3.6 AIR QUALITY

This section describes the environmental setting of the Bay Area with respect to air quality and the regulatory controls applicable to emissions from vessels and vehicular traffic. Federal, state, and regional regulations apply to Bay Area air quality and set controls and goals for air quality criteria for the regional area. These criteria and the regional compliance with established air quality standards are summarized below. A list of acronyms and technical terms is provided at the end of this section.

3.6.1 Environmental Setting

3.6.1.1 Study Area

The proposed project area covers the entire San Francisco Bay Area Air Basin. Although ferry terminals would only be located along the perimeter of the Bay, people would be traveling from many areas within the air basin to use the ferries. Motor vehicles and vessels would be a source of air pollutants associated with the project. The project area and the air basin are under the jurisdiction of the Bay Area Air Quality Management District (BAAQMD). The air basin covers all or part of nine counties surrounding San Francisco Bay: all of Alameda, Contra Costa, Marin, Napa, San Francisco, San Mateo, and Santa Clara; and portions of Solano and Sonoma.

3.6.1.2 Project Setting

The Bay Area Air Basin consists of seven regions with varying meteorological, climatological, and air pollution characteristics. This section summarizes these characteristics and differences. This project is regional in nature, and there could be potential impacts from motor vehicles throughout the region. Therefore, the climate and air quality for the entire Bay Area is described, as ferry commuters could be driving from the farthest reaches of the Bay Area.

Meteorology, Climatology, and Air Quality of the Bay Area Region

The BAAQMD operates a regional air quality monitoring network for criteria pollutants, including ozone (O_3), carbon monoxide (CO), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), and particulate matter less than 10 micrometers in diameter (PM_{10}). Table 3.6.1 presents a 4-year summary of ambient air quality measured at seven monitoring stations throughout the Bay Area. This table also shows the number of exceedances of the state and national ambient air quality standards at each station, for pollutants for which there were exceedances. Monitoring data from the BAAQMD network are used by the U.S. Environmental Protection Agency (USEPA) and the California Air Resources Board (CARB) to designate the attainment status of the area and to classify the severity of nonattainment problems.

The Bay Area is in attainment of most pollutant standards. The exceptions are O_3 and particulate matter, the standards for which are exceeded periodically. As shown in Table 3.6.1, monitoring stations throughout the different meteorological subregions of the Bay Area reflect the same pattern: only the state O_3 and PM_{10} standards are exceeded.

In addition to criteria pollutants, both the BAAQMD and the CARB operate toxic air contaminant (TAC) monitoring networks in the San Francisco Bay Area. These stations measure

10 to 15 TACs, depending on the specific station. The TACs selected are those that have traditionally been found in the highest concentrations in ambient air, and therefore tend to produce the most significant risk.

The climate of the San Francisco Bay Area is diverse and varies widely from region to region. In general, the Bay Area is classified as having a Mediterranean climate, with warm, dry summers and mild, wet winters. In the summer, air flow generally approaches the Bay Area from the Pacific Ocean (from the west or northwest). This air, which is generally cool and moisture-laden from its movement across the Pacific Ocean, is further cooled as it flows across a cold bank of water existing off the coast of the Bay Area. This cooling often produces condensation, resulting in fog and stratus clouds along the Bay Area coast. In winter, storms are frequent. Ninety percent of the Bay Area's precipitation occurs between November and April. During winter rainy periods, inversions are weak or nonexistent, winds are often moderate, and air pollution potential is very low. During winter dry periods, inversions become strong, winds are light, and pollution potential is high. During these dry, winter periods, winds can flow out of the Central Valley into the Bay Area, bringing tule fog into the region.

The Bay Area is characterized by terrain consisting of coastal mountain ranges, inland valleys, and bays. Elevations of 1,500 feet are common in the higher terrain of this area. Normal wind flow is often distorted in many areas.

Due to the topographical diversity of the Bay Area, it is appropriate to describe the meteorology and climate of the Bay Area in more detail by discussing several of the Bay Area subregions and their microclimates. Table 3.6.1 provides a 4-year summary of ambient air quality measured at seven different air quality monitoring stations throughout the Bay Area, providing an overview of the ambient air quality of many of the Bay Area microclimates.

Carquinez Strait Region

The Carquinez Strait area is the only major sea level pass through California's Coast Range. Prevailing winds flow from west to east. During the summer and fall months, air pressure patterns become established, drawing marine air eastward through Carquinez Strait almost every day. Afternoon wind speeds of 15 to 20 mph are common throughout the straits region. Occasionally, pressure patterns will reverse, causing an east to west air flow through the strait, elevating pollutant levels in the Bay Area. This air flow pattern has low wind speeds and shallow mixing depths, thereby allowing localized emissions to build up. Also, this air mass is generally warm and contains more pollutants than the marine air flow, thereby increasing photochemical activity.

Many industrial facilities within the strait region have significant emissions. The general west-to-east flow of the winds in the straits tends to move pollutants east. Receptors to the east of the industrial facilities in the strait generally have longer term exposure to pollutants than other receptors in the region.

Average daily maximum temperatures (in degrees Fahrenheit) are in the mid to high 50s in the winter and the high 80s in the summer. Average minimum temperatures are in the high 30s to low 40s in the winter and the mid-50s in the summer. Rainfall amounts in the region vary from 13 inches annually in Antioch to 22 inches annually in Fairfield. In Table 3.6.1, the data presented for Pittsburg is representational of average ambient air quality in the Carquinez Strait region.

Diablo Valley–San Ramon Valley Region

East of the Coast Range lie the Diablo and San Ramon Valleys. The Diablo Valley is a broad valley, approximately 5 miles wide and 10 miles long. The Carquinez Strait is at its north end and the south tapers into the San Ramon Valley. The San Ramon Valley is long and narrow, approximately 12 miles long and one mile wide. Its southern end opens to the Amador Valley. The Coast Range on the west side of these valleys blocks much of the marine air from reaching the valleys. The wind speeds in these valleys are generally the lowest in the Bay Area. During the daytime, there are two weakly predominant air flow patterns: an upvalley flow and a westerly flow across the lower elevations of the Coast Range. On clear nights, a surface inversion sets up and separates the surface flow from the upper layer flow. When this occurs, the terrain channels the flow downvalley toward the Carquinez Strait. Crow Canyon gap, which is near the town of San Ramon, allows polluted air from cities near the Bay to travel into the San Ramon Valley during the summer months.

These valleys are cooler in the winter and warmer in the summer than areas closer to Bay waters. High temperatures range from the 50s in the winters to the 90s in the summers. Low temperatures in the winter are in the low to mid-40s. Tule fogs are common on clear winter nights. Rainfall averages approximately 19 inches annually.

Pollution potential is high in these valleys. In the winter, light winds at night, inversion, and terrain blocking to the east and west does not allow much dispersion of pollutants. In the summer, ozone can be transported into the valleys from both the Central Valley and the central Bay Area. Due to the narrowness of the San Ramon Valley, winter pollution buildups can be high due to automobile emissions from Interstate 680 (which runs down the center of the valley) and emissions from fireplaces and woodstoves. The data presented for Concord in Table 3.6.1 are representational of average ambient air quality in the Diablo Valley–San Ramon Valley region.

Livermore Valley Region

The Livermore Valley is a northwest-to-southeast running, sheltered inland valley bound by 1,000- to 1,500-foot hills on its east and west sides. On the western side of the valley, two gaps connect it to San Francisco Bay. The eastern side of the Livermore Valley has one major passage to the San Joaquin Valley. The valley connects to the Diablo Valley–San Ramon Valley at its northwest point and the south side of the valley terminates at the 3,000-foot Diablo range.

During winter dry periods, a weak pressure pattern exists in the valley. At night and during the early morning, cool air flows down the valley from its hills, gaps, and passes. Solar heating, which occurs during the day, can reverse this air flow. A weak temperature inversion can be present during the summer, causing afternoon winds to flow from the Bay. When a strong temperature inversion is present during the summer, air flow is minimal. Winter high temperatures range from the high 50s to the low 60s and low temperatures range from the mid- to high 30s, with extremes in the high teens and low 20s. Summer high temperatures range from the 80s to the low 90s, with extremes in the 100s, and minimum temperatures are in the low 50s. Average annual precipitation is 14 inches.

