

CHAPTER 3

EMISSION INVENTORY

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3. EMISSION INVENTORY

3.1 INTRODUCTION

This chapter describes the ~~baseline 2002~~ 2002 emission inventory used in the development of this ~~2004 2007~~ 2007 Clean Air Plan (~~2004 2007~~ Plan), as recommended by the USEPA maintenance plan guidance document. The emission inventory accounts for the types and amounts of pollutants emitted from a wide variety of sources, including on-road motor vehicles and other mobile sources, fuel combustion at industrial facilities, solvent and surface coating usage, consumer product usage, and emissions from natural sources. The emission inventory is used to describe and compare contributions from air pollution sources, evaluate control measures, schedule rule adoptions, forecast future pollution, and prepare clean air plans.

The emission inventory is divided into two geographical regions: *Santa Barbara County* and the *Outer Continental Shelf (OCS)*. The Santa Barbara County emission inventory encompasses all onshore sources of air pollution within Santa Barbara County and the State Tidelands (three miles from the shoreline). The OCS emission inventory includes pollution sources 25 miles beyond the State Tideland boundary offshore of Santa Barbara County.

~~The 2000~~ This chapter describes the “2002 Annual Emission Inventory”, which was derived from many sources including the APCD’s Annual Emission Inventory Questionnaire and Annual Reports programs, the Santa Barbara County Association of Governments, the California Air Resources Board, surveys from Santa Barbara businesses, and other U.S., California, and Santa Barbara County government agencies.

Also included in this chapter is a modified version of the ~~2000 2002~~ 2002 Annual Emission Inventory, known as ~~a~~ the “2002 Planning Emission Inventory,” which will be used as the ~~baseline~~ base year to forecast emissions for the years ~~2005~~, 2010, 2015, and 2020. Please refer to Chapter 6, Emission Forecasting, for more discussion on how the ~~2000 2002~~ 2002 Planning Emission Inventory is used to forecast future emissions.

The 2002 Planning Emission Inventory is a modified subset of ~~an~~ the 2002 Annual Emission Inventory and they differ from each other in several ways. First, the creation of the 2002 Planning Emission Inventory involves adjusting the 2002 Annual Emission Inventory to account for seasonal variation because most exceedances of ~~the state 1-hour~~ ozone standards occur during the April to October ozone season. This is commonly referred to as a “summer seasonal” inventory. Second, the emissions from natural sources such as biogenics, oil and gas seeps, and wildfires that are part of the 2002 Annual Emission Inventory are excluded from the 2002 Planning Emission Inventory since they are not regulated or controlled through implementation of emission control measures. Finally, the annual emissions in the 2002 Annual Emission Inventory are converted to daily emissions in the 2002 Planning Emission Inventory.

This chapter presents both the ~~2000 2002~~ 2002 Annual Emission Inventory and the ~~2000 2002~~ 2002 Planning Emission Inventory for both Santa Barbara County and the OCS. These inventories are presented in Tables 3-1 and ~~to 3-4~~ 3-2, and Figures 3-1 to 3-4.

3.2 POLLUTANTS

The Annual Emission Inventory and Planning Emission Inventory include two pollutants that contribute to ozone formation, referred to as *ozone precursors*. These pollutants are reactive organic compounds (ROC) and oxides of nitrogen (NO_x). The definition of ROC used in this plan is essentially equivalent to the USEPA's definition of Volatile Organic Compounds (VOC) and ARB's definition of Reactive Organic Gases (ROG), and does not include ethane, acetone or perchloroethylene as reactive organic chemical species.

3.3 ANNUAL EMISSION INVENTORY HIERARCHY

The annual emission inventory is organized in a three-tiered hierarchy that categorizes all air pollution sources. The first tier of this hierarchy contains four *divisions*: **Stationary Sources** (individual facilities and aggregated point sources), **Area-Wide Sources** (geographically dispersed area sources), **Mobile Sources** (both on-road vehicles and off-road sources) and **Natural Sources** (not man-made). In the second tier, each of the four divisions is sub-divided into *major source* categories. The third tier divides the major source categories into *summary* categories

The following sections discuss each of the four divisions and their major source and summary categories:

3.3.1 STATIONARY SOURCES

The *Stationary Sources* emission inventory division contains five major source categories: Fuel Combustion, Waste Disposal, Cleaning and Surface Coatings, Petroleum Production and Marketing, and Industrial Processes.

The specific summary categories and sources of emissions associated with these major categories are identified and described in the following sections.

3.3.1.1 Fuel Combustion

This major source category contains emissions produced by stationary fossil fuel combustion equipment such as boilers and engines. Fuel combustion is the greatest source of NO_x emissions within the Stationary Sources division. Emissions in the Fuel Combustion major source category are produced in the following eight summary categories:

- A. Electric Utilities: ~~Diesel engines~~ and Natural gas turbines used at electrical generation facilities.
- B. Cogeneration: Natural gas turbine engines used in the production of electrical energy and useful thermal energy.
- C. Oil and Gas Production (Combustion): Natural gas engines, boilers, process heaters, turbines, and steam generators at facilities engaged in the extraction and processing of petroleum products for shipment. Also diesel drilling rigs. Most of the emissions in this summary category are from natural gas-fired engines used in oil production operations.
- D. Petroleum Refining (Combustion): Natural gas boilers and process heaters located at refineries.
- E. Manufacturing and Industrial: Most of the emissions in this summary category are from diesel-fired engines and natural gas process heaters used in other industrial and manufacturing activities

such as: sand, rock, and gravel processing; concrete and asphalt production; and mineral processing.

- F. Food and Agricultural Processing: Diesel-fired and natural gas-fired engines used for agricultural irrigation.
- G. Service and Commercial: Natural gas commercial space and water heaters and small boilers and diesel-fired engines at non-industrial facilities.
- H. Other (Fuel Combustion). Fuel combustion not accounted for in any other category.

3.3.1.2 Waste Disposal

This major source category contains emissions associated with wastewater treatment plants, municipal landfills and incineration in five summary categories:

- A. Sewage Treatment: Wastewater treatment plants and process gas flares.
- B. Landfills: Landfill gas emissions from natural biodegradation and decomposition of waste material at ~~Class I and~~ Class II landfill sites. Also waste gas flares.
- C. Incinerators: Incinerators burning natural gas and process gas.
- D. Soil Remediation: Contaminated soil clean-up sites.
- E. Other (Waste Disposal). Waste disposal not accounted for in any other category.

3.3.1.3 Cleaning and Surface Coatings

This major source category consists entirely of evaporative ROC emissions from solvents and coatings, and is the most significant source of ROC emissions in the Stationary Sources division. ~~The in the following~~ six summary categories are:

- A. Laundering: Use of petroleum-based solvents at dry cleaning facilities.
- B. Degreasing: Cold cleaning of parts and materials at industrial and commercial facilities, mostly using petroleum naphtha, isopropyl alcohol and other degreasing solvents.
- C. Coatings and Related Process Solvents: Automotive refinishing, metal parts, furniture and wood product coatings and associated solvent and thinner use.
- D. Printing: Inks, solvents and cleaning agents.
- E. Adhesives and Sealants: Organic solvent-based and water-based adhesives and sealants used in various commercial and industrial applications.
- F. Other (Cleaning and Surface Coating): Solvents not accounted for in any other category.

