 3-6B

Summary of Emissions By Major Source Category: 2023 Baseline
Summer Planning Inventory (tpd[1])

	Summer Ozone Precursors	
SOURCE CATEGORY	**VOC**	**NOx**
Stationary Sources		
Fuel Combustion	14	27
Waste Disposal	14	2
Cleaning and Surface Coatings	56	0
Petroleum Production and Marketing	37	0
Industrial Processes	17	0
Solvent Evaporation		
Consumer Products	91	0
Architectural	20	0
Others	3	0
Misc. Processes	9	13
RECLAIM Sources	0	27
Total Stationary Sources	**261**	**69**
Mobile Sources		
On-Road Vehicles	69	117
Off-Road Vehicles	108	133
Total Mobile Sources	**177**	**250**
TOTAL	**438**	**319**

[1] Values are rounded to nearest integer.

TABLE 3-7A

Summary of Emissions By Major Source Category: 2030 Baseline
Average Annual Day (tpd[1])

SOURCE CATEGORY	VOC	NOx	CO	SOx	PM2.5
Stationary Sources					
Fuel Combustion	15	28	59	3	6
Waste Disposal	15	2	1	0	0
Cleaning and Surface Coatings	54	0	0	0	2
Petroleum Production and Marketing	38	0	5	1	2
Industrial Processes	17	0	2	0	9
Solvent Evaporation					
Consumer Products	93	0	0	0	0
Architectural	18	0	0	0	0
Others	2	0	0	0	0
Misc. Processes*	16	15	102	1	36
RECLAIM Sources	0	27	0	6	0
Total Stationary Sources	**268**	**72**	**169**	**11**	**55**
Mobile Sources					
On-Road Vehicles	55	101	446	2	12
Off-Road Vehicles	84	116	886	7	6
Total Mobile Sources	**139**	**217**	**1332**	**9**	**18**
TOTAL	**407**	**289**	**1501**	**20**	**73**

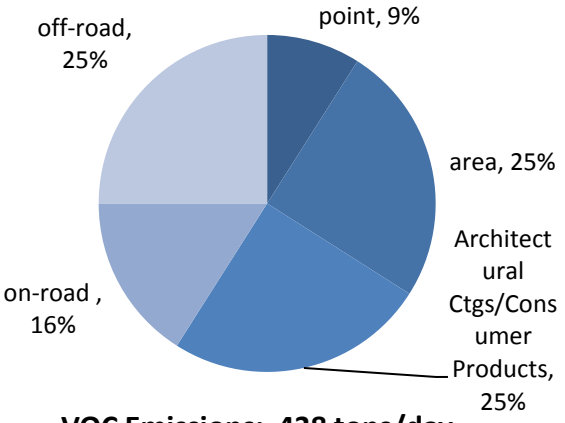
[1] Values are rounded to nearest integer.

TABLE 3-7B

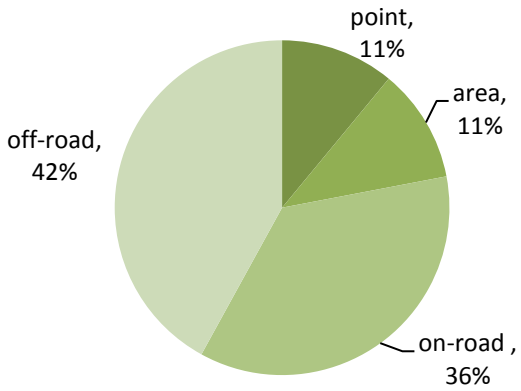
Summary of Emissions By Major Source Category: 2030 Baseline
Summer Planning Inventory (tpd[1])

	Summer Ozone Precursors	
SOURCE CATEGORY	**VOC**	**NOx**
Stationary Sources		
Fuel Combustion	15	29
Waste Disposal	15	2
Cleaning and Surface Coatings	62	0
Petroleum Production and Marketing	38	0
Industrial Processes	19	0
Solvent Evaporation		
Consumer Products	95	0
Architectural	20	0
Others	3	0
Misc. Processes	9	12
RECLAIM Sources	0	27
Total Stationary Sources	**276**	**70**
Mobile Sources		
On-Road Vehicles	56	95
Off-Road Vehicles	105	119
Total Mobile Sources	**161**	**214**
TOTAL	**437**	**284**

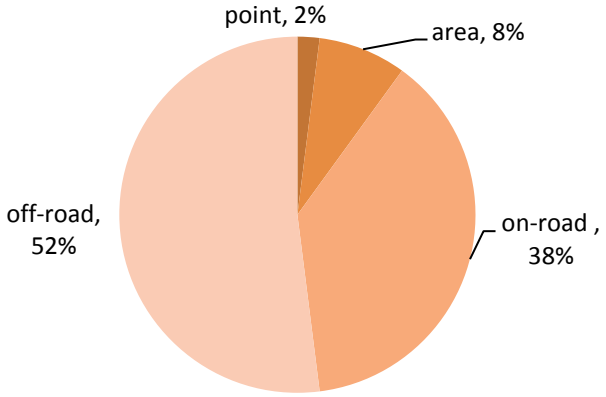
[1] Values are rounded to nearest integer.



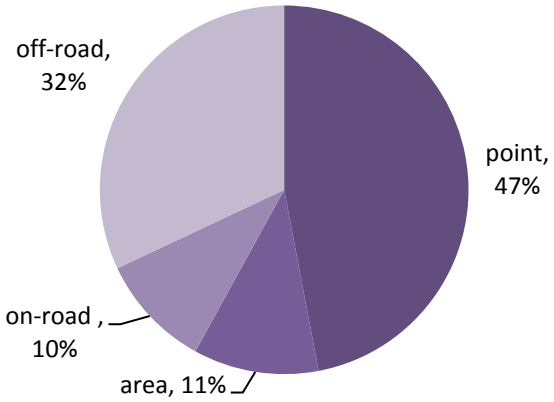
VOC Emissions: 438 tons/day



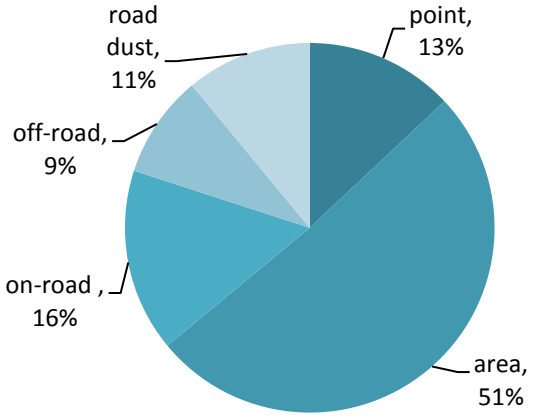
NOx Emissions: 319 tons/day



CO Emissions: 1583 tons/day



SOx Emissions: 18 tons/day



Directly Emitted PM2.5 Emissions: 71 tons/day

FIGURE 3-4

Relative Contribution by Source Category to 2023 Emission Inventory
(VOC & NOx – Summer Planning; CO, SOx, & PM2.5 – Annual Average Inventory)