The potential for air pollution in the Livermore Valley is high, especially for photochemical pollutants. The valley traps locally generated pollutants and can be the receptor of ozone and ozone precursors from San Francisco, Alameda, Contra Costa, and Santa Clara Counties.

Occasionally in the fall, northeasterly winds flow in the area, allowing ozone to enter the valley from the San Joaquin Valley. The strong temperature inversion that often occurs in the winter allows local pollutants from automobiles, fireplaces and agricultural burning to concentrate, raising carbon monoxide and particulate levels. The data presented for Livermore in Table 3.6.1 are representative of average ambient air quality in the Livermore Valley region.

Marin County Basins Region

The Marin County Basins region is bound on the west by the Pacific Ocean, on the east by San Pablo Bay, on the south by the Golden Gate, and on the north by the Petaluma Gap. The area is mostly hilly. Most of the population lives in small, sheltered valleys on the eastern side of the hills. The western, coastal side of the region is subjected to cool marine air; often with fog in the summer and relatively warm, clear skies in the winter. The eastern side of the region has generally warmer weather and less fog than the western side. The low terrain of 800 to 1,000 feet allows for marine air to flow through the area. However, due to the wedge shape of the region, the northern sections of the area are farther from the ocean, allowing the marine air mass to be heated before it arrives.

Temperatures vary throughout the region. In the coastal area, temperatures range from the high 50s in the winter to the low 60s in the summer. San Rafael, which is near the Bay, experiences average maximum winter temperatures in the high 50s to low 60s, average minimum winter temperatures in the low 40s, average maximum summer temperatures in the high 70s to low 80s, and average minimum summer temperatures in the 50s. Inland areas generally experience temperature fluctuations a few degrees warmer and a few degrees cooler from the average temperatures along the Bay. Rainfall averages between 25 and 50 inches annually, depending on location, with some of the more mountainous regions experiencing more rainfall than most locations in the Bay Area.

The potential for air pollution is highest on the eastern side of Marin County, where the sheltered valleys and largest population centers are located. The data presented for San Rafael in Table 3.6.1 are representational of average ambient air quality in the Marin County Basins region.

East Bay Region

The East Bay region stretches from Richmond in the northwest to Milipitas in the southeast. Its western boundary is defined by San Francisco Bay and its eastern boundary by the East Bay Hills. The area is generally flat, with most of its population living between the Bay and an elevation of 500 feet.

Maritime intrusion through the Golden Gate is a dominant weather factor. Winds that enter the Golden Gate diverge as a result of the East Bay Hills in the Oakland/Berkeley area, with south-southwesterly winds in the Richmond area and northwesterly winds in the rest of the East Bay. During periods of little or no wind, the Bay can generate its own circulation system. During the winter, winds from the east or southeast are common.

Temperatures in the southern parts of the East Bay region are generally cooler in the winter and warmer in the summer than in the northern parts of the region. Summer temperatures vary from the mid-50s to the low 70s. Winter temperatures vary from the mid-30s to the mid- to high 50s. Annual rainfall averages between 14 inches in the south and 22 inches in the north.

In the northern areas, the potential for air pollution is minor. Occasionally, these areas experience light winds at night and early in the morning, which may allow elevated pollutant levels. In the southern areas, the air pollution potential is relatively high during the summer and fall months. When high pressure dominates the weather, low mixing depths and marine wind patterns can concentrate and carry pollutants from other cities to the southern part of this region, adding to the locally emitted pollutants. This polluted air is then pushed up against the East Bay Hills. Winter pollution levels are generally moderate. The data presented for Oakland in Table 3.6.1 are representative of average ambient air quality in the East Bay region.

Peninsula Region

The Peninsula region of the Bay Area extends from the area northwest of San Jose to the Golden Gate. The Santa Cruz Mountains extend up the center of the peninsula, with elevations exceeding 2,000 feet at the south end, and gradually decreasing to 500 feet in South San Francisco, where the mountain range terminates. The west side of these mountains experiences a high incidence of cool, foggy weather in the summer. The southeastern area of the peninsula experiences warmer temperatures and few foggy days. At the north end of the peninsula lies San Francisco. Because most of the topography of San Francisco is below 200 feet, the marine layer is able to flow across most of the city, making its climate cool and windy.

The coastal area has relatively high wind speeds, out of the west. Low-lying areas in the mountain range, at San Bruno Gap and Crystal Springs Gap, commonly allow the marine layer to pass across the peninsula. On mornings without a strong pressure gradient, areas on the east side of the peninsula often experience an eastern flow in the surface air layer, induced by upslope flow on the east-facing slopes and by the bay breeze.

Due to the blocking effect of the Santa Cruz Mountains, summertime maximum temperatures along the ocean coast and San Francisco are 62 to 64 degrees, while on the eastern side of the mountains, the maximum summer temperatures are in the low 80s. Daily maximum temperatures throughout the peninsula during the winter months are in the high 50s. Rainfall amounts range from 19.5 inches annually on the east side of the peninsula to 25 inches annually on the west side. The western slopes of the Santa Cruz Mountains have significantly higher annual rainfall amounts.

The potential for air pollution is highest along the southeastern portion of the peninsula because this area is protected from the high winds and fog of the marine layer, the emission density is relatively high, and pollutant transport from upwind sites is possible. In the northern areas of the Peninsula, pollutant emissions are high, but winds are generally fast enough to carry the pollutants away before they can accumulate. The data presented for San Francisco in Table 3.6-1 are representative of average ambient air quality in the Peninsula region.

Santa Clara Valley Region

The northwest/southeast-oriented Santa Clara Valley is bounded by the Santa Cruz Mountains to the west, the Diablo Range to the east, San Francisco Bay to the north and the convergence of the Gabilan Range and the Diablo Range to the south.

The wind patterns roughly parallel to the valley's northwest-southeast axis with a north-northwesterly sea breeze extending up the valley during the afternoon and early evening and a light south-southeasterly drainage flow occurring during the late evening and early morning. In summer, air flowing northward from Monterey Bay through the Pajaro Gap at the southern end of the valley forms a convergence zone in the southern end of the valley with the prevailing north-northwesterly winds.

At the northern end of the valley, the mean maximum temperatures range from the high 70s to the low 80s during the summer and from the high 50s to the low 60s during the winter. Mean minimum temperatures range from the low 40s during the winter to the high 50s during the summer. Farther inland, where the moderating effect of the Bay is not as strong, temperature extremes are greater. Summer highs are more than 10 degrees warmer and winter nights greater than 10 degrees cooler. Annual rainfall ranges from 13 inches in the lowlands to 20 inches in the hills.

The air pollution potential of the Santa Clara Valley is high. The valley has a large population and the largest complex of mobile sources in the Bay Area, making it a major source of carbon monoxide, particulate and photochemical air pollution. In addition, photochemical precursors from San Francisco, San Mateo, and Alameda Counties can be carried along by the prevailing winds to the Santa Clara Valley, making it a major ozone receptor. Geographically, the valley tends to channel pollutants to the southeast. Meteorologically, on high-ozone/low-inversion summer days, the pollutants can be re-circulated by the prevailing northwesterly winds in the afternoon and the light drainage flow in the late evening and early morning, significantly increasing the impact of emissions. On days with high concentrations of particulates and carbon monoxide during late fall and winter, clear, calm, and cold conditions associated with a strong surface-based temperature inversion prevail. The data presented for San Jose in Table 3.6.1 are representative of average ambient air quality in the Santa Clara Valley region (BAAQMD 1999).

Existing Bay Area Pollution Sources

The BAAQMD maintains an inventory of point, area, and mobile sources within the San Francisco Bay Area air basin. Point sources include industrial plants and refineries; area sources include numerous small sources such as dry cleaners, gas stations, and paint and solvent use; and mobile sources include on-road and off-road vehicles and marine sources. The year 2000 BAAQMD emission inventory is summarized in Table 3.6.2. This is a planning inventory from the ozone attainment plan for the Bay Area, and it itemizes sources within a given source category.