3.3.1.4 Petroleum Production and Marketing

This major source emission category includes emissions resulting from the handling of petroleum liquids and gases at petroleum extraction, processing, transport, and marketing facilities. This category is comprised primarily of ROC emissions ~~and is the most significant source of ROC emissions in the Stationary Sources division.~~ The emissions are produced from processes in the following three summary categories:

- A. Oil and Gas Production: Fugitive hydrocarbon emissions from oil wells, oil valves and fittings, compressor seals, flanges, fixed and floating roof tanks, oil sumps, pits and well cellars, glycol regenerator vents, tank car and truck loading operations, and combustion emissions from vapor recovery flares at oil and gas extraction and processing facilities.
- B. Petroleum Refining: Fugitive hydrocarbon emissions from valves, fittings, storage tanks and loading racks at oil and gas production facilities.
- C. Petroleum Marketing: Fugitive hydrocarbon emissions from crude oil storage tanks affiliated with pipelines, and loading of marine vessels and tank cars and trucks with crude oil, natural gas

transmission losses, refined fuel vapor losses from underground storage tanks, gasoline dispensing facilities, and bulk fuel storage plants.

3.3.1.5 Industrial Processes

The Industrial Processes major source category pertains to industries other than the petroleum industry. Industrial Processes produce only a small fraction of the county's ROC and NO_x emissions. They include the following seven summary categories:

- A. Chemical: Fiberglass operations and plastic product manufacturing.
- B. Food and Agriculture: Wine fermentation and aging.
- C. Mineral Processes: Crushed rock, diatomaceous earth processing, asphalt and cement concrete production and limestone processing.
- D. Metal Processes: There are no sources in Santa Barbara County for this category.
- E. Wood and Paper: There are no sources in Santa Barbara County for this category.
- F. Electronics: Chemicals used in semiconductor manufacturing.
- G. Other (Industrial Processes): Aerospace operations (missile launches from Vandenberg Air Force Base).

3.3.2 AREA-WIDE SOURCES

The *Area-Wide Sources* emission inventory division is composed entirely of emissions from sources that are not subject to APCD permitting requirements. Emissions are geographically dispersed throughout the county but are aggregated into two major source emission categories: Solvent Evaporation and Miscellaneous Processes.

3.3.2.1 Solvent Evaporation

The Solvent Evaporation major source category consists entirely mostly of evaporative ROC emissions from consumer product use, architectural coatings, and pesticide use. The Solvent Evaporation major source category includes the following four summary categories:

- A. Consumer Products: Solvents used in antiperspirants, personal fragrance products, air fresheners, automotive cleaners, household and bathroom cleaners, insecticides, barbecue lighter fluid, aerosol paints, hair spray, rubbing alcohol, and laundry detergents.
- B. Architectural Coatings and Related Process Solvents: Oil and water-based paints and thinners used to paint commercial and residential buildings and other structures.
- C. Pesticides/Fertilizers: Pesticides used in agricultural, structural and consumer product applications.
- D. Asphalt Roofing and Paving: Road oils, emulsified asphalt, and hot-mix asphalt.

3.3.2.2 Miscellaneous Processes

The emissions produced by miscellaneous processes are listed in the following 10 summary categories:

- A. Residential Fuel Combustion: Fuel combustion for cooking, space, and water heating using natural gas, distillate oil, and liquified petroleum gas. Also wood stoves and fireplaces.
- B. Farming Operations: Tilling, harvest season operations and cattle feedlots.
- C. Construction and Demolition: Residential, commercial and industrial building and demolition, and road construction.

- D. Paved Road Dust: Vehicular travel on paved roads, including freeways, major roads, and local streets.
- E. Unpaved Road Dust: Vehicular travel on unpaved roads, including city and county, farm and federal land roads.
- F. Fugitive Windblown Dust: Wind erosion of agricultural fields, pastures, and unpaved roads.
- G. Fires: Automobile and structural fires.
- H. Waste Burning and Disposal: Burning of agricultural debris, weed abatement and range management burning, prescribed forest management burning and fire fighting training.
- I. Cooking: Commercial charbroiling.
- J. Other (Miscellaneous Processes): Miscellaneous processes not accounted for in any other category.

3.3.3 MOBILE SOURCES

The *Mobile Sources* emission inventory division contains emissions related to on-road motor vehicles and a variety of off-road vehicles and equipment, including aircraft, recreational vehicles and marine vessels. Mobile Sources consists of two major source categories: On-Road Motor Vehicles and Other Mobile Sources.

The Mobile Sources emission inventory category contains most of the NO_x emissions and a substantial ~~amounts percentage~~ of the ROC emissions in the Santa Barbara County and OCS inventories. ~~county's onshore and offshore inventory.~~

3.3.3.1 On-Road Motor Vehicles

The On-Road Motor Vehicles emission inventory in the ~~2004~~ 2007 Plan was developed from the latest working draft version of ARB's EMFAC2002 model, which incorporates county-specific vehicle activity data generated by SBCAG's Santa Barbara Travel Model, ARB, and vehicle demographic data from the Department of Motor Vehicles (DMV). SBCAG coordinates with CalTrans and the ARB to estimate vehicle emissions by vehicle class. Chapter 5 (Transportation Control Measures) of the 2007 Plan will provide analysis of the On-Road Motor Vehicle inventory.

The On-Road Motor Vehicles major source category includes ~~17 gasoline and diesel light-duty passenger vehicles (automobiles), gasoline and diesel light-duty trucks (pick-up trucks), medium-duty trucks, light heavy-duty trucks, medium heavy-duty trucks, and heavy heavy-duty trucks, motorcycles, heavy-duty gasoline and diesel buses, school buses, and motor homes.~~ The summary categories are described in more detail below:

- A. Light Duty Passenger (LDA): Catalytic and non-catalytic converter-equipped gasoline engine and diesel engine automobiles designed primarily for transportation and having a design capacity of 12 persons or less.
- B. Light Duty Trucks – 1 (LDT1): Catalytic and non-catalytic converter-equipped gasoline engine and diesel engine trucks rated at less than or equal to 3,750 pounds gross vehicle weight designed primarily for transportation of property but also includes Sport Utility Vehicles (SUV).
- C. Light Duty Trucks – 2 (LDT2): Catalytic and non-catalytic converter-equipped gasoline engine and diesel engine trucks from 3,751 to 5,750 pounds gross vehicle weight designed primarily for transportation of property but also includes Sport Utility Vehicles (SUV).

- D. Medium Duty Trucks (MDV): Catalytic and non-catalytic converter-equipped gasoline engine and diesel engine trucks from 5,751 to 8,500 pounds gross vehicle weight. Some larger SUV are included in this vehicle class.
- E. Light Heavy Duty Gas Trucks – 1 (LHDV1): Catalytic and non-catalytic converter-equipped gasoline engine trucks from 8,501 to 10,000 pounds gross vehicle weight.
- F. Light Heavy Duty Gas Trucks – 2 (LHDV2): Catalytic and non-catalytic converter-equipped gasoline engine trucks from 10,001 to 14,000 pounds gross vehicle weight.
- G. Medium Heavy Duty Gas Trucks (MHDV): Catalytic and non-catalytic converter-equipped gasoline engine trucks from 14,001 to 33,000 pounds gross vehicle weight.
- H. Heavy Heavy Duty Gas Trucks (HHDV): Catalytic and non-catalytic converter-equipped gasoline engine trucks from 33,001 to 60,000 pounds gross vehicle weight.
- I. Light Heavy Duty Diesel Trucks – 1 (LHDV1): Diesel engine trucks from 8,501 to 10,000 pounds gross vehicle weight.
- J. Light Heavy Duty Diesel Trucks – 2 (LHDV2): Diesel engine trucks from 10,001 to 14,000 pounds gross vehicle weight.
- K. Medium Heavy Duty Diesel Trucks (MHDV): Diesel engine trucks from 14,001 to 33,000 pounds gross vehicle weight.
- L. Heavy Heavy Duty Diesel Trucks (HHDV): Diesel engine trucks from 33,001 to 60,000 pounds gross vehicle weight.
- M. Motorcycles (MCY): Non-catalytic converter equipped gasoline engines in vehicles with not more than three wheels and weighing less than 1,500 pounds.
- N. Heavy Duty Diesel Urban Buses (UB): Diesel engine buses typically used for municipal transportation.
- O. Heavy Duty Gas Urban Buses (UB): Gas engine buses typically used for municipal transportation.
- P. School Buses (SB).
- Q. Motor Homes (MH).