IMPACT OF GROWTH

The Final 2012 AQMP forecasts the 2030 emissions inventories ‘‘with growth’’ through a detailed consultation process with SCAG. The region is likely to see a 16% growth in population, 18% growth in housing units, 16% growth in employment, and 11% growth in vehicle miles traveled between 2008 and 2030. To illustrate the impact of demographic growth on emissions, year 2030 no-growth emissions were estimated by removing the growth factors from the 2030 baseline emissions. Table 3-8 presents the comparison of the projected 2030 emissions with and without growth. It should be noted that in this analysis, the benefit of potential applications of BACT under District’s Reg XIII-New Source Review (NSR) is not included. The growth impacts to year 2030 for VOC, NOx, CO, SOx and PM2.5 are 77, 76, 311, 5 and 11 tons per day respectively.

Pre-Base-Year Offsets

The District’s growth projections include pre-base year emissions, consistent with the requirements of 40 CFR § 51.165(a)(3)(i)(C)(*1*). To the extent offsets are required under NSR for permitted facilities to be sited or expanded in this region, pre-2008 emission credits authorized under Reg XIII can be used and are explicitly identified and accounted for in the Final 2012 AQMP through growth projections, up to the amounts shown in Table 3-8. While Table 3-8 includes projected growth in certain sources not subject to NSR, the AQMP does not limit growth to individual source categories. Therefore, Table 3-8 explicitly identifies pre-base-year offsets in the amounts up to the difference between the growth and no-growth projections for the point and area source categories that are potentially subject to NSR and could potentially require the use of pre-base-year offsets. *See* 57 Fed. Reg. 13, 498.

This growth presents a formidable challenge to our air quality improvement efforts since the projected growth will offset the impressive progress made in reducing VOC and NOx and PM2.5 emissions through adopted regulations. Meeting the U.S. EPA’s current and future more-stringent air quality standards will require the continuation of aggressive emissions reduction efforts from all levels of government.

TABLE 3-8

Growth Impact to 2030 Emissions* in Tons per Day

WITH GROWTH	VOC	NOX	CO	SOX	PM2.5
Point	38	33	38	9	10
Area	230	39	131	2	37
Road Dust	0	0	0	0	8
On-Road	55	101	446	2	12
Off-Road	84	116	886	7	6
Total	**407**	**289**	**1501**	**20**	**73**
NO GROWTH	**VOC**	**NOX**	**CO**	**SOX**	**PM2.5**
Point	29	32	33	8	8
Area	188	28	117	1	32
Road Dust	0	0	0	0	8
On-Road	49	82	398	2	10
Off-Road	64	71	642	4	4
Total	**330**	**213**	**1190**	**15**	**62**
IMPACT OF GROWTH	**VOC**	**NOX**	**CO**	**SOX**	**PM2.5**
Point	9	1	5	1	2
Area	42	11	14	1	5
Road Dust	0	0	0	0	0
On-Road	6	19	47	0	2
Off-Road	20	45	245	3	2
Total	77	**76**	**311**	**5**	**11**

*Annual Average Inventory

TOP TEN SOURCE CATEGORIES (2008, 2014, 2023)

The rankings of the top ten source contributors to the emissions inventories for VOC, NOx, SOx and PM2.5 are listed and briefly discussed in this section. The 2023 summer planning inventory for VOC and NOx, along with the 2008, 2014 and 2023 annual average inventory for VOC, NOx, SOx and PM2.5 are shown in the figures 3-5 to 3-16. These source categories are fairly broad and are intended for illustration purposes only.

Table 3-9 lists the top ten categories for each of the three inventory years for VOCs. Two of top five categories are on-road mobile sources in the 2008 inventory, but none of the on-road categories are found in the top five categories for 2023. This demonstrates the effect of more-stringent on-road standards in the future. Table 3-9 shows that consumer products, off-road equipment, and recreational boats remain as high-emitting categories over time. The top 10 categories account for 78% of the total VOC inventory in 2008 and 71% in 2023.

TABLE 3–9

Top Ten Ranking Emitters for VOC Emissions (Annual Average: 2008, 2014, and 2023)

	2008	2014	2023
1	Consumer Products	Consumer Products	Consumer Products
2	Passenger Cars	Off-Road Equipment	Off-Road Equipment
3	Off-Road Equipment	Passenger Cars	Petroleum Marketing
4	Light-Duty Trucks	Petroleum Marketing	Coatings & Related Processes
5	Recreational Boats	Light-Duty Trucks	Recreational Boats
6	Petroleum Marketing	Recreational Boats	Light-Duty Trucks
7	Medium-Duty Trucks	Coatings & Related Processes	Passenger Cars
8	Architectural Coatings	Medium-Duty Trucks	Architectural Coatings
9	Coatings & Related Processes	Architectural Coatings	Medium-Duty Trucks
10	Heavy-Duty Gasoline Trucks	Degreasing	Degreasing