Impacts of Existing Ferry Services on Bay Area Air Quality

Emissions from ferries are included in the BAAQMD planning inventory under the category of Commercial Boats, which includes ferries, fishing boats, tugs, towboats, and dredges. The year 2000 emissions from ferries alone are 0.13 tons per day of ROG and 2.42 tons per day of NO_x. Emissions from ferries represent 0.03 percent of the total Bay Area ROG emissions and 0.45 percent of total Bay Area NO_x emissions. Comparable emissions inventory data for the other pollutants, CO, SO_2, and PM_{10}, are unavailable in the planning inventory.

3.6.1.3 Regulatory Setting

The project area is subject to major air quality planning programs required by both the federal Clean Air Act, which was last amended in 1990 (42 United States Code [USC] 7401 et seq.), and the California Clean Air Act of 1988 (California Health and Safety Code Section 39600 et seq.).

Both the federal and state statutes provide for ambient air quality standards to protect public health, timetables for progressing toward achieving and maintaining ambient standards, and the development of plans to guide the air quality improvement efforts of state and local agencies. The federal plan, which is referred to as the State Implementation Plan (SIP), must contain control strategies that demonstrate attainment with national ambient air quality standards by deadlines established in the federal Clean Air Act. The state plan is called the Clean Air Plan (CAP). The CAP must show satisfactory progress in attaining state ambient air quality standards. Deadlines are not fixed for attaining state standards. The SIP and the CAP overlap and generally contain the same emissions control measures.

Both the SIP and the CAP rely on the combined emission control programs of the USEPA, the CARB, and the BAAQMD. The role of each agency in controlling emissions in the project area is described below.

Federal

The USEPA oversees state and local implementation of federal Clean Air Act requirements. They set emission standards for many of the mobile sources, such as new on-road motor vehicles, including transport trucks that are sold outside of California. The USEPA also sets emission standards for various classes of new off-road mobile sources, including locomotives that are sold throughout the country. The USEPA is also working with the International Maritime Organization to begin the process of setting international standards to lower emissions from new marine vessels that operate under that organization's protocol.

In 1999 the USEPA issued a final rule to reduce emissions from new large marine diesel engines. These emission reduction requirements take place from 2004 through 2007. This program will reduce emissions of NO_x (an ozone precursor) and PM_{10} generated by marine diesel engines larger than 50 horsepower. This rule would affect new ferry vessels and vessels with engines replaced after 2004.

State and Local

Under California law, the responsibility to carry out air pollution control programs is split between the CARB and local or regional air pollution control agencies. In the project area, the BAAQMD regulates stationary sources. The BAAQMD can require stationary sources to obtain permits, as well as impose emission standards, set fuel or material specifications, or establish operational limits to reduce air emissions.

The CARB shares the regulation of mobile sources with the USEPA. The CARB has the authority to set emission standards for on-road motor vehicles and for some classes of off-road mobile sources that are sold in California. The emission standards with the largest effect in the project area are those set for automobile, light- and medium-duty truck, California heavy-duty truck, and other diesel engines. The CARB also regulates vehicle fuels, with the intent to reduce emissions. The CARB has set emission reduction performance requirements for gasoline (California reformulated gasoline) and has limited the sulfur and aromatic content of diesel fuel to make it burn more cleanly. The CARB also sets the standards used to pass or fail vehicles in the smog check and heavy-duty truck inspection programs.

The federal, state, and regional control programs described above are directed primarily toward criteria pollutants—the pollutants for which ambient air quality standards exist. Programs are also in place to reduce public exposure to other pollutants, such as those that present a potential hazard to public health. These pollutants are called "hazardous air pollutants" (HAPs) in federal law and "toxic air contaminants" (TACs) under California law. TACs are pollutants "which may cause or contribute to an increase in mortality or in serious illness, or which may pose a present or potential hazard to human health" (BAAQMD 1997). The federal and state programs are currently directed toward reducing TAC emissions from stationary sources. Unlike criteria pollutants, TACs have no ambient standards; however, BAAQMD regulates new or expanding stationary sources of TACs.

Transportation Conformity

Transportation projects receiving federal funding must be found to conform with the current State Implementation Plan (SIP). The SIP is a plan that describes how a state will reduce air emissions such that ambient pollutant concentrations will decrease and the state will achieve attainment of ambient air quality standards. Each region in the state submits its emissions budgets and strategies for reducing air emissions to the California Air Resources Board (CARB), which prepares the SIP.

Transportation planning is coordinated with this "conformity" process. The Regional Transportation Plan (RTP) contains a long-range plan for transportation projects and emissions budgets for those projects. The RTP must conform to the SIP by having an emissions budget from its planned projects that does not exceed the emissions budget in the SIP. For an individual project to conform to the SIP, it must be contained in a conforming RTP.

The WTA program must eventually be included in a conforming RTP if it is found to conform to the SIP. The legislation that created the WTA and mandated preparation of this EIR and IOP (refer to Section 1) did not fund specific projects. As funding is identified for water transit expansion, further review (including air quality evaluations) will have to take place to advance a more defined set of the projects to the RTP.

National and State Ambient Air Quality Standards

Criteria Pollutants

National and state ambient air quality standards have been established for CO, O_3, NO_2, SO_2, and particulate matter 10 micrometers or less in diameter (PM_{10} and $PM_{2.5}$).[1] Ambient standards specify the concentration of these "criteria pollutants" that the public can be exposed to without adverse health effects. Since individuals vary widely in their sensitivity to air pollutants, standards are set to protect more sensitive populations (i.e., children and the elderly). National and state standards are reviewed and updated periodically based on new health studies. California ambient standards tend to be at least as protective as national ambient standards and are often more stringent. National and state ambient air quality standards are listed in Table 3.6.3. The criteria pollutants and associated adverse health effects are summarized below:

- **Carbon Monoxide.** Exposure to high concentrations of CO reduces the oxygen-carrying capacity of the blood, and therefore can cause dizziness and fatigue, impair central nervous system functions, and induce angina in persons with serious heart disease. The most

[1] Other pollutants (e.g., lead) also have ambient standards, but they are not discussed in this document because emissions of these pollutants from cars and marine vessels are expected to be minimal.

important sources of high CO levels in the ambient air are passenger cars, light-duty trucks, and residential wood burning.

- **Ozone.** While O_3 serves a beneficial purpose in the upper atmosphere (stratosphere) by reducing potentially harmful ultraviolet radiation, when it reaches elevated concentrations in the lower atmosphere it can be harmful to the human respiratory system and to sensitive species of plants. O_3 concentrations build to peak levels during periods of light winds, bright sunshine, and high temperatures. Short-term O_3 exposure can reduce lung function in children, make persons susceptible to respiratory infection, and produce symptoms that cause people to seek medical treatment for respiratory distress. Long-term exposure can impair lung defense mechanisms, and lead to emphysema and chronic bronchitis. Sensitivity to O_3 varies among individuals. About 20 percent of the population is sensitive to O_3, with exercising children being particularly vulnerable. O_3 is formed in the atmosphere by a complex series of photochemical reactions that involve "ozone precursors." Ozone precursors are categorized into two families of pollutants: oxides of nitrogen (NO_x) and reactive organic gases (ROGs). NO_x and ROGs are emitted from a variety of stationary and mobile sources. While NO_x is considered a criteria pollutant, ROGs are not in this category, but are included in this discussion as O_3 precursors.
- **Nitrogen Dioxide.** The major health effect from exposure to high levels of NO_2 is the risk of acute and chronic respiratory disease. NO_2 is a combustion by-product, but it can also form in the atmosphere by chemical reaction. It is a reddish-brown gas often observed during the same conditions that produce high levels of O_3. NO_2 is a precursor to O_3.
- **Sulfur Dioxide.** The major health effect from exposure to SO_2 is acute and chronic respiratory disease. Asthmatics are particularly sensitive. SO_2 can also react with water in the atmosphere to form acids (or so-called "acid rain"), which can cause damage to vegetation and man-made materials. The main source of SO_2 is the combustion of fuels containing sulfur, chiefly coal and fuel oil. California has very low levels of SO_2 because most large combustion sources burn natural gas, which contains only trace quantities of sulfur. California regulations also limit the sulfur content of gasoline and diesel fuel.
- **Particulate Matter.** Particulate matter is regulated as PM_{10} (particulate matter less than 10 micrometers in diameter). More recently it has been subdivided into coarse and fine fractions, with particulate matter less than 2.5 micrometers in diameter ($PM_{2.5}$) constituting the fine fraction. The health effects from long-term exposure to high concentrations of particulate matter are increased risk of chronic respiratory disease like asthma and altered lung function in children. Short-term exposure to high levels of particulate matter has been shown to increase the number of people seeking medical treatment for respiratory distress, and to increase mortality among those with severe respiratory problems. Particulate matter also results in reduced visibility. Ambient particulate matter has many sources. It is emitted directly by combustion sources like motor vehicles, industrial facilities, and residential wood burning, and in the form of dust from ground-disturbing activities such as construction and farming. It also forms in the atmosphere from the chemical reaction of precursor gases.