3.3.3.2 Other Mobile Sources

The Other Mobile Sources category pertains to emission sources that do not produce ~~their~~ emissions on roads and highways. These include ships, boats, airplanes, trains, residential utility equipment, and construction and mining equipment. Although the ARB has the primary responsibility for estimating the emissions from these categories, the APCD currently estimates the emissions from ships, commercial boats (diesel), OCS crew & supply boats, aircraft, and trains.

The ARB uses the model known as OFFROAD to calculate emissions from these categories. The OFFROAD model consists of four main modules: population, activity, emissions, and control factor. The base year equipment population is adjusted for growth and scrappage, producing population distributions for specified calendar years through 2020. The statewide population is allocated to each geographic region, including air basin and county. The base emission factors are corrected for in-use and ambient conditions. The annual equipment emissions are adjusted for seasonal and diurnal factors, producing the base emissions output.

Virtually all of the Other Mobile Source emissions are related to fuel combustion in engines. A significant percentage of the NO_x emissions come from marine vessels that operate in the State Tidelands and the Outer Continental Shelf. The Other Mobile Sources category is divided into ~~seven~~ eight summary categories:

- A. Aircraft: Piston and jet powered commercial, civil, and military aircraft, and agricultural crop dusting.

- B. Trains: Diesel road hauling locomotives ~~on the railway line linking the Los Angeles area with the San Francisco Bay area.~~
- C. Ships and Commercial Boats: A variety of large container ships, tankers, and cargo vessels, both of US and foreign origin traversing the Santa Barbara Channel, gasoline and diesel commercial fishing vessels, and crew and supply boats servicing offshore oil production platforms.
- D. Recreational Boats: Gasoline and diesel powered boats, determined by ARB's OFFROAD model. These emissions are divided equally between the Santa Barbara County onshore (which includes the State Tidelands) and the Outer Continental Shelf.
- E. Off-Road Recreational Vehicles: Four-wheel drive all-terrain and off-road passenger vehicles, and off-road motorcycles, determined by ARB's OFFROAD model.
- F. Off-Road Equipment: Gasoline, diesel and LPG powered construction and industrial equipment. Light duty equipment with engines less than 175 horsepower, such as forklifts, mobile cranes, airport ground support equipment, portable generators, compressors, and pumps. Heavy-duty non-farm equipment with engines greater than or equal to 175 horsepower including construction equipment such as pavers, scrapers, loaders and mining equipment. Diesel powered refrigeration units on trucks and trailers. This category also includes emissions from lawn and garden equipment, which include small horsepower two and four stroke utility engines driving chainsaws, lawn mowers, leaf blowers, portable compressors and generators used in residential and commercial applications. Lastly, there are emissions from oil drilling and workover, and military tactical support equipment. The emissions from these categories are determined by ARB's OFFROAD model.
- G. Farm Equipment: Gasoline and diesel heavy-duty farm equipment, including tractors, mowers, combines and other mobile agricultural equipment. The emissions from these categories are determined by ARB's OFFROAD model.

~~Also within the Other Mobile Sources major source category is construction equipment. This emission category is diverse in terms of equipment types and sizes, and includes gas and diesel fired engines with horsepower ranges from under 15 to over 500 horsepower. Construction emissions are estimated by the ARB for the APCD using the OFFROAD model in the summary category Off Road Equipment (Construction and Mining Equipment). Within this category, construction emissions are aggregated with emissions from equipment used in mining operations. This single category includes approximately 27 equipment types including pavers, loaders, excavators, dozers, graders and tractors. The ARB, using the OFFROAD model, estimated that about 1,646 tons per year of NO_x, 183 tons per year of ROC and 1,146 tons per year of CO were emitted from construction and mining equipment in 2000. Previous estimates from the early and mid-1990's using statewide construction valuation permit data allocated to the county level and construction permit data from SBCAG showed NO_x emissions in the range of 300 to 525 tons per year from construction equipment alone. Since current estimates of construction emissions are aggregated with emissions from mining equipment, it is difficult to determine whether these estimates compare favorably with previous estimates. Based on the equipment types included in the Construction and Mining Equipment category along with housing and population growth, however, it is reasonable to believe that current construction emissions alone equal or exceed the high end of the range suggested from earlier estimates.~~

3.3.4 NATURAL SOURCES

The *Natural Sources* emission inventory division consists of emissions that are not man-made. Emission estimates for these categories tend to be difficult to quantify with any degree of certainty. Note that natural emissions are excluded from the Planning Emission Inventory.

3.3.4.1 Natural Sources

There are four summary categories of Natural Sources emissions:

- A. Biogenic Sources: Emission estimates from natural vegetation are generated using the Urban Airshed Model's Biogenic Emission Inventory System (BEIS), a complex regional model incorporating biomass types and distribution, plant species emission factors and climate correction factors. Soil microorganisms contribute some NO_x emissions.
- B. Geogenic Sources: Naturally occurring oil seeps and gas seeps located off the southern coast of Santa Barbara County. Seep emissions flow out from subsurface sources on the ocean floor, primarily in the State Tidelands, and exhibit a high degree of temporal and spatial variability. We have worked in cooperation with the Institute of Crustal Studies at the University of California at Santa Barbara to determine estimates of seep emissions in the Santa Barbara Channel. The results of their research have been used in this inventory.
- C. Wildfires: Timber, grass and brush wildfires. This is different from the planned or prescribed burn fires that are part of the Area-Wide Source division.
- D. Windblown Dust.

Based on information presented in Sections 3.2 and 3.3, the ~~2000~~ 2002 Annual Emission Inventory and the ~~2000~~ 2002 Planning Emission Inventory will be described in the following sections. These two inventories will form the basis for determining emission reductions and forecasting future inventories.

3.4 ~~2000~~ 2002 ANNUAL EMISSION INVENTORY

The ~~2000~~ 2002 Santa Barbara County and the Outer Continental Shelf Annual Emission Inventory document the current sources of ROC and NO_x emissions, both in quantity and relative contribution.