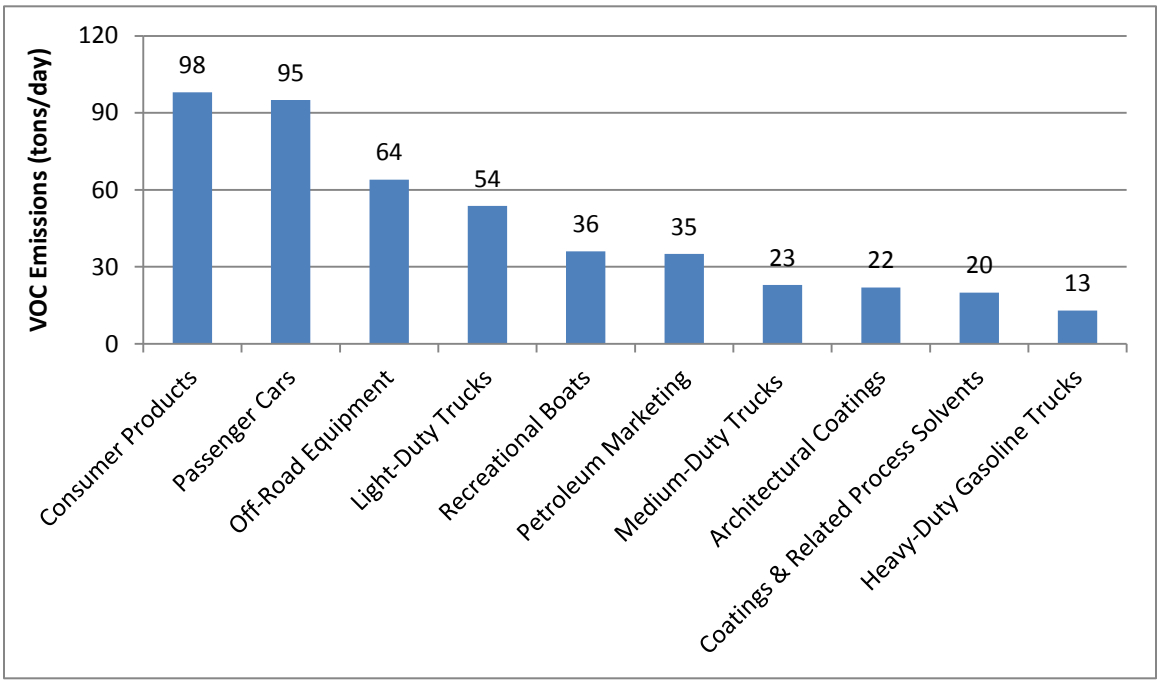


FIGURE 3-5

Top Ten Emitter Categories for VOC in 2008 (Annual Average)

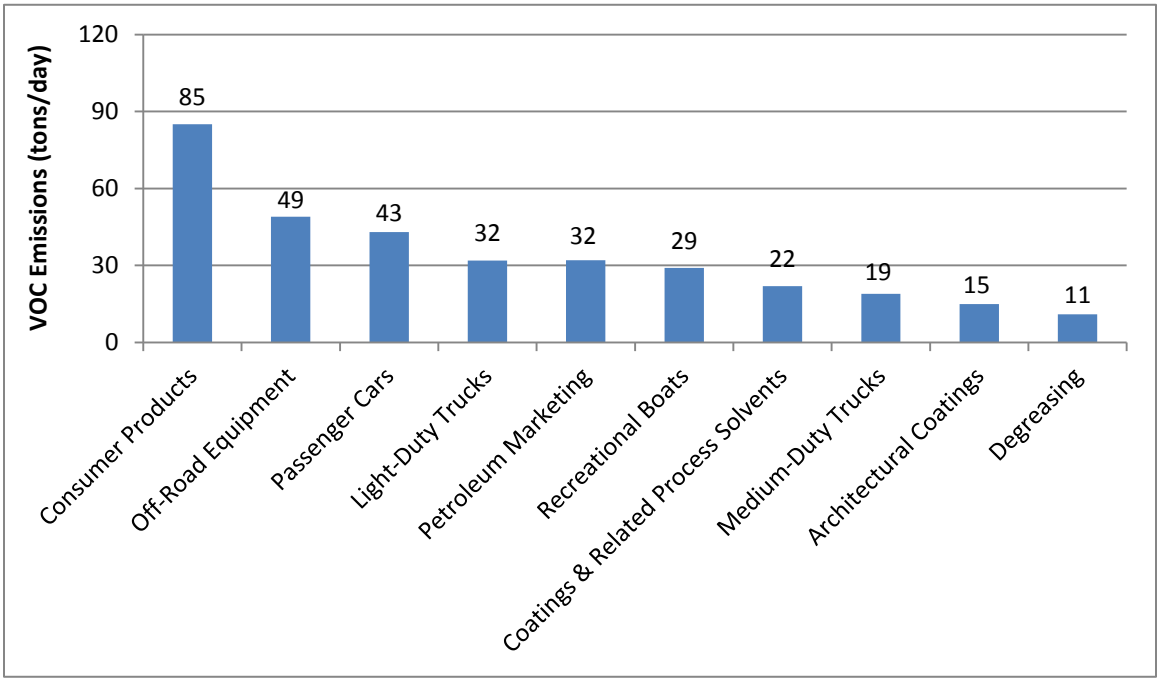


FIGURE 3-6

Top Ten Emitter Categories for VOC in 2014 (Annual Average)

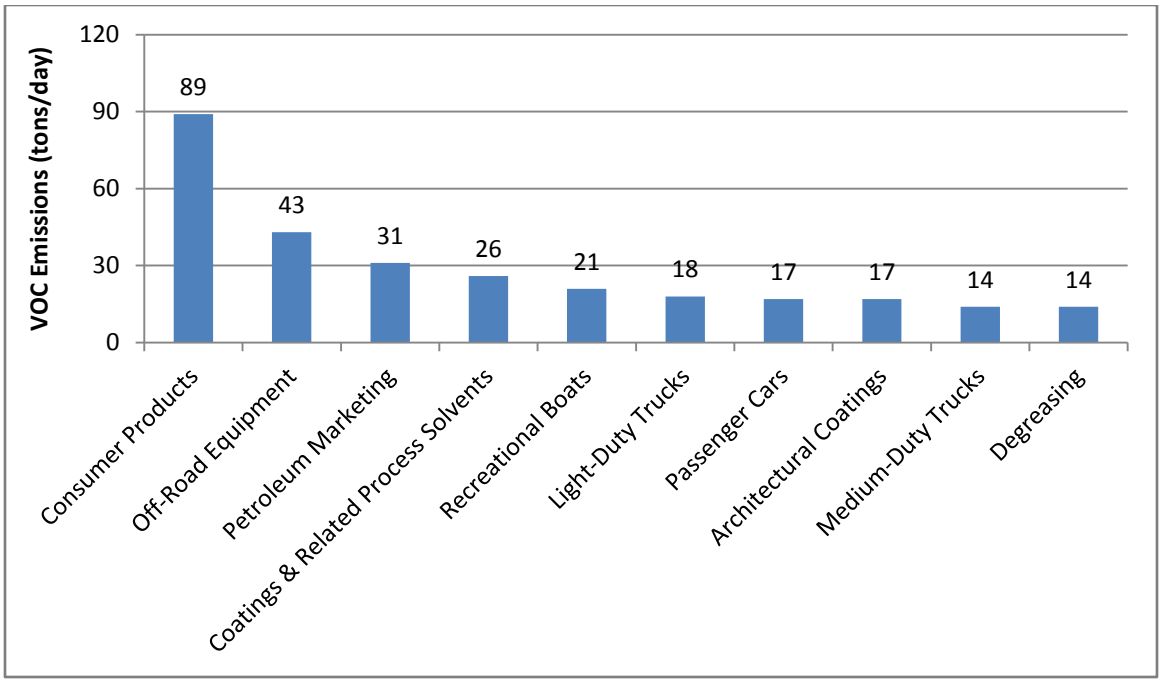


FIGURE 3-7A

Top Ten Emitter Categories for VOC in 2023 (Annual Average)