For planning purposes, regional areas like the San Francisco Bay Area are given an air quality status "label" by the federal and state regulatory agencies. Areas with monitored pollutant concentrations that are lower than ambient air quality standards are designated as "attainment areas" on a pollutant-by-pollutant basis. When monitored concentrations exceed ambient standards (the national and state standards are presented in Table 3.6.3), areas are designated as "nonattainment areas." An area that recently exceeded ambient standards, but is now in attainment, is designated as a "maintenance area." Nonattainment areas are further classified based on the severity and persistence of the air quality problem as "moderate" "severe" or "serious." Classifications determine the applicability and minimum stringency of pollution control requirements. In general, the more serious the air quality classification, the more stringent are the control requirements that must be contained in the regional air quality plans (see discussion above of the SIP and CAP).

Toxic Air Contaminants

As noted above, no ambient air quality standards exist for TACs. Many pollutants are identified as TACs because of their potential to increase the risk of developing cancer. For TACs that are known or suspected carcinogens, the CARB has consistently found that there are no levels or thresholds below which exposure is risk free. Individual TACs vary greatly in the risk they present; at a given level of exposure one TAC may pose a hazard that is many times greater than another. Where data are sufficient to do so, a "unit risk factor" can be developed for cancer risk. The unit risk factor expresses assumed risk to a hypothetical population, the estimated number of individuals in a million who may develop cancer as the result of continuous, lifetime (70-year) exposure to 1 microgram per cubic meter ($\mu g/m^3$) of the TAC. Unit risk factors provide a standard that can be used to establish regulatory thresholds for permitting purposes. However, this is not a measure of actual health risk because actual populations do not experience the extent and duration of exposure that the hypothetical population is assumed to experience. For noncancer health effects, a similar factor called a Hazard Index is used.

New Air Quality Standards

In July 1997, the USEPA adopted a number of changes to national ambient air quality standards for O_3 and particulate matter (USEPA 1997a,b,c,d). These new standards are discussed separately because from a regulatory standpoint they have a different status than previously adopted standards. None of the new standards is in full effect at this time because the data and information needed to develop control programs will require several years to collect.

Ozone

The USEPA adopted a new 8-hour standard that will eventually replace the existing 1-hour standard. For particulate matter, the USEPA adopted a 24-hour standard and an annual average standard for the fine fraction of particulate matter, $PM_{2.5}$ (USEPA 1997a). The USEPA retained the existing PM_{10} standards, but slightly changed the form of the 24-hour standard (USEPA 1997b).

The new O_3 standard was adopted after the USEPA found that the previous national 1-hour standard of 0.12 part per million (ppm) did not adequately protect the public from adverse health effects. Of particular concern is evidence that exposure to O_3 levels below 0.12 ppm is associated with increased hospital admissions for people with respiratory ailments, including asthma, and with reductions in lung function in children and adults who are active outdoors (USEPA 1997c). Evidence also exists that long-term exposure can cause repeated inflammation of the lung, impairment of lung defense mechanisms, and irreversible damage in lung structure, leading to premature aging of the lungs and chronic respiratory illnesses (USEPA 1997c).

Particulate Matter

The USEPA's review of its particulate standard showed "coarse" respirable particles (2.5 to 10 micrometers in size) can be inhaled and aggravate health problems such as asthma. Therefore, the USEPA chose to retain PM_{10} standards. The USEPA also reviewed studies providing epidemiological evidence that exposure to particulate matter at levels well below the existing PM_{10} standards were associated with increased hospital admissions and premature mortality (USEPA 1997b). In addition, the USEPA found that finer particles (less than 2.5 micrometers in diameter) can penetrate more deeply into lungs, and are more likely than coarser particles to contribute to more severe health effects (USEPA 1997b). Therefore, the USEPA established new standards for $PM_{2.5}$.

The USEPA has not yet designated any areas of the country as being in attainment or nonattainment for the new O_3 and $PM_{2.5}$ standards. In May 1999, a federal appeals court remanded both the new ozone and the new particulate ambient standards back to the USEPA for failing to articulate adequately its authority to set the standards. The new standard was upheld by the federal D.C. Circuit Court of Appeals on February 27, 2001. The CARB is currently in the process of evaluating the attainment status of the state's air basins with respect to the USEPA's $PM_{2.5}$ standards.

Revision of Existing Standards

California Senate Bill 25, Escutia 1999, established the Children's Environmental Health Protection Act and commissioned a report to assess health-based ambient air quality standards. This report concluded that the standards for particulate matter, ozone, and nitrogen dioxide are inadequate to protect public health. The standards for particulate matter were found to have the highest priority for revision (CARB 2000). The staff of the CARB will present a final particulate matter standards report, containing recommendations for revising particulate matter standards, to the CARB for review in May 2002. Similar reports will be written by the CARB staff for ozone and nitrogen dioxide standards are tentatively scheduled to be presented to the CARB on December 2003 and December 2004, respectively. The CARB staff is also investigating the establishment of a California standard for $PM_{2.5}$.

Diesel Particulate Matter

On August 27, 1998, the CARB formally identified particulate matter emitted by diesel-fueled engines as a TAC. Diesel-fueled engines emit TACs in both gaseous and particulate forms. The particles emitted are coated with chemicals, many of which have been identified by the USEPA as HAPs and by the CARB as TACs. Since by weight, the vast majority of diesel exhaust particles are very small (94 percent of their combined mass consists of particles less than 2.5 micrometers in diameter), both the particles and their coating of TACs are inhaled into the lungs. While the gaseous portion of diesel exhaust also contains TACs, the CARB's August action was specific to diesel particulate emissions which, according to supporting CARB studies, represent 50 to 90 percent of the mutagenicity of diesel exhaust (CARB 1998). The CARB action was taken at the end of a lengthy process that considered dozens of health studies, extensive analysis of health effects and exposure data, and public input collected over the last 9 years. The CARB's Scientific Advisory Committee has recommended a unit risk factor of 300 in a million for diesel particulate.[2] This action will lead to additional control by CARB of diesel emissions in coming years. The USEPA has also begun an evaluation of both the cancer and noncancer health effects of diesel exhaust.

3.6.2 Impacts and Mitigation

Impact Assessment Methodology

This evaluation addresses impacts from both vehicle and ferry emissions sources for the Proposed Project and the No Project Alternative. The evaluation is based on a calculation of the total emissions from all modes of travel (ferry, car, bus) that might be affected by implementation of the Proposed Project. The different travel modes generate different rates of emissions.

The overall impacts from the system (i.e., ferries, passenger cars, and buses) were evaluated to obtain a regional, cumulative emissions estimate for the Proposed Project and the No Project Alternative. For the purposes of evaluating the significance of impacts, the estimated emissions from all travel modes were summed for each alternative. The total emissions were then compared between the Proposed Project and the No Project Alternative to determine whether the Proposed Project would result in an overall decrease or increase in emissions. This is discussed in more detail under “Significance Criteria” below. This comparative evaluation was done instead of examining the emissions from each individual source alone and comparing them to a threshold level.