3.4.1 SANTA BARBARA COUNTY ANNUAL EMISSIONS

The ~~2000~~ 2002 Santa Barbara County Annual Emissions Inventory of ROC and NO_x in tons per year is presented in Table 3-1. The Santa Barbara County inventory represents onshore and State Tidelands emission sources, and includes natural sources. Figure 3-1 shows each major source category's relative contribution for each pollutant during ~~2000~~ 2002. The largest sources of each pollutant and their percent of contribution are as follows:

~~2000~~ 2002 Santa Barbara County ROC Annual Emissions: ~~44,348~~ 43,149 tons per year

- ~~8%~~ 7% **Stationary Sources: ~~3,667~~ 3,169 tons per year**
Primarily from Coatings and Process Solvents (~~Thinning and Cleanup Solvents~~), Degreasing, Adhesives and Sealants, and Oil and Gas Production (~~Fugitives from Crude Oil Valves~~).
- ~~7%~~ 10% **Area-Wide Sources: ~~3,064~~ 4,356 tons per year**
Primarily from Consumer Products, Pesticides & Fertilizers (~~Methyl Bromide~~), and Architectural Coatings and Related Process Solvents (Thinning and Cleanup Solvents), Forest Management, and Farming Livestock Waste.
- ~~14%~~ 10% **Mobile Sources – On-Road Motor Vehicles: ~~6,122~~ 4,502 tons per year**
Predominantly Light Duty Passenger cars and Light Duty Trucks, and ~~Medium Duty Trucks~~.
- ~~6%~~ **Other Mobile Sources: ~~2,565~~ 2,513 tons per year**

Significant emissions are from Lawn and Garden Equipment, Transport Refrigeration Units, Fuel Storage and Handling, Recreational Boats, and ~~Farm Equipment~~ (Diesel Agricultural Equipment), and Diesel Construction and Mining Equipment.

- **~~65%~~ 66% Natural Sources: ~~28,930~~ 28,608 tons per year**
Mostly Biogenic Sources with a significant contribution from Geogenic Sources.

2000 2002 Santa Barbara County NO_x Annual Emissions: ~~17,615~~ 17,455 tons per year

- **~~12%~~ 14% Stationary Sources: ~~2,096~~ 2,469 tons per year**
Almost all from Oil and Gas Production (Natural Gas IC Engines), Manufacturing and Industrial (Diesel IC Engines), Agricultural Irrigation (Diesel and Natural Gas IC Engines).
- **~~2%~~ 4% Area-Wide Sources: ~~350~~ 692 tons per year**
Mostly Residential Fuel Combustion (Natural Gas Space and Water Heating) and Forest Management.
- **~~50%~~ 38% Mobile Sources – On-Road Motor Vehicles: ~~8,890~~ 6,691 tons per year**
The majority from Light Duty Passenger cars, Light Duty Trucks, and Heavy Heavy Duty Diesel Trucks.
- **~~28%~~ 39% Other Mobile Sources: ~~4,913~~ 6,722 tons per year**
Contributors are from Trains, ~~Off-Road Equipment~~ (Diesel Construction and Mining Equipment), and ~~Farm Equipment~~ (Diesel Agricultural Equipment), and Transport Refrigeration Units.
- **~~8%~~ 5% Natural Sources: ~~1,365~~ 882 tons per year**
Mostly Exclusively from Biogenic Sources ~~with some Wildfire (Timber and Brush) emissions~~.

In summary, Natural Sources (both Biogenic and Geogenic Sources) contribute the most ROC emissions in the Annual Emission Inventory. On-Road Motor Vehicles, specifically Light Duty Passenger, also produce large amounts of ROC emissions and most of the NO_x emissions. On-Road Motor Vehicles, Light Duty Trucks, and Other Mobile Sources, Trains, Off-Road Equipment and Farm Equipment, also contribute large amounts of NO_x emissions.

3.4.2 OCS ANNUAL EMISSIONS

The 2000 2002 OCS emission inventory is presented in Table 3-2. The OCS emissions are summarized separately from the onshore emission inventory for clarity. Figure 3-2 shows each major source's relative contribution for each pollutant during 2000 2002. The largest sources of each pollutant and their percent of contribution are discussed below.

2000 2002 OCS ROC Annual Emissions: ~~3,067~~ 3,280 tons per year

- **~~14%~~ 13% Stationary Sources: ~~417~~ 426 tons per year**
Primarily Oil and Gas Production (Fugitives from Crude Oil Valves).
- **~~21%~~ 24% Mobile Sources: ~~646~~ 775 tons per year**
Mostly Ships (Foreign Motor Ships), Recreational Boats, and Commercial Boats.
- **~~65%~~ 63% Natural Sources: ~~2,004~~ 2,079 tons per year**
All from Geogenic Sources (Gas Seeps and Oil Seeps).

2000 2002 OCS NO_x Annual Emissions: ~~12,175~~ 13,641 tons per year

- **~~2%~~ Stationary Sources: ~~298~~ 305 tons per year**

Primarily Oil and Gas Production (Natural Gas Turbine IC Engines).

- **98% Mobile Sources: 11,876 13,336 tons per year**

Predominantly Ships (Foreign Motor Ships) and Commercial Boats.

It should be noted that the method used for determining emissions from marine shipping was updated since the completion of the 2001 Clean Air Plan. The 1999 marine shipping inventory that was included in the 2001 Clean Air Plan was calculated based on average horsepower ratings for each ship type (e.g., cargo ships, container ships, auto carriers, etc.). In addition, the types of marine vessels transiting off the coast of Santa Barbara County were derived by assuming the same percentages of each vessel type as those departing or arriving from the north out of or into the Port of Los Angeles—Long Beach. The fleet makeup and average horsepower ratings for the 1999 inventory were obtained from the September 1999 report *Marine Vessel Emissions Inventory, Update to 1996 Report: Marine Vessel Emissions Inventory and Control Strategies* prepared by ARCADIS for the South Coast Air Quality Management District. Since the preparation of the 1999 marine shipping inventory, we have acquired the Lloyds Registry of Ships database that includes ship specific horsepower ratings for marine vessels including those transiting off the coast of Santa Barbara County.

The 2002 In developing the 2000 marine shipping inventory, was developed using ship-specific data including ship name, vessel number, ship type, and cruising speed that were obtained from the Southern California Marine Exchange and Port Hueneme, Marine Exchange of Los Angeles—Long Beach Harbor. The 2000-2002 marine shipping inventory is based on estimating emissions by utilizing the ship-specific power consumption data for each ship that transited the coast of the county during 2000 2002. Ship power data were obtained from the Lloyds Maritime Database and correlated to each ship transiting the Santa Barbara Channel by a unique vessel number. Utilizing ship speed data along with a ship travel distance of 130 miles (county-line to county-line distance), the amount of time it took each ship to transit the Santa Barbara County coastline was determined. Emissions were then calculated by essentially multiplying together transit time, ship power, number of transits through the Channel and a NOx emission factor that ranges from 16.32 grams per kilowatt-hour for cargo ships to 17.09 grams per kilowatt-hour for container ships. It is assumed that the ships operate at 70 percent load while in transit, rather than by using averages of power by ship type and assumed fleet makeup as was done for the 1999 inventory. This methodology update has increased our current marine shipping NOx emission estimates by about 4.1 tons per day over 1999 estimates. The significant increase in marine shipping emissions from 1999 to 2000 is a direct result of our updated calculation methodology as opposed to an increase in the level of marine shipping activity or the number of vessel transits off our coast. Of the 13,336 tons of NOx emissions in 2002, about 88% are from foreign motor ships with about 9% from U.S. motor ships.

In summary, two thirds of the ROC emissions in the OCS are from Natural Sources, specifically offshore oil seeps and gas seeps. Ships and Commercial Boats in transit, and Oil and Gas Production, primarily offshore platform fugitive hydrocarbons, contribute the largest remaining portions of ROC emissions to the OCS inventory. Ships and Commercial Boats also account for almost all of the NO_x emissions.