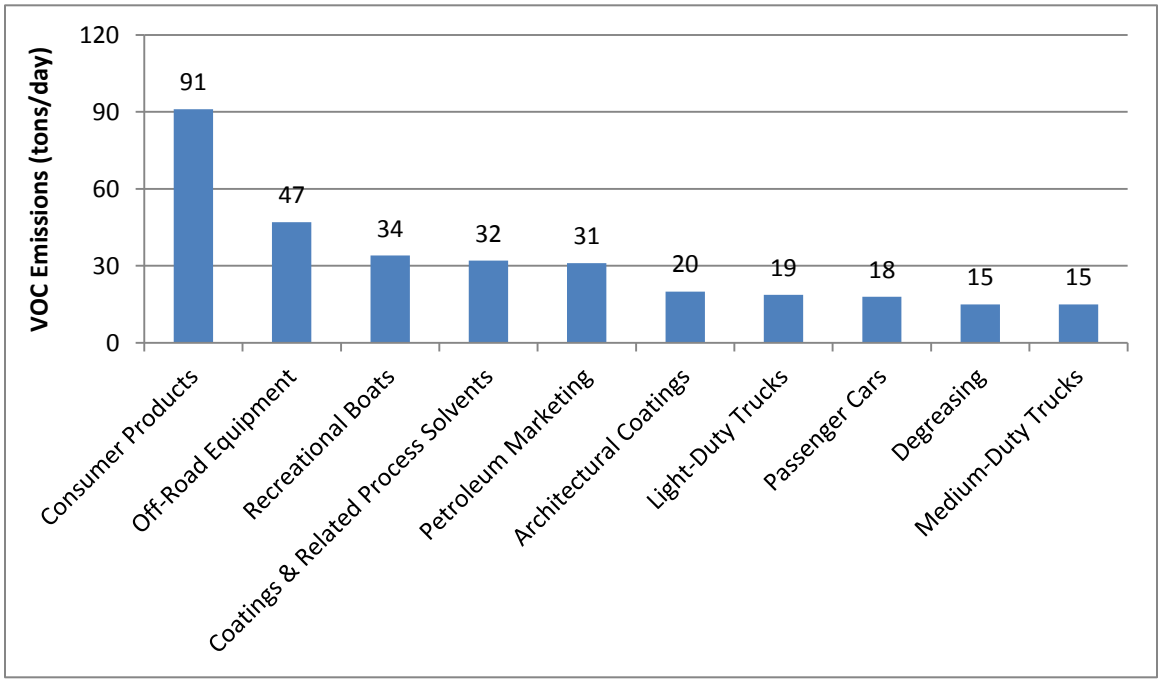


FIGURE 3-7B

Top Ten Emitter Categories for VOC in 2023 (Summer Planning)

Table 3-10 shows the top ten categories for NOx emissions in each of the three years. Mobile source categories remain the predominant contributor to NOx emissions. Heavy-duty diesel trucks and off-road equipment make the top two on the list for all three years. NOx RECLAIM and residential fuel combustion are the two non-mobile categories which make it to the top ten list. The top ten categories account for 87% of the total NOx inventory in 2008, and 78% in 2023.

TABLE 3-10

Top Ten Ranking Emitters for NOx Emissions (Annual Average: 2008, 2014, and 2023)

	2008	**2014**	**2023**
1	Heavy-Duty Diesel Trucks	Heavy-Duty Diesel Trucks	Heavy-Duty Diesel Trucks
2	Off-Road Equipment	Off-Road Equipment	Off-Road Equipment
3	Passenger Cars	Ships & Commercial Boats	Ships & Commercial Boats
4	Light-Duty Trucks	Passenger Cars	NOx RECLAIM
5	Ships & Commercial Boats	Light-Duty Trucks	Locomotives
6	Medium-Duty Trucks	Medium-Duty Trucks	Aircraft
7	Heavy-Duty Gasoline Trucks	NOx RECLAIM	Residential Fuel Combustion
8	Locomotives	Heavy-Duty Gasoline Trucks	Heavy-Duty Gasoline Trucks
9	Residential Fuel Combustion	Locomotives	Passenger Cars
10	NOx RECLAIM	Residential Fuel Combustion	Light-Duty Trucks

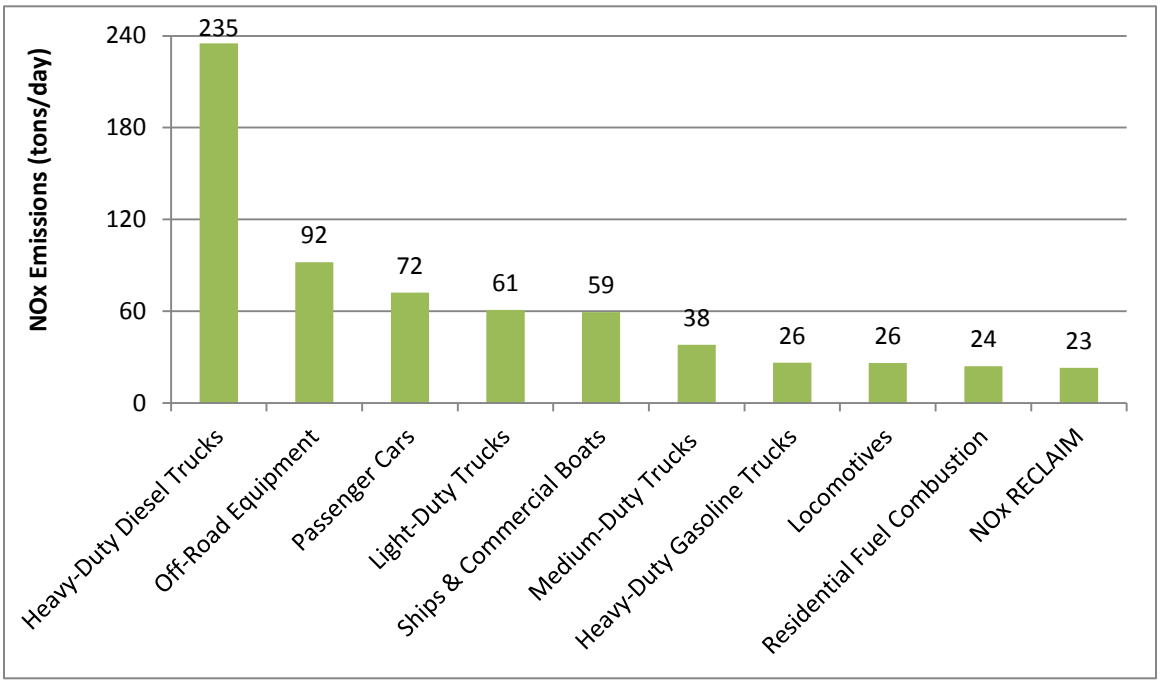


FIGURE 3-8

Top Ten Emitter Categories for NOx in 2008 (Annual Average)