Ferry and vehicle emissions are presented for criteria pollutants, which include oxides of nitrogen (NO_x), reactive organic gases (ROG), carbon monoxide (CO), sulfur dioxide (SO_2), and particulate matter (PM_{10}).

Vehicle Emissions

Vehicle emissions (passenger cars and buses) were calculated using forecasts of total vehicle miles traveled for the year 2025. Ferry emissions were calculated using the projected schedule of routes and frequencies for that same year. The emissions calculations were performed for the Proposed Project and the No Project Alternative. The year 2025 is consistent with the Metropolitan Transportation Commission (MTC) travel forecast model that was used as a basis for the vehicle forecasts.

The California Air Resources Board (CARB) model "San Francisco Bay Area EMFAC 2000" (EMFAC2000) was used to calculate regional emissions based on vehicle miles traveled (VMTs) for each alternative. At the time of the modeling, EMFAC2000 was the latest in the series of California emission factor models that calculate emissions of CO, NO_x, ROG, and PM_{10} for current and future years. This model is accepted by the CARB and most local air pollution control districts for analysis of motor vehicle emissions in California. The EMFAC2000 model reflects emissions decreases from motor vehicles in future years due to anticipated improvements in engine and fuel technology and retirement of older vehicles from the fleet. For example, year 2025 passenger car emissions of ROG, CO, and NO_x are anticipated to decrease from 1.5, 10.8,

[2] The Scientific Review Committee findings are Attachment A to CARB Resolution 98-35, August 27, 1998.

and 1.0 grams per mile, respectively, in 2002 to 0.3, 1.5, and 0.2 grams per mile, respectively, in 2025. PM_{10} emissions are not expected to change significantly.

In addition, emissions from cold-starts based on trip purpose were calculated for each alternative, using factors from the EMFAC2000 model. The cold-start emissions were incorporated into the daily total emissions calculated for passenger vehicles. Cold-starts occur after a vehicle has been off for more than four hours, and cold-start emissions are important because they represent a major portion of the total trip emissions for a vehicle. The traffic analysis included information on the number of daily trips based on the purpose of the trip (e.g. shopping, work, recreation, etc.). All home-based work trips were assumed to be in cold-start mode (i.e., the vehicle would have been off for more than four hours). Cold-start emissions were calculated by multiplying the number of cold-start trips by an emission factor of pounds of pollutant per cold-start. This calculation was done for both the morning and evening commutes to yield a total pounds-per-day emissions from cold-starts.

Ferry Emissions

Ferry emissions were estimated assuming that USEPA Tier 2 standards would be in effect. These standards require that new diesel engines manufactured after the year 2007 meet lower emissions requirements than current diesel engines. The assumption was that all ferries in the year 2025, with or without the project, would have engines that would at least meet the USEPA Tier 2 standards. With the Proposed Project, the ferries would also have control devices to reduce the levels of NO_x and PM_{10}. Selective catalytic reduction (SCR) and particulate traps would reduce NO_x emissions to 10 percent of Tier 2 levels and PM_{10} emissions to 5 percent of Tier 2 levels. Therefore, for the Proposed Project emissions were assumed to be at least 85% below Tier 2 standards. These standards are included in the WTA Vessel Specifications.

The WTA evaluation considered a range of vessel types, fuels, and propulsion systems (JJMA 2002) that could be potentially used on the projected service routes. These different technologies result in various levels of emissions of NO_x, ROG, CO, SO_2, and PM_{10}. Some examples of the technologies include diesel engines fueled with natural gas, gas turbines fueled with diesel or natural gas, and diesel engines fueled with diesel with SCR and particulate traps. The WTA's evaluation of vessel technology involved a comprehensive investigation of emerging technologies and their relative suitability to Bay Area passenger service. Section 2.5 (Vessel Technology) summarizes the evaluation that was performed in coordination with the "Clean Marine Ad Hoc" Work Group. The use of SCR and particulate traps was found to currently be the most effective combination of control measures.

The ferry emissions for the WTA program were developed for the projected year 2025 using a combination of site-specific data, readily available emission factors, and current and projected operating conditions. Existing data for each ferry system were reviewed and analyzed. Future baseline emissions were based upon peak and off-peak conditions, where peak hours represented 6 hours per day and non-peak hours represented 6.5 hours per day. Baseline emissions for each period were calculated by multiplying together the total travel time from all ferries, the average horsepower rating, and the emission factors for marine diesels. Total travel time was computed for both peak and non-peak periods by: (1) dividing the total time within each period by the frequency of visits by each ferry to obtain the number of trips; (2) multiplying the number of trips for each ferry by the estimated time per trip; and (3) summing the trip times for all ferries.

For the No Project Alternative, average power outputs were assumed for each route, based on the current ferries in use on these routes. Characteristics of the current ferries are available in the working document, *New Technologies and Alternative Fuels*, prepared for the WTA (JJMA 2002). For the Proposed Project, two ferry vessel types were assumed, which is consistent with the Implementation and Operations Plan (IOP). One type would be 350-passenger with a maximum power output of 8,000 horsepower (5,966 kW). The other would be 149-passenger with a maximum power output of 2,900 horsepower (2,163 kW) (Hutchison 2002).

For the Larkspur ferry route, only the newer catamaran vessels used on this route were assumed for the No Project Alternative. The monohull boats used on this route were constructed in the 1970s and will be taken out of commission by 2025.

The ferry system schedules are presented in Appendix AIR-A. Tables 3.6.4 through 3.6.6 present the data used for the ferry emissions calculations: ferry power rating, ferry power usage, hours of operation, pollutant emission factors, and calculated emissions in pounds per day.

The significance criteria used for this study and a discussion of each of the impacts follow.

3.6.2.1 Significance Criteria

The significance criterion used in this EIR is as follows:

- Higher cumulative emissions from all travel modes for the Proposed Project than for the No Project Alternative would be considered a significant impact.

As applied to the WTA program, this involved calculation of total emissions by criteria pollutant, for each mode of travel: ferry, bus, and passenger car. These were compared to the No Project Alternative to determine whether the Proposed Project would result in overall higher or lower regional emissions. This criterion was used because it allows comparison of alternatives on a regional scale, consistent with the WTA program. This type of significance criterion was used in the 2001 Regional Transportation Plan (RTP) EIR issued by the Metropolitan Transportation Commission (MTC 2001).

3.6.2.2 Impacts

Impact A-1 **Regional cumulative emissions of NO_x, PM_{10}, CO, SO_2, CO_2, and ROG could increase as a result of the implementation of the Proposed Project.**

The evaluation of significance is based on the sum of vehicle (passenger car and shuttle bus) emissions plus ferry emissions for the Proposed Project versus vehicle emissions plus ferry emissions for the No Project Alternative. If the emissions sum of vehicles plus ferries for the Proposed Project is less than the emissions sum of vehicles plus ferries for the No Project Alternative, the impact would be considered less than significant. If, however, the sum of vehicles plus ferry emissions from the Proposed Project is greater than the sum of passenger car plus ferry emissions from the No Project Alternative, then the impact would be considered significant. This comparison was done for each of the pollutants.

The Bay Area emissions inventory is summarized in Table 3.6.7. Table 3.6.8 summarizes emissions from ferries, passenger cars, and shuttle buses for the Proposed Project and the No

Project Alternative. Tables in Appendix AIR-A present route information (frequencies, number of vessels, sailing times) for each alternative, as well as the per-route emissions.

Regional cumulative emissions of NO_x, PM_{10}, and CO from passenger cars, buses, and ferries would decrease with the Proposed Project below those for the No Project Alternative. Emissions of SO_2 and ROG would increase with the Proposed Project, by 0.3 percent and 0.02 percent respectively. The sum of ROG plus NO_x emissions (ozone precursors) would be less with the Proposed Project than for the No Project Alternative.

Greenhouse gas emissions include carbon dioxide (CO_2), methane, and chlorofluorocarbons. The predominant greenhouse gas from fossil fuel combustion is CO_2. Operation of the Proposed Project would result in an increase in CO_2 emissions.

CO_2 is not a priority pollutant and currently, there are no State or Federal standards that apply to the emissions of greenhouse gases. Therefore, there is no standard of significance against which to compare emissions increases.