3.5 ~~2000~~ 2002 PLANNING EMISSION INVENTORY

The ~~2000~~ 2002 Planning Emission Inventory was developed by modifying the Annual Emission Inventory three significant ways. First, seasonal variations are factored into the Planning Emission Inventory because most exceedances of ~~the state~~ ozone standards occur during the April to October ozone season. Second, the Planning Emission Inventory excludes emissions from natural sources such as biogenics, oil seeps and gas seeps, and wildfires, since they are not regulated or controlled. Third, the emission values are converted from tons per year to tons per day.

3.5.1 SANTA BARBARA COUNTY PLANNING EMISSION INVENTORY

Table 3-3 and Figure 3-3 shows each major source's relative contribution for each pollutant during ~~2000~~ 2002. The largest sources of each pollutant and their relative contribution are discussed in the following section.

~~2000~~ 2002 Santa Barbara County ROC Planning Emissions: ~~41.84~~ 38.57 tons per day

- ~~24%~~ 23% **Stationary Sources: ~~10.05~~ 8.69 tons per day**
Primarily from Coatings and Process Solvents (~~Thinning and Cleanup Solvents~~), Degreasing, Adhesives and Sealants, and Oil and Gas Production (~~Fugitives from Crude Oil Valves~~).
- ~~19%~~ 28% **Area-Wide Sources: ~~7.94~~ 10.67 tons per day**
Primarily from Consumer Products, Pesticides & Fertilizers (~~Methyl Bromide~~), and Architectural Coatings and Related Process Solvents (Thinning and Cleanup Solvents), Forest Management, and Farming Livestock Waste.
- ~~43%~~ 32% **Mobile Sources – On-Road Motor Vehicles: ~~16.77~~ 12.34 tons per day**
Predominantly Light Duty Passenger cars and Light Duty Trucks, ~~and Medium Duty Trucks~~.
- ~~18%~~ **Other Mobile Sources: ~~7.07~~ 6.89 tons per day**
Significant emissions are from Lawn and Garden Equipment, Transport Refrigeration Units, Fuel Storage and Handling, Recreational Boats, and ~~Farm Equipment (Diesel Agricultural Equipment)~~, and Diesel Construction and Mining Equipment.

~~2000~~ 2002 Santa Barbara County NO_x Planning Emissions: ~~43.89~~ 44.37 tons per day

- ~~13%~~ 15% **Stationary Sources: ~~5.57~~ 6.61 tons per day**
Almost all from Oil and Gas Production (Natural Gas IC Engines), Manufacturing and Industrial (Diesel IC Engines), Agricultural Irrigation (Diesel IC Engines).
- ~~1%~~ 2% **Area-Wide Sources: ~~0.48~~ 1.00 ton per day**
Mostly Residential Fuel Combustion (Natural Gas Space and Water Heating) and Forest Management.
- ~~55%~~ 41% **Mobile Sources – On-Road Motor Vehicles: ~~24.36~~ 18.33 tons per day**
The majority from Light Duty Passenger cars, Light Duty Trucks, and Heavy-Heavy Duty Diesel Trucks.
- ~~31%~~ 42% **Other Mobile Sources: ~~13.48~~ 18.42 tons per day**
Contributors are from Trains, ~~Off Road Equipment (Diesel Construction and Mining Equipment)~~, and Farm Equipment (Diesel Agricultural Equipment), and Transport Refrigeration Units.

In summary, On-Road Motor Vehicles, specifically Light Duty Passenger cars and Light Duty Trucks produce about two-thirds of the ROC emissions along with significant contributions from Cleaning and

Surface Coatings, Solvent Evaporation, and Petroleum Production and Marketing. On-Road Motor Vehicles, primarily Light Duty Passenger cars, Light Duty Trucks, and Heavy, Heavy Duty Diesel Trucks, along with the Other Mobile Source categories of Off-Road Equipment and Farm Equipment, produce the majority of the NO_x emissions.

3.5.2 OCS PLANNING EMISSION INVENTORY

The ~~2000~~ 2002 OCS Planning Emission Inventory is presented in Table 3-4. The OCS emissions are summarized separately from the onshore emission inventory for clarity. Figure 3-4 shows each major source's relative contribution for each pollutant during ~~2000~~ 2002. The largest sources of each pollutant and their percent of contribution are discussed as follows.

~~2000~~ 2002 OCS ROC Planning Emissions: ~~2.91~~ 3.29 tons per day

- **~~39%~~ 36% Stationary Sources: ~~1.14~~ 1.17 tons per day**
Primarily Oil and Gas Production (Fugitives from Crude Oil Valves).
- **~~61%~~ 64% Mobile Sources: ~~1.77~~ 2.12 tons per day**
Mostly Ships (Foreign Motor Ships), Recreational Boats, and Commercial Boats.

~~2000~~ 2002 OCS NO_x Planning Emissions: ~~33.37~~ 37.38 tons per day

- **2% Stationary Sources: ~~0.82~~ 0.84 tons per day**
Primarily Oil and Gas Production (Natural Gas Turbine IC Engines).
- **98% Mobile Sources: ~~32.55~~ 36.55 tons per day**
Predominantly Ships (Foreign Motor Ships) ~~and Commercial Boats~~.

In summary, the most significant contributors of ROC and NO_x emissions to the Planning Emission Inventory on the OCS are from Ships ~~and Commercial Boats~~ (Foreign Motor Ships).

3.6 CONCLUSION

In this chapter we have described how our emission inventories are categorized into Stationary Sources, Area-Wide Sources, Mobile Sources and Natural Sources. The emphasis in the ~~2004~~ 2007 Plan is on the ozone precursors of ROC and NO_x. We have also discussed the development of the ~~2000~~ 2002 Annual Emission Inventory and ~~2000~~ 2002 Planning Emission Inventory for both Santa Barbara County and the Outer Continental Shelf. These inventories provide the foundation for this plan and are key elements to calculating emission reductions attributable to control measures and for forecasting future emission inventories for ~~2005~~, 2010, 2015, and 2020.

In Santa Barbara County, the largest contributor of ROC emissions is from natural sources in the Annual Emission Inventory and on-road motor vehicles in the Planning Emission Inventory. Santa Barbara County NO_x emissions for both inventories are mostly from on-road motor vehicles and other mobile sources, such as trains and off-road equipment. The largest contributor of locally generated ROC and NO_x emissions in both the Annual Emission Inventory and Planning Emission Inventory is on road motor vehicles. The most significant source of ROC and NO_x emissions in both the Annual Emission Inventory and the Planning Emission Inventory for the Outer Continental Shelf is Other Mobile Sources (predominately international marine shipping activities).