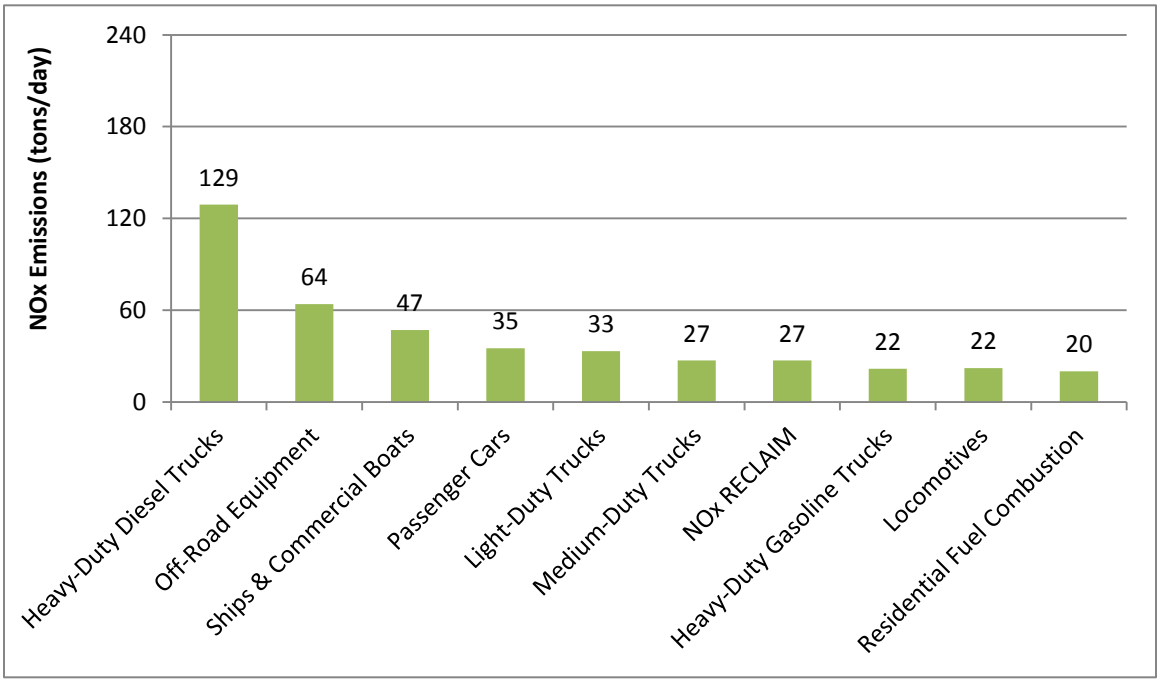


FIGURE 3-9

Top Ten Emitter Categories for NOx in 2014 (Annual Average)

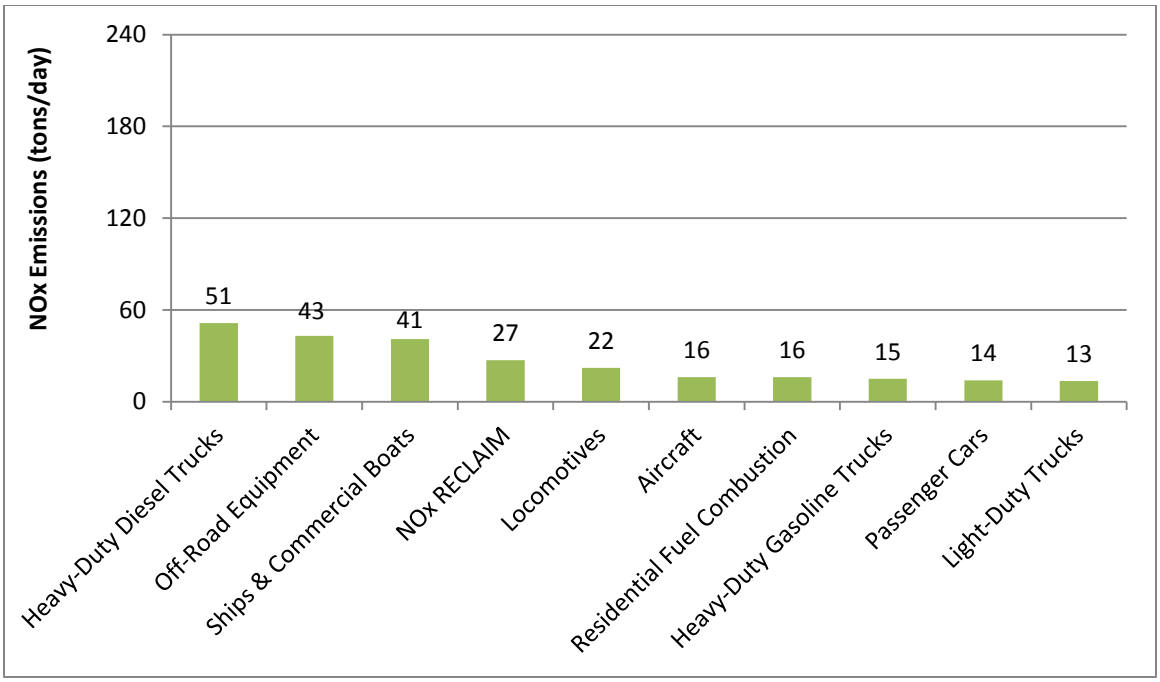


FIGURE 3-10A

Top Ten Emitter Categories for NOx in 2023 (Annual Average)