CO_2 emissions from ferries were calculated using fuel consumption rates, hours of usage, and the amount of carbon in diesel fuel, which when combusted converts to CO_2. In addition, there would be a decrease in passenger vehicle miles traveled due to the proposed project. The decrease in CO_2 emissions from passenger cars was calculated using the decrease in vehicle miles traveled and the CO_2 emission factor from EMFAC2000.

The increase/decrease of emissions of various constituents for the Proposed Project (compared to the No Project Alternative) are summarized below:

Constituent	Proposed Project Emission Compared to No Project
NO_x	Net Decrease
SO_2	0.3% Increase
PM_{10}	Net Decrease
CO	Net Decrease
CO_2	Net Increase
ROG	0.02% Increase

In conclusion, small region-wide increases in SO_2 and ROG would remain with implementation of the Proposed Project. ROG is primarily of concern because it is one of the precursors of ozone. However, as noted above, the Proposed Project would result in a net decrease in both ozone precursors (NO_x and ROG combined). The Proposed Project would result in a net increase in CO_2 emissions. The remaining pollutant of concern, SO_2, is currently in attainment in the Bay Area. However, as the analysis indicates a small region-wide increase for the Proposed Project, this impact is identified as potentially significant.

Summary of Impact A-1

- Proposed Project emissions from vehicles (passenger cars and buses) plus ferries would be less than those for the No Project Alternative for NO_x, PM_{10}, and CO, resulting in a less than significant impact.
- Proposed Project emissions from vehicles plus ferries would be greater than those for the No Project Alternative for SO_2 and ROG, resulting in a significant impact.
- The sum of ozone precursors ROG plus NO_x would be less with the Proposed Project than with the No Project Alternative.
- There would be a net increase in CO_2 from the Proposed Project, resulting in a significant impact.

Future engine fuel and/or pollution control technologies that are not at present commonly used could have an effect on future emission levels. One such engine technology is the use of fuel cells instead of combustion of fossil fuels. While the 2025 emissions are based on current or 2007 technology, it is expected that by 2025, other technologies will be available and cost effective and will further reduce emissions. Emissions could be reduced or eliminated through use of these engine technologies..

The WTA is planning to continue investigating the feasibility and applicability of using energy sources other than fossil fuels and different engine technologies. One promising technology is the use of fuel cells. The WTA has investigated the use of alternative fuels for ferries in: *New Technologies and Alternative Fuels Working Document* (JJMA 2002). Alternative energy sources and engine technologies will become available and will be incorporated as they become feasible and cost-effective. However, as future technology cannot be predicted, this impact remains potentially significant

Impact A-2 **Motor vehicles leaving ferry terminals during the evening commute period would produce cold-start emissions that could lead to localized violations of the short-term carbon monoxide standard.**

As vehicles in a parking area leave a ferry terminal, there could be a concentration of cold-start emissions at those locations, instead of the emissions being dispersed throughout the Bay Area at people's homes, as during the morning commute. This "clustering" of cold-start emissions during the evening commute hour could produce a violation of the one-hour carbon monoxide standard at locations near the terminal parking lots. This is a potentially significant impact.

Summary of Impact A-2

- The Proposed Project would result in cold-start emissions during the evening commute period that could lead to a violation of the short-term carbon monoxide standard, leading to a potentially significant impact.

Mitigation A-2.1: Cold-start emissions shall be reduced by encouraging non-drive access at the ferry terminals. Techniques for encouraging non-drive access could include fees for parking, provision of preferential parking for carpools and vanpools, comprehensive shuttle access, land use scenarios that encourage non-drive access, and encouraging bicycle and pedestrian access. In addition, feeder shuttle buses could be equipped with zero emission or ultra-low emission engines.

Impact After Mitigation: The effectiveness of Mitigation A-2 cannot be quantified, as the design and exact number of ferry terminals are not defined at this time. Therefore, this impact remains potentially significant.

Impact A-3 **Ferries would emit toxic pollutants in the exhaust in the form of particulate matter from the combustion of diesel fuel.**

In 1998, the CARB formally identified particulate matter emitted by diesel-fueled engines as a toxic air contaminant (TAC). Diesel engines emit TACs in both gaseous and particulate forms. The particles emitted by diesel engines are coated with chemicals, many of which have been identified by the USEPA as hazardous air pollutants (HAPs), and by the CARB as TACs. The vast majority of diesel exhaust particles are very small (94 percent of their combined mass consists of particles less than 2.5 microns in diameter), and both the particles and their coating of TACs can be inhaled into the lungs. While the gaseous portion of diesel exhaust also contains TACs, the CARB's 1998 action was specific to diesel particulate emissions, which, according to supporting CARB studies, represent 50 to 90 percent of the mutagenicity of diesel exhaust (CARB 1998).

Diesel particulate emissions were calculated as described above under "Ferry Emissions." For the purposes of characterizing potential air toxic impacts, the entire mass of estimated particulate matter emissions from diesel engines is considered toxic.

Since the majority of diesel particulate matter is in the fine fraction (less than 2.5 micrometers in diameter, or $PM_{2.5}$), it can remain airborne for several days. The area of impact will depend on meteorological conditions. If light to moderate wind conditions prevail in the project area, diesel particulate is likely to be dispersed widely and have its impact on a regional scale. During periods of very light wind speeds, low inversion heights, and atmospheric stability, diesel particulates may remain in the project area and have a relatively larger local impact. Because health risks relate to long-term, lifetime exposure, it is long-term average exposure to diesel particulate that is of most concern. Due to the prevailing meteorological conditions in the project area and the distance of the closest residential areas to the emissions sources, particulates in the area of local impact are expected to be well dispersed.

Emissions from the Proposed Project would be less than those for the No Project Alternative, resulting in a less than significant impact.

Summary of Impact A-3

- Proposed Project $PM_{2.5}$ emissions from ferries would be less than those for the No Project Alternative, resulting in a less than significant impact.

Impact A-4 **Air pollutants would be deposited in the Bay, which could increase the levels of nitrates and sulfates in the water.**

A fraction of the airborne pollutant emissions from ferry fuel combustion would be deposited on the Bay. The rest would be transported over land by winds. The amount of pollutants deposited on land versus on the Bay depends on several factors including the proximity of the ferry to land, the distance the ferry travels over water, the amount of wind transporting the pollutants, and the location of the exhaust port on the ferry.

Emissions of nitrogen and sulfur oxides would be deposited as nitrates and sulfates. A portion of the particulate matter in the diesel exhaust, mostly in the fine fraction ($PM_{2.5}$), would also be deposited.

The level of nitrates would decrease with the Proposed Project below those for the No Project Alternative. However, the level of sulfates would increase with the Proposed Project.

Summary of Impact A-4

- Deposition of nitrates on the Bay from ferry emissions would decrease with the Proposed Project, resulting in a less than significant impact.
- Deposition of sulfates on the Bay from ferry emissions would increase under the Proposed Project, leading to a potentially significant impact.

Mitigation A-4.1: Use of a fuel technology that lowers SO_2 emissions would reduce sulfate emissions and subsequent deposition.

Impact After Mitigation: The effectiveness of such mitigation cannot be reasonably quantified, due to the variability of the factors affecting deposition levels. This impact would remain potentially significant.

Impact A-5 **Construction of ferry terminals would create emissions of fugitive dust from excavation and grading, and emissions of ROG, NO_x, CO, SO_2, and PM_{10} from construction equipment exhaust.**

Construction-related pollutant emissions have not been quantified because the specific plans for each terminal are not defined at this time. Furthermore, the BAAQMD does not require quantification of construction emissions, but does require a discussion of construction mitigation measures. As for any construction project, there can be occasional concentrations of emissions from construction activities that temporarily approach or exceed air quality standards.

Summary of Impact A-5

- Construction emission impacts under the Proposed Project could be potentially significant.

Mitigation A-5.1: The project proponent(s) shall implement the mitigation measures contained in the BAAQMD CEQA Guidelines (BAAQMD 1999) to control fugitive dust emissions from construction activities. These measures include activities such as watering and covering exposed soil surfaces to minimize dust emissions.