TABLE 3 – 1 2002 Emission Inventory – Santa Barbara County		Annual ROC <i>(tons per year)</i>	Planning ROC <i>(tons per day)</i>	Annual NOx <i>(tons per year)</i>	Planning NOx <i>(tons per day)</i>
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STATIONARY SOURCES

Fuel Combustion

010	ELECTRIC UTILITIES	1.84	0.0050	8.89	0.0244
020	COGENERATION	13.08	0.0358	43.18	0.1183
030	OIL AND GAS PRODUCTION (COMBUSTION)	86.63	0.2373	561.21	1.5376
040	PETROLEUM REFINING (COMBUSTION)	0.81	0.0022	18.13	0.0497
050	MANUFACTURING AND INDUSTRIAL	30.73	0.0852	420.20	1.1559
052	FOOD AND AGRICULTURAL PROCESSING	45.40	0.1226	1,102.56	3.0207
060	SERVICE AND COMMERCIAL	12.79	0.0296	231.80	0.4787
099	OTHER (FUEL COMBUSTION)	0.00	0.0000	0.00	0.0000
	<i>Fuel Combustion Total</i>	191.28	0.5177	2,385.97	6.3853

Waste Disposal

110	SEWAGE TREATMENT	0.10	0.0003	3.23	0.0088
120	LANDFILLS	123.06	0.3371	1.25	0.0034
130	INCINERATORS	0.34	0.0009	3.14	0.0086
140	SOIL REMEDIATION	94.69	0.2594	0.00	0.0000
199	OTHER (WASTE DISPOSAL)	0.00	0.0000	0.00	0.0000
	<i>Waste Disposal Total</i>	218.19	0.5977	7.62	0.0208

Cleaning and Surface Coatings

210	LAUNDERING	2.01	0.0055	0.00	0.0000
220	DEGREASING	567.28	1.5542	0.00	0.0000
230	COATINGS AND RELATED PROCESS SOLVENTS	689.67	1.8895	0.00	0.0000
240	PRINTING	165.10	0.4523	0.00	0.0000
250	ADHESIVES AND SEALANTS	315.62	0.8647	0.00	0.0000
299	OTHER (CLEANING AND SURFACE COATINGS)	35.15	0.0963	0.00	0.0000
	<i>Cleaning and Surface Coatings Total</i>	1,774.83	4.8625	0.00	0.0000

Petroleum Production and Marketing

310	OIL AND GAS PRODUCTION	657.90	1.8025	27.01	0.0740
320	PETROLEUM REFINING	16.07	0.0440	0.05	0.0001
330	PETROLEUM MARKETING	217.91	0.5970	0.00	0.0000
	<i>Petroleum Production and Marketing Total</i>	891.88	2.4435	27.06	0.0741

Industrial Processes

410	CHEMICAL	9.49	0.0260	0.00	0.0000
420	FOOD AND AGRICULTURE	44.75	0.1329	0.00	0.0000
430	MINERAL PROCESSES	4.01	0.0110	17.34	0.0475
440	METAL PROCESSES	NA	NA	NA	NA
450	WOOD AND PAPER	NA	NA	NA	NA
470	ELECTRONICS	0.11	0.0003	0.00	0.0000
499	OTHER (INDUSTRIAL PROCESSES)	34.17	0.0936	30.62	0.0839
	<i>Industrial Processes Total</i>	92.53	0.2638	47.96	0.1314

	STATIONARY SOURCES TOTAL	3,168.71	8.6852	2,468.61	6.6116
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TABLE 3 – 1 2002 Emission Inventory – Santa Barbara County		Annual ROC <i>(tons per year)</i>	Planning ROC <i>(tons per day)</i>	Annual NOx <i>(tons per year)</i>	Planning NOx <i>(tons per day)</i>
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AREA-WIDE SOURCES

Solvent Evaporation

510	CONSUMER PRODUCTS	1,123.22	3.0773	0.00	0.0000
520	ARCHITECTURAL COATINGS AND SOLVENTS	535.86	1.4681	0.00	0.0000
530	PESTICIDES/FERTILIZERS	1,138.29	3.1186	0.00	0.0000
540	ASPHALT PAVING/ROOFING	79.40	0.2755	0.00	0.0000
	<i>Solvent Evaporation Total</i>	2,876.77	7.9395	0.00	0.0000

Miscellaneous

610	RESIDENTIAL FUEL COMBUSTION	50.87	0.1220	300.77	0.4661
620	FARMING OPERATIONS	454.06	1.2440	0.00	0.0000
630	CONSTRUCTION AND DEMOLITION	0.00	0.0000	0.00	0.0000
640	PAVED ROAD DUST	0.00	0.0000	0.00	0.0000
645	UNPAVED ROAD DUST	0.00	0.0000	0.00	0.0000
650	FUGITIVE WINDBLOWN DUST	0.00	0.0000	0.00	0.0000
660	FIRES	1.28	0.0035	0.40	0.0011
670	WASTE BURNING AND DISPOSAL	963.02	1.3293	390.61	0.5363
690	COOKING	10.46	0.0287	0.00	0.0000
699	OTHER (MISCELLANEOUS PROCESSES)	0.00	0.0000	0.00	0.0000
	<i>Miscellaneous Total</i>	1,479.69	2.7275	691.78	1.0035

	AREA-WIDE SOURCES TOTAL	4,356.46	10.6670	691.78	1.0035
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MOBILE SOURCES

On-Road Motor Vehicles

710	LIGHT DUTY PASSENGER	2,063.53	5.6535	1,846.72	5.0595
722	LIGHT DUTY TRUCKS – 1	881.29	2.4145	1,043.83	2.8598
723	LIGHT DUTY TRUCKS – 2	629.66	1.7251	1,003.46	2.7492
724	MEDIUM DUTY TRUCKS	147.68	0.4046	296.23	0.8116
732	LIGHT HEAVY DUTY GAS TRUCKS – 1	106.91	0.2929	79.24	0.2171
733	LIGHT HEAVY DUTY GAS TRUCKS – 2	116.11	0.3181	102.09	0.2797
734	MEDIUM HEAVY DUTY GAS TRUCKS	151.91	0.4162	123.55	0.3385
736	HEAVY HEAVY DUTY GAS TRUCKS	104.24	0.2856	285.58	0.7824
742	LIGHT HEAVY DUTY DIESEL TRUCKS – 1	0.95	0.0026	26.39	0.0723
743	LIGHT HEAVY DUTY DIESEL TRUCKS – 2	3.80	0.0104	92.45	0.2533
744	MEDIUM HEAVY DUTY DIESEL TRUCKS	12.56	0.0344	649.81	1.7803
746	HEAVY HEAVY DUTY DIESEL TRUCKS	53.44	0.1464	810.26	2.2199
750	MOTORCYCLES	179.62	0.4921	40.26	0.1103
760	HEAVY DUTY DIESEL URBAN BUSES	4.75	0.0130	126.18	0.3457
762	HEAVY DUTY GAS URBAN BUSES	8.91	0.0244	11.64	0.0319
770	SCHOOL BUSES	6.10	0.0167	76.32	0.2091
780	MOTOR HOMES	30.92	0.0847	76.61	0.2099
	<i>On-Road Motor Vehicles Total</i>	4,502.38	12.3352	6,690.62	18.3305

TABLE 3 – 1 2002 Emission Inventory – Santa Barbara County		Annual ROC <i>(tons per year)</i>	Planning ROC <i>(tons per day)</i>	Annual NOx <i>(tons per year)</i>	Planning NOx <i>(tons per day)</i>
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Other Mobile Sources

810	AIRCRAFT	282.63	0.7743	31.56	0.0865
820	TRAINS	110.45	0.3026	2,332.46	6.3903
830	SHIPS AND COMMERCIAL BOATS	18.01	0.0502	177.78	0.4965
840	RECREATIONAL BOATS	338.36	0.9270	51.69	0.1416
850	OFF-ROAD RECREATIONAL VEHICLES	257.98	0.7068	20.81	0.0570
860	OFF-ROAD EQUIPMENT	929.98	2.5479	2,790.57	7.6454
870	FARM EQUIPMENT	224.95	0.6163	1,316.66	3.6073
890	FUEL STORAGE AND HANDLING	350.51	0.9603	0.00	0.0000
	<i>Other Mobile Sources Total</i>	2,512.87	6.8854	6,721.53	18.4246