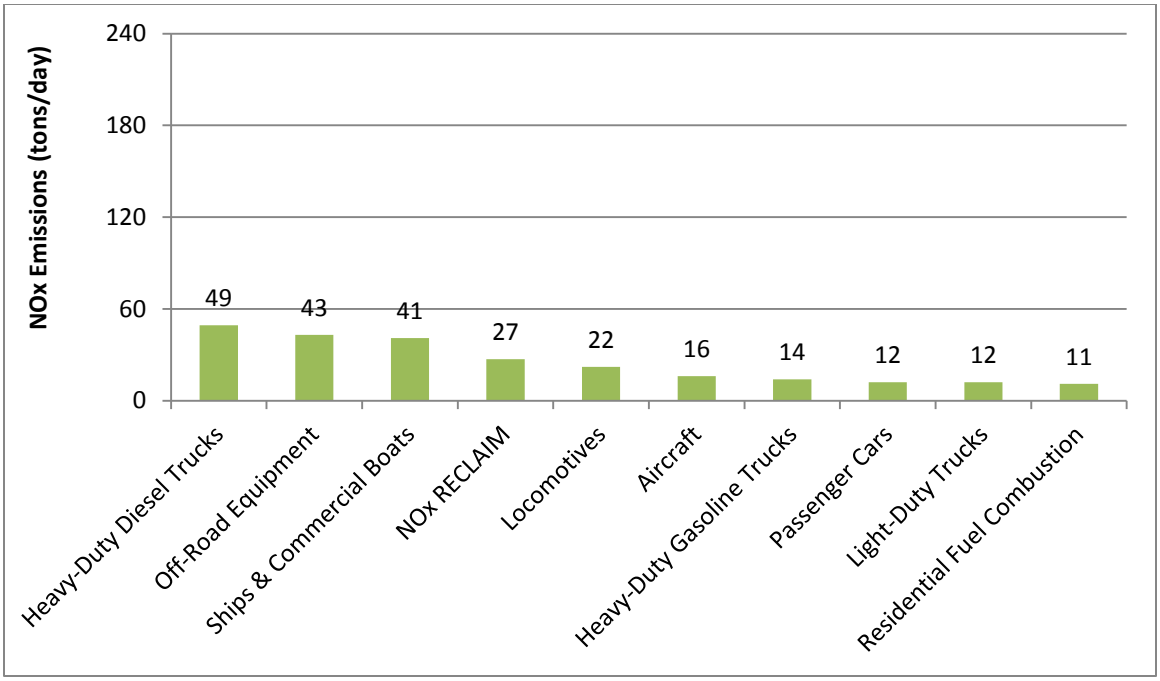


FIGURE 3-10B

Top Ten Emitter Categories for NOx in 2023 (Summer Planning)

Table 3-11 shows the top source categories for SOx emissions in the years 2008, 2014 and 2023. The emissions level of SOx is relatively low. Therefore, only the categories that emit more than 0.5 tons per day of SOx are ranked and listed. The top five high emitting source categories remain the same in 2008 and 2023. Ships & Commercial Boats and SOx RECLAIM emissions are the most significant contributors. The top categories represent 93% of the total SOx inventory in 2008 and 81% in 2023.

TABLE 3-11

Top Emitter Categories for SOx Emissions (Annual: 2008, 2014, 2023) over 0.5 tpd

	2008	2014	2023
1	Ships & Commercial Boats	SOx RECLAIM	SOx RECLAIM
2	SOx RECLAIM	Ships and Commercial Boats	Ships & Commercial Boats
3	Aircraft	Aircraft	Aircraft
4	Service and Commercial Combustion	Service and Commercial Combustion	Service and Commercial Combustion
5	Passenger Cars	Passenger Cars	Passenger Cars
6	Petroleum Refining	Petroleum Refining	Manufacturing and Industrial Combustion
7	--	Manufacturing and Industrial Combustion	Petroleum Refining
8	--	Light-Duty Trucks	--

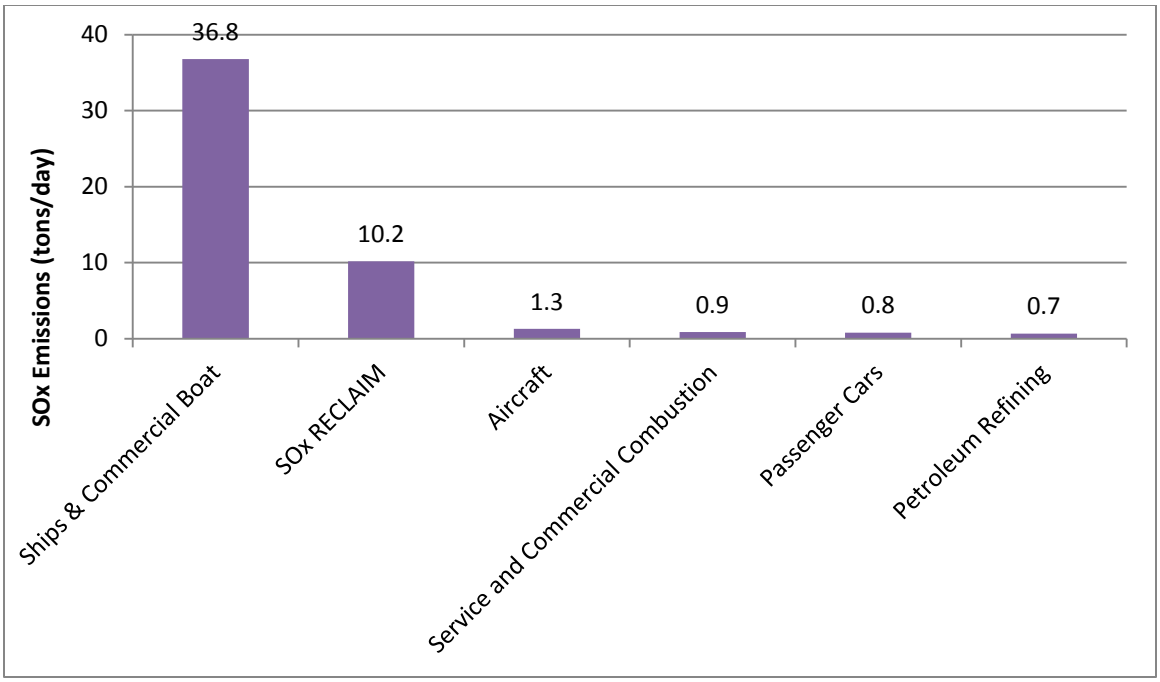


FIGURE 3-11

Top Emitter Categories for SOx Over 0.5 tpd in 2008 (Annual Average)