Mitigation A-5.2: Measures to reduce emissions from vehicles and heavy equipment shall include: 1) Use alternative fueled construction equipment when possible; 2) Minimize idling time, for example, 5-minute maximum; 3) Properly maintain equipment; and 4) Limit the hours of operation of heavy-duty equipment and/or the amount of equipment in use.

Impact After Mitigation: The BAAQMD considers construction impacts to be less than significant if the recommended mitigation measures are used. Each individual ferry expansion project should employ the current BAAQMD-recommended construction emissions control measures to reduce impacts.

Impact A-6 **The Proposed Project could result in concentrations of nitrogen dioxide and particulate matter above state and federal standards at the Ferry Building.**

Based on the independent analysis by the BAAQMD (Appendix AIR-B), the increased ferry service to and from the San Francisco Ferry Building could add between 6 and 55 percent to the existing concentration values of nitrogen dioxide and particulate matter. The magnitude of the increases would depend on vessel design (particularly the location of the vessel exhaust in relation to passenger and public areas) and dockside idle time. Localized pollutant concentrations are highly dependent upon the height of the engine exhaust pipes.

Summary of Impact A-6

- Under the Proposed Project, local concentrations of nitrogen dioxide and particulate matter could exceed state and federal standards at the Ferry Building. This would be a significant impact.

Mitigation A-6.1: Engine exhaust pipes shall be located sufficiently high to reduce localized impacts. During their analysis, BAAQMD staff hypothesized that the location of the exhaust points was an important factor in local concentrations of air pollutants. This was tested with a model scenario wherein all future vessels would have exhaust heights at 20 feet above the waterline.

While the BAAQMD's choice of modeling the exhaust location at 20 feet above the waterline was somewhat arbitrary, the results indicate that this height would reduce the potential for unhealthy concentrations of air pollutants[3] (Murphy 2003). Therefore, exhaust points shall be located at least 20 feet above the waterline unless future modeling indicates that lower heights would reduce concentrations of pollutants to acceptable levels.

Mitigation A-6.2: Project proponents shall minimize dockside idling time at the Ferry Building.

Impact After Mitigation: Impact A-6 would be less than significant after implementation of Mitigations A-6.1 and A-6.2.

Impact A-7 **The Proposed Project could result in increases of pollutants from ferry exhaust deposited directly into the Bay.**

The amount of pollutants from exhaust that would be deposited in the Bay depends upon the height of the exhaust port. If the exhaust ports are located high, the predominant wind patterns in the Bay Area would transport much of the pollutants emitted from the ferries over land such that only a small amount is deposited into the Bay. However, if the exhaust ports on the new ferries are close to the water, the turbulent eddies in the boat wake could capture some of the emissions, resulting in an increased amount of pollutants deposited into the Bay.

[3] BAAQMD notes, however, that this result may only be valid if ferry service equals or is less than the frequency proposed in the December 2002 IOP.

Summary of Impact A-7

- Under the Proposed Project, pollutants from exhaust could be deposited in the Bay due to turbulent eddies in the vessel wake if the exhaust ports are located near the waterline. This could be a potentially significant impact.

Mitigation A-7.1: Implement Mitigation A.6-1, which is to locate exhaust pipes at least 20 feet above the waterline.

Impact After Mitigation: Impact A-7 would be less than significant after implementation of Mitigation A-7.1.

Impact A-8 **Equipment and boats used for dredging of the harbor at the Hercules/Rodeo terminal would emit criteria air pollutants. These emissions would exceed the significance thresholds of 80 pounds per day for NO_x, ROG, and PM_{10} listed in the BAAQMD CEQA Guidelines.**

Air pollutant emissions associated with dredging activities were estimated assuming that just less than 50,000 cubic yards (yd^3) of material would need to be dredged. Due to the nature of the project, a number of assumptions were made in order to estimate the air emissions. It was assumed that the dredging would occur on a barge with a capacity of 4,000 yd^3 of dredge material. One 800 hp engine was assumed to power the dredging operation and one tugboat was assumed to be required to move the barge to the release point in the Bay. There are a number of areas in the Bay where dredge material can be dumped. It was assumed that there would be a four hour round trip between the dredging point and the release point. The entire process was assumed to take twelve and a half 10-hour days. One round trip to the release point would be completed each day. The emissions and emission factors used are summarized in Table 3.6.9.

Summary of Impact A-8

- Dredging for the Proposed Project would emit criteria air pollutants. These emissions would exceed the significance thresholds of 80 pounds per day for NO_x, ROG, and PM_{10} listed in the BAAQMD CEQA Guidelines. The exceedences would occur for approximately 12 days every 3 to 6 years. This is a potentially significant impact.

Mitigation A-8.1: Minimize required dredging for construction and maintenance, both in terms of dredge volume and maintenance dredging interval.

Mitigation A-8.2: Utilize dredging contractors with the best available emission controls on their equipment.

Impact After Mitigation: With implementation of Mitigations A-8.1 and A-8.2, Impact A-8 would be less than significant.

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Table 3.6.1

Ambient Air Quality (1997-2000)

	1997	1998	1999	2000
Ambient Ozone levels (ppm)				
Concord-2975 Treat Blvd.				
Highest 1-hour Concentration	0.099	0.147	0.156	0.138
Measured days>State standard	2	13	8	2
Measured days>National standard	0	2	2	1
Highest 8-hour Concentration	0.081	0.109	0.122	0.094
Measured days>National standard	0	6	6	1
Livermore-Old 1st Street				
Highest 1-hour Concentration	0.114	0.146	0.146	0.137
Measured days>State standard	3	21	14	5
Measured days>National standard	0	6	2	2
Highest 8-hour Concentration	0.084	0.11	0.116	0.11
Measured days>National standard	0	10	5	2
Oakland-Alice Street				
Highest 1-hour Concentration	0.079	0.056	0.081	0.072
Measured days>State standard	0	0	0	0
Measured days>National standard	0	0	0	0
percent year coverage	99	79	98	98
Highest 8-hour Concentration	0.062	0.045	0.059	0.048
Measured days>National standard	0	0	0	0
Pittsburg-10th Street				
Highest 1-hour Concentration	0.087	0.097	0.098	0.107
Measured days>State standard	0	4	2	1
Measured days>National standard	0	0	0	0
Highest 8-hour Concentration	0.067	0.089	0.087	0.08
Measured days>National standard	0	1	1	0
San Francisco-Arkansas Street				
Highest 1-hour Concentration	0.068	0.053	0.079	0.058
Measured days>State standard	0	0	0	0
Measured days>National standard	0	0	0	0
Highest 8-hour Concentration	0.059	0.046	0.057	0.043
Measured days>National standard	0	0	0	0
San Jose-4th Street				
Highest 1-hour Concentration	0.094	0.147	0.109	0.073
Measured days>State standard	0	4	3	0
Measured days>National standard	0	1	0	0
Highest 8-hour Concentration	0.068	0.091	0.084	0.061
Measured days>National standard	0	1	0	0
San Rafael-4th Street				
Highest 1-hour Concentration	0.106	0.074	0.102	0.071
Measured days>State standard	1	0	2	0
Measured days>National standard	0	0	0	0
Highest 8-hour Concentration	0.073	0.058	0.08	0.058
Measured days>National standard	0	0	0	0

Table 3.6.1 - Continued

Ambient Air Quality (1997-2000)