	MOBILE SOURCES TOTAL	7,015.25	19.2206	13,412.15	36.7551
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NATURAL SOURCES

Natural Sources

910	BIOGENIC SOURCES	22,532.47	0.0000	882.48	0.0000
920	GEOGENIC SOURCES	6,075.73	0.0000	0.00	0.0000
930	WILDFIRES	0.00	0.0000	0.00	0.0000
940	WINDBLOWN DUST	0.00	0.0000	0.00	0.0000
	<i>Natural Sources Total</i>	28,608.20	0.0000	882.48	0.0000

	NATURAL SOURCES TOTAL	28,608.20	0.0000	882.48	0.0000
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	2002 SANTA BARBARA COUNTY TOTAL	43,148.62	38.5728	17,455.02	44.3702
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TABLE 3 – 2 2002 Emission Inventory – OCS		Annual ROC <i>(tons per year)</i>	Planning ROC <i>(tons per day)</i>	Annual NOx <i>(tons per year)</i>	Planning NOx <i>(tons per day)</i>
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STATIONARY SOURCES

Fuel Combustion

030	OIL AND GAS PRODUCTION (COMBUSTION)	24.96	0.0684	295.28	0.8090
	<i>Fuel Combustion Total</i>	24.96	0.0684	295.28	0.8090

Cleaning and Surface Coatings

230	COATINGS AND RELATED PROCESS SOLVENTS	19.82	0.0543	0.00	0.0000
	<i>Cleaning and Surface Coatings Total</i>	19.82	0.0543	0.00	0.0000

Petroleum Production and Marketing

310	OIL AND GAS PRODUCTION	381.10	1.0441	9.88	0.0271
	<i>Petroleum Production and Marketing Total</i>	381.10	1.0441	9.88	0.0271

	STATIONARY SOURCES TOTAL	425.88	1.1668	305.16	0.8361
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MOBILE SOURCES

Other Mobile Sources

810	AIRCRAFT	7.81	0.0214	5.68	0.0156
830	SHIPS AND COMMERCIAL BOATS	428.85	1.1757	13,278.81	36.3898
840	RECREATIONAL BOATS	338.36	0.9270	51.59	0.1416
	<i>Other Mobile Sources Total</i>	775.02	2.1241	13,336.08	36.5470

	MOBILE SOURCES TOTAL	775.02	2.1241	13,336.08	36.5470
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NATURAL SOURCES

Natural Sources

920	GEOGENIC SOURCES	2,078.90	0.0000	0.00	0.0000
	<i>Natural Sources Total</i>	2,078.90	0.0000	0.00	0.0000

	NATURAL SOURCES TOTAL	2,078.90	0.0000	0.00	0.0000
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	2002 OUTER CONTINENTAL SHELF TOTAL	3,279.80	3.2909	13,641.24	37.3831
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Figure 3-1