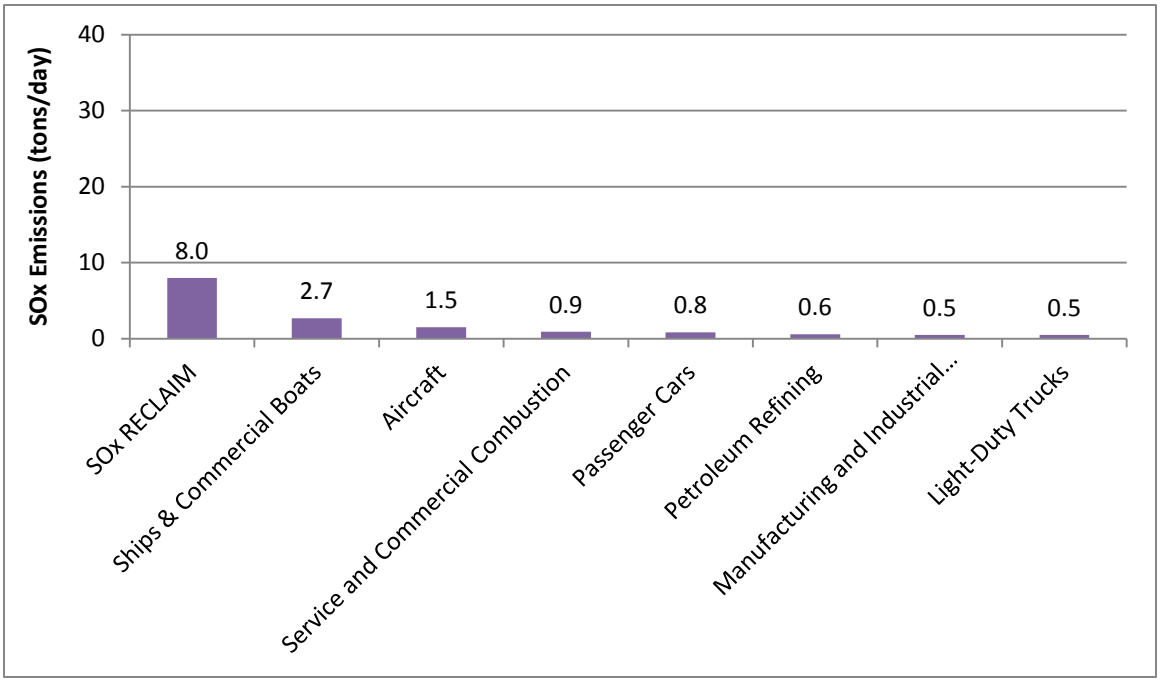


FIGURE 3-12

Top Emitter Categories for SOx Over 0.5 tpd in 2014 (Annual)

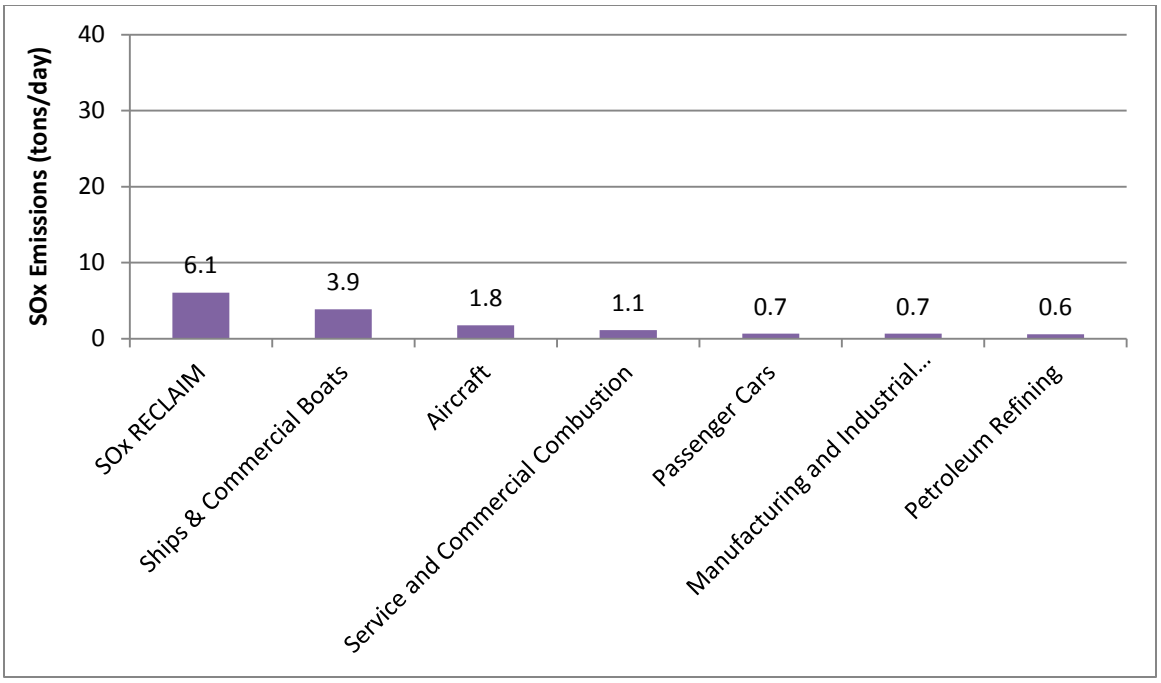


FIGURE 3-13

Top Emitter Categories for SOx Over 0.5 tpd in 2023 (Annual)

Table 3-12 shows the top ten source categories in each of the three years for directly emitted PM2.5. Commercial cooking, paved road dust, and residential fuel combustion are the top three highest emitting categories in both 2008 and 2023. The top ten categories represent 71% of the total directly emitted PM2.5 inventory in 2008 and 70% in 2023.

TABLE 3-12

Top Ten Ranking Emitters for Directly Emitted PM2.5 Emissions (Annual: 2008, 2014, 2023), from Highest to Lowest

	2008	2014	2023
1	Commercial Cooking	Commercial Cooking	Commercial Cooking
2	Heavy-Duty Diesel Trucks	Residential Fuel Combustion	Paved Road Dust
3	Residential Fuel Combustion	Paved Road Dust	Residential Fuel Combustion
4	Paved Road Dust	Waste Burning and Disposal	Waste Burning and Disposal
5	Off-Road Equipment	Passenger Cars	Passenger Cars
6	Passenger Cars	Off-Road Equipment	Mineral Processes
7	Ships & Commercial Boats	Heavy-Duty Diesel Trucks	Wood and Paper
8	Mineral Processes	Mineral Processes	Off-Road Equipment
9	Light-Duty Trucks	Wood and Paper	Construction and Demolition
10	Wood and Paper	Construction and Demolition	Heavy-Duty Diesel Trucks