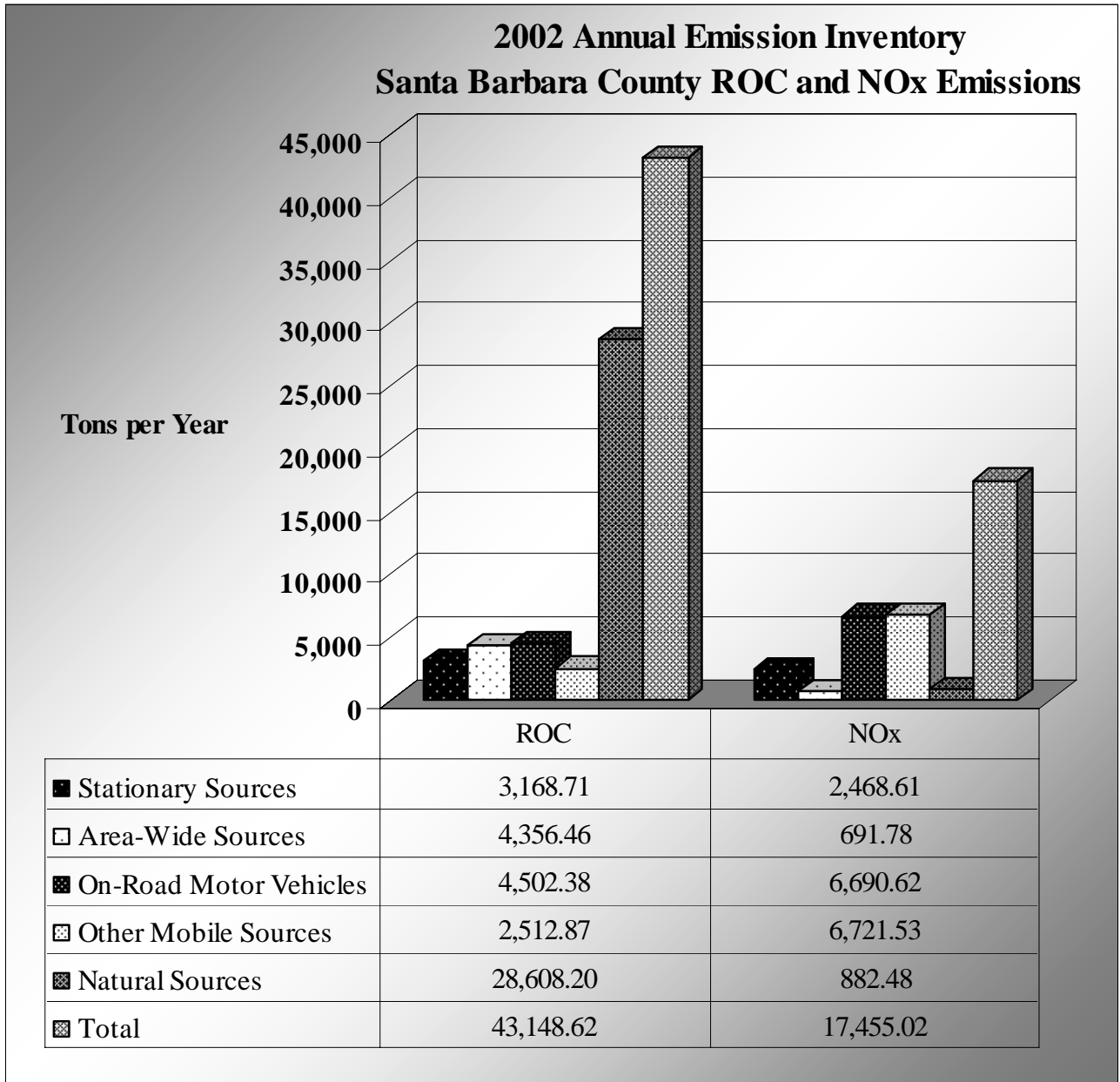


Figure 3-2

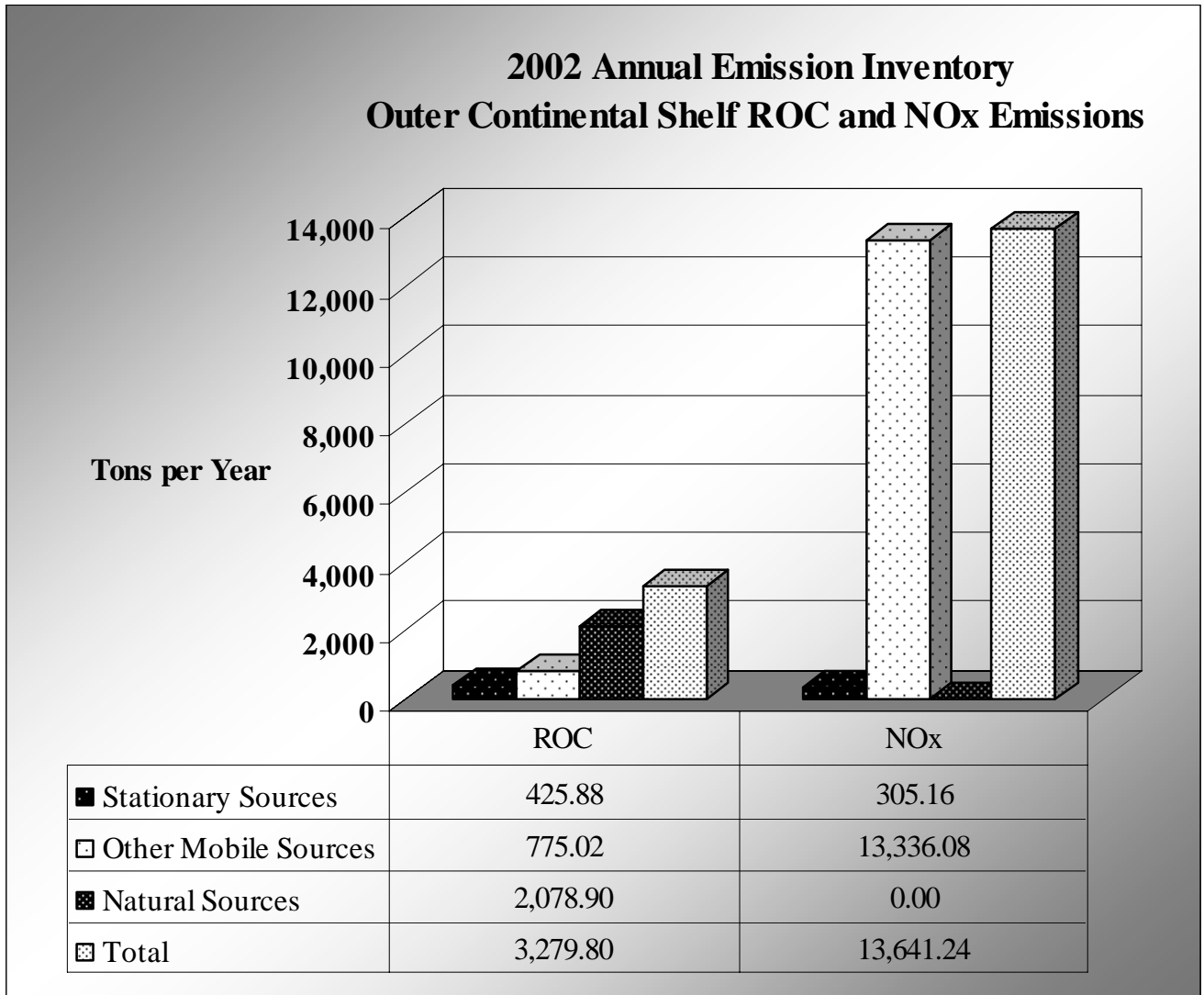


Figure 3-3

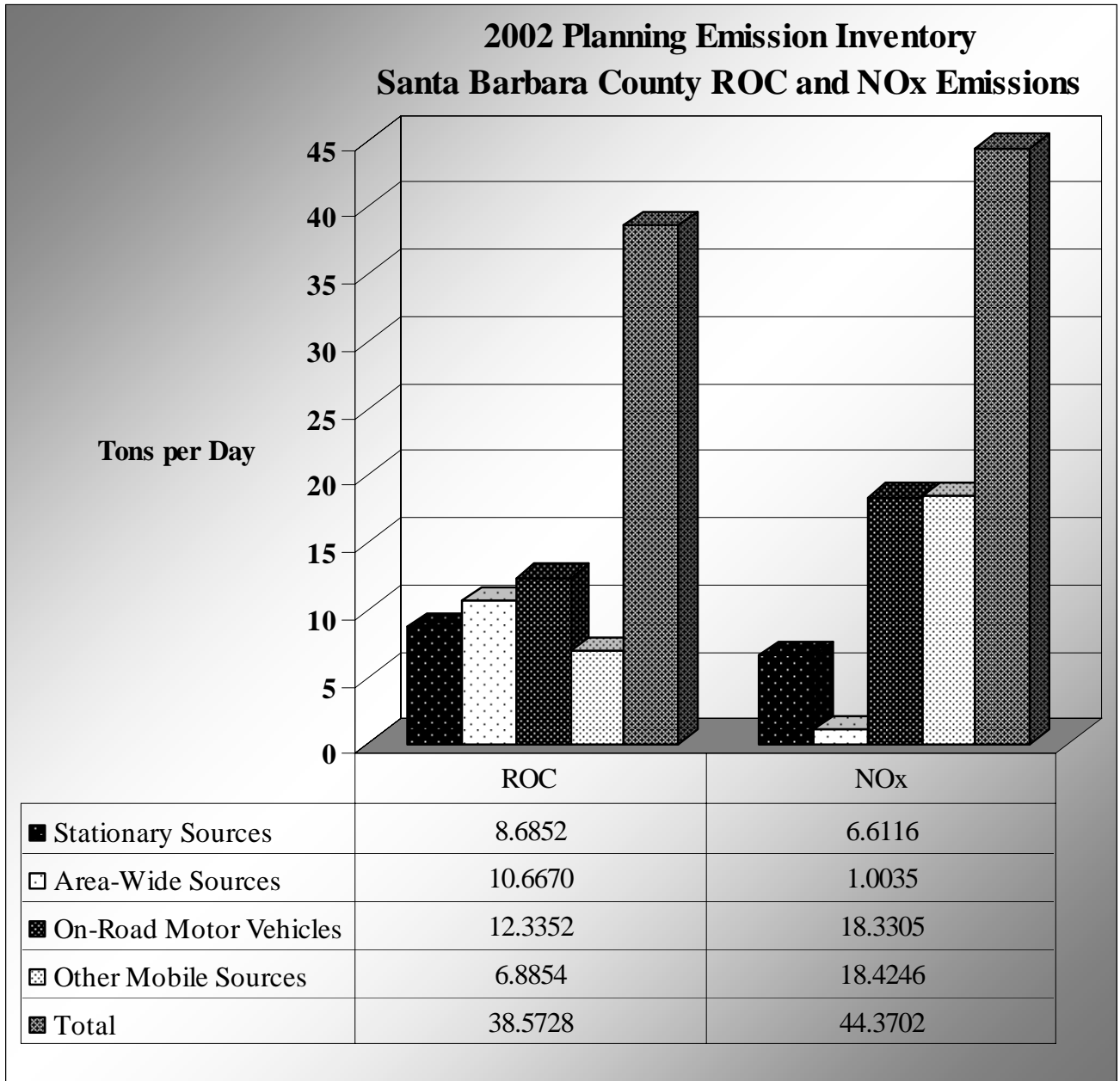


Figure 3-4