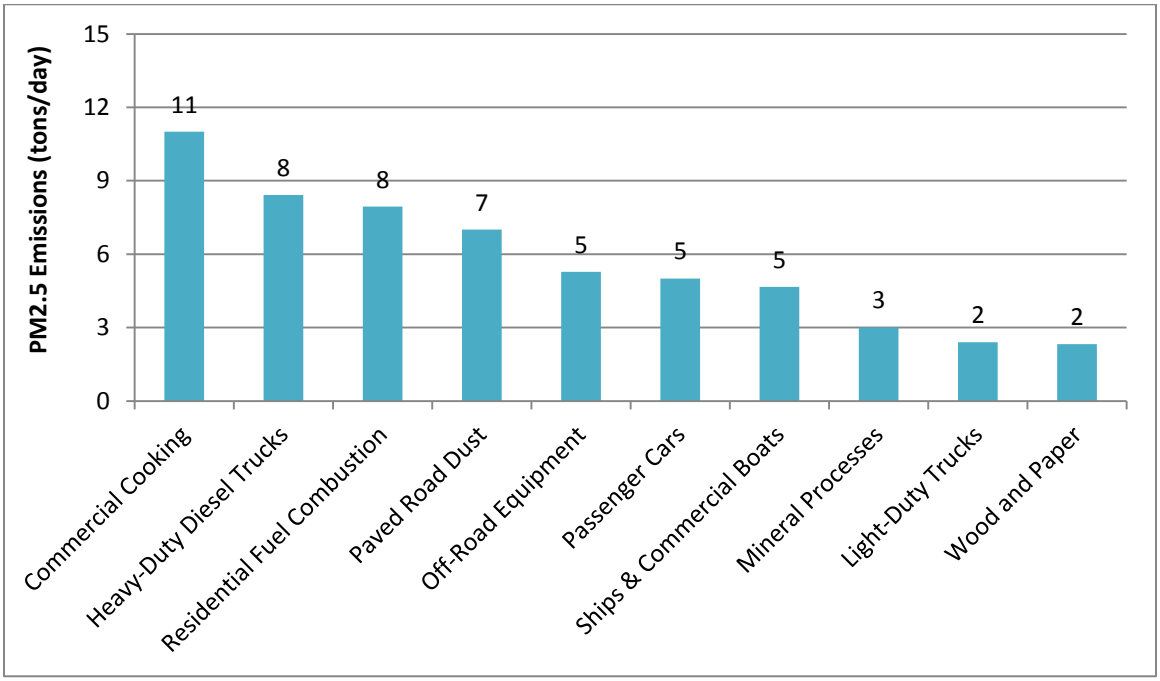


FIGURE 3-14

Top Ten Emitter Categories for Directly Emitted PM2.5 in 2008 (Annual)

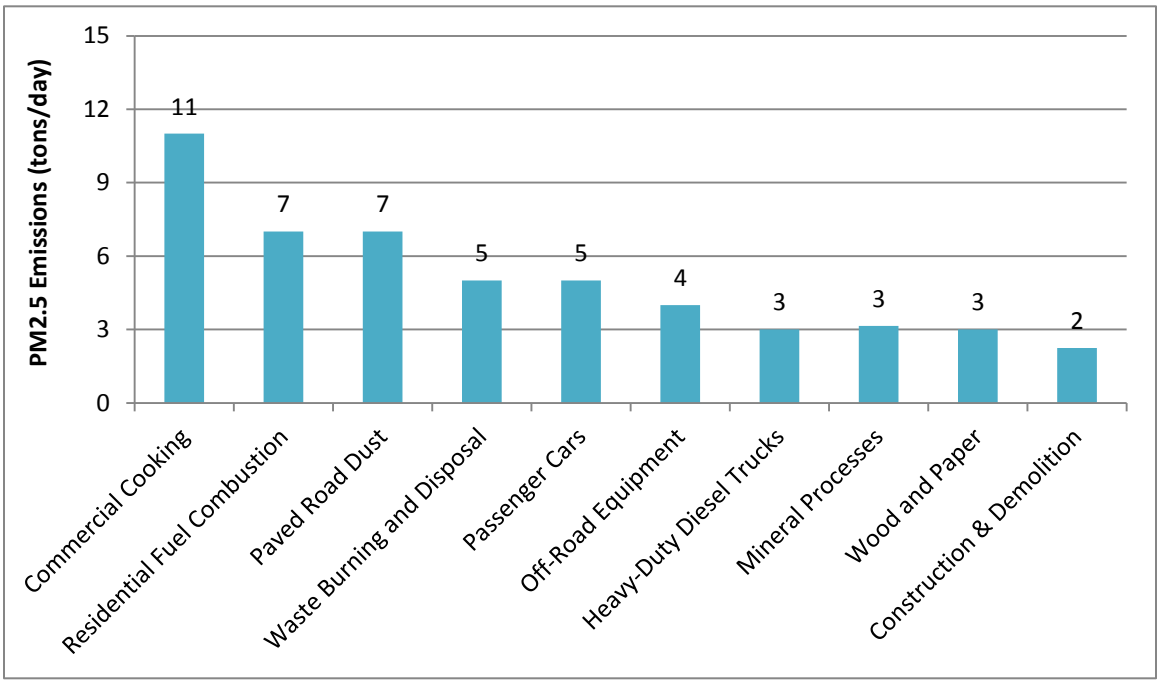


FIGURE 3-15

Top Ten Emitter Categories for Directly Emitted PM2.5 in 2014 (Annual)

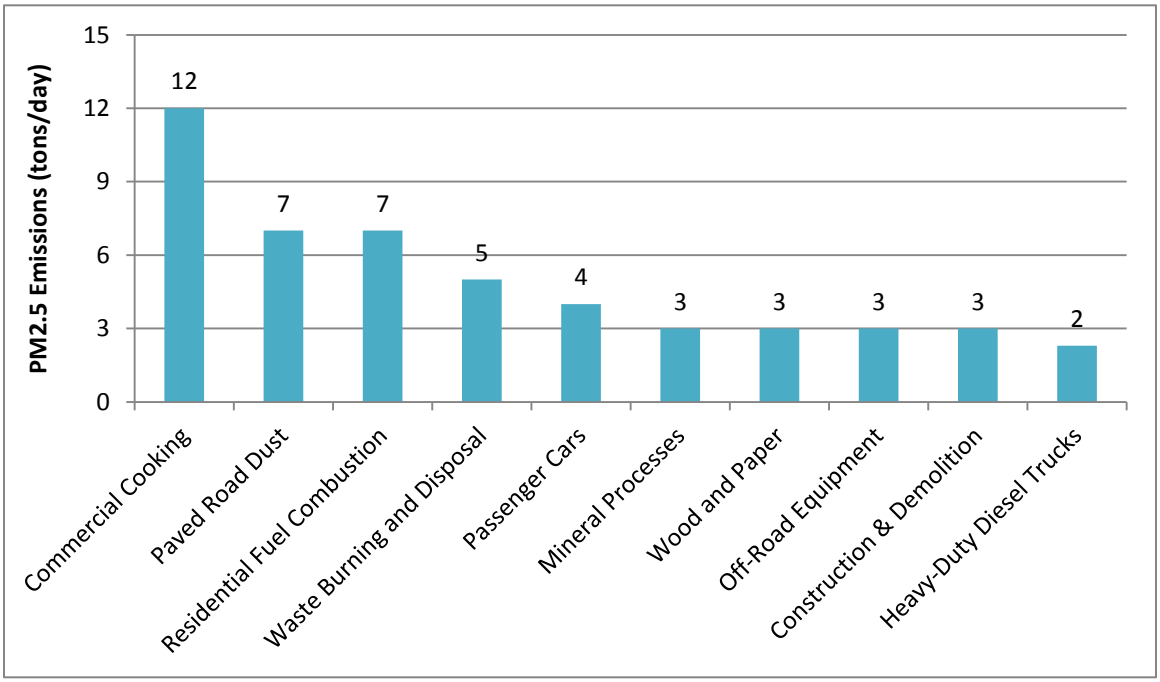


FIGURE 3-16

Top Ten Emitter Categories for Directly Emitted PM2.5 in 2023 (Annual)