	1997	1998	1999	2000
Ambient CO levels (ppm)				
Concord-2975 Treat Blvd.				
Highest 8-hour Concentration	3.03	3.75	3.11	2.7
Livermore-Old 1st Street				
Highest 8-hour Concentration	2.53	2.36	2.91	--
Oakland-Alice Street				
Highest 8-hour Concentration	3.58	4.58	5.23	3.43
Pittsburg-10th Street				
Highest 8-hour Concentration	3.19	2.65	3.27	2.68
San Francisco-Arkansas Street				
Highest 8-hour Concentration	3.45	3.96	3.68	3.19
San Jose-4th Street				
Highest 8-hour Concentration	6.11	6.27	6.28	7.03
San Rafael-4th Street				
Highest 8-hour Concentration	2.64	3.3	2.92	2.26
Ambient NO_2 levels (ppm)				
Concord-2975 Treat Blvd.				
Highest 1-hour Concentration	0.076	0.066	0.079	0.074
Annual Average	0.016	0.016	0.018	0.016
Livermore-Old 1st Street				
Highest 1-hour Concentration	0.082	0.071	0.094	0.073
Annual Average	0.018	0.019	0.02	0.017
Oakland-Alice Street				
Highest 1-hour Concentration	--	--	--	--
Annual Average	--	--	--	--
Pittsburg-10th Street				
Highest 1-hour Concentration	0.07	0.064	0.087	0.054
Annual Average	0.014	0.014	0.015	0.013
San Francisco-Arkansas Street				
Highest 1-hour Concentration	0.067	0.08	0.103	0.074
Annual Average	0.02	0.02	0.021	0.02
San Jose-4th Street				
Highest 1-hour Concentration	0.118	0.083	0.128	0.114
Annual Average	0.025	0.025	0.026	0.025
San Rafael-4th Street				
Highest 1-hour Concentration	0.067	0.062	0.087	0.057
Annual Average	0.016	0.017	0.018	0.016
Ambient SO_2 levels (ppm)				
Concord-2975 Treat Blvd.				
Highest 24-hour Concentration	0.008	0.007	0.012	0.005
Annual Average	0.001	0.002	0.002	0.002
Livermore-Old 1st Street				
Highest 24-hour Concentration	--	--	--	--
Annual Average	--	--	--	--
Oakland-Alice Street				
Highest 24-hour Concentration	--	--	--	--
Annual Average	--	--	--	--

Table 3.6.1 - Continued

Ambient Air Quality (1997-2000)

	1997	1998	1999	2000
Pittsburg-10th Street				
Highest 24-hour Concentration	0.008	0.016	0.01	0.009
Annual Average	0.002	0.003	0.002	0.002
San Francisco-Arkansas Street				
Highest 24-hour Concentration	0.007	0.005	0.007	0.008
Annual Average	0.001	0.001	0.002	0.002
San Jose-4th Street				
Highest 24-hour Concentration	--	--	--	--
Annual Average	--	--	--	--
San Rafael-4th Street				
Highest 24-hour Concentration	--	--	--	--
Annual Average	--	--	--	--
Ambient PM_{10} levels (micrograms/cubic meter)				
Concord-2975 Treat Blvd.				
Highest 24-hour Concentration	75.6	65.9	63.8	53.8
Measured days>State standard	2	1	3	1
Measured days>National standard	0	0	0	0
State annual geometric mean	17.4	16.5	18.1	16.1
National annual arithmetic mean	19.4	17.9	20.8	17.8
Livermore-Old 1st Street				
Highest 24-hour Concentration	61.6	62.3	86.6	67.5
Measured days>State standard	2	2	3	2
Measured days>National standard	0	0	0	0
State annual geometric mean	22	19.4	22.6	19.1
National annual arithmetic mean	24.3	21.3	25.6	21.2
Oakland-Alice Street				
Highest 24-hour Concentration	--	--	--	--
Measured days>State standard	--	--	--	--
Measured days>National standard	--	--	--	--
State annual geometric mean	--	--	--	--
National annual arithmetic mean	--	--	--	--
Pittsburg-10th Street				
Highest 24-hour Concentration	--	--	72	55.5
Measured days>State standard	--	--	2	1
Measured days>National standard	--	--	0	0
State annual geometric mean	--	--	20.9	13.8
National annual arithmetic mean	--	--	28.9	16.3
San Francisco-Arkansas Street				
Highest 24-hour Concentration	81	52.4	77.9	63.2
Measured days>State standard	3	1	6	2
Measured days>National standard	0	0	0	0
State annual geometric mean	22.4	20.2	22.6	21.6
National annual arithmetic mean	24.9	21.7	26.4	24

Table 3.6.1 - Continued

Ambient Air Quality (1997-2000)

	1997	1998	1999	2000
San Jose-4th Street				
Highest 24-hour Concentration	78	92	114.4	76.1
Measured days>State standard	3	3	5	7
Measured days>National standard	0	0	0	0
State annual geometric mean	23.7	22.5	25.4	23.7
National annual arithmetic mean	25.8	25	28.7	26.7
San Rafael-4th Street				
Highest 24-hour Concentration	72	52.4	75.6	39.5
Measured days>State standard	2	1	2	0
Measured days>National standard	0	0	0	0
State annual geometric mean	20.2	18.7	19.5	18.1
National annual arithmetic mean	21.9	20.1	22	19.5

Notes:

1. Data obtained from the California Air Resources Board Internet Site.
2. CO, NO_2, and SO_2 levels did not exceed state or federal standards during this period.
3. Annual data capture of PM_{10} for Pittsburg in 1999 was 52% and for San Rafael in 2000 was 88%.
4. Annual data capture of CO for Livermore in 1999 was 73% and for Oakland in 1998 was 84%.
5. Annual data capture of ozone for Oakland in 1998 was 79%.

Table 3.6.2
2000 Planning Inventory for the Bay Area

Source Category	VOC (tpd)	NO_z (tpd)
INDUSTRIAL COMMERCIAL PROCESSES		
Petroleum Refining Facilities:		
Basic Refining Processes	0.10	6.49
Wastewater (Oil-Water) Separators	3.53	--
Wastewater Treatment Facilities	0.09	--
Cooling Towers	2.35	--
Flares and Blowdown Systems	0.08	1.36
Other Refining Processes	0.54	--
Fugitives	8.93	--
Subtotal	***15.6***	***7.9***
Chemical Manufacturing Facilities:		
Sulfur Manufacturing	0.03	0.07
Coatings and Inks Manufacturing	0.70	--
Resins Manufacturing	0.02	--
Other Chemicals Manufacturing	0.74	2.20
Fugitives (all manufacturing) – Valves and Flanges	1.70	--
Subtotal	***3.2***	***2.3***
Other Industrial Commercial Processes:		
Bakeries	1.30	--
Cooking	1.07	--
Wineries	0.88	--
Other Food and Agricultural Processes	0.26	--
Metallurgical	0.04	0.01
Asphalt Concrete Plants	0.03	0.03
Glass and Related Products Manufacturing	0.02	0.87
Stone, Sand and Gravel	0.04	--
Oil Production Fields	0.05	--
Gas Production Fields	0.19	--
Waste Management	4.22	0.25
Semiconductor Manufacturing	0.78	--
Flexible and Rigid Discs Manufacturing	0.02	--
Fiberglass Products Manufacturing	0.52	--
Rubber Products Manufacturing	0.22	--
Plastic Products Manufacturing	0.72	0.03
Contaminated Soil Aeration	3.06	--
Soil Vapor Extraction and Air Stripping	0.30	
Other Industrial Commercial	0.90	0.23
Subtotal	***14.6***	***1.4***
PETROLEUM PRODUCTS/SOLVENT EVAPORATION		
Petroleum Refinery:		
Storage Tanks	7.48	--
Loading Operations	2.74	--
Subtotal	***10.2***	***--***

Table 3.6.2 - Continued
2000 Planning Inventory for the Bay Area

Source Category	VOC (tpd)	NO_z (tpd)
Fuels Distribution:		
Natural Gas Distribution	0.45	--
Bulk Plants (Gasoline Only)	0.70	--
Bulk Plants and Terminals (Non-gasoline)	0.06	--
Loading Trucks	0.41	--
Trucking	0.15	--
Gasoline Filling Stations	9.80	--
Aircraft Fueling	2.82	--
Recreational Boat Fueling	0.93	--
Ferry and Fishing Boats Fueling	0.20	--
Other Fueling	0.20	--
Subtotal	***15.7***	***--***
Other Organic Compound Evaporation:		
Industrial Degreasing	3.33	--
Commercial Degreasing	2.26	--
Dry cleaners	0.15	--
Printing	6.75	--
Adhesives and Sealants	8.98	--
Structures Coating	26.00	--
Industrial/Commercial Coating	30.70	--
Storage Tanks	1.51	--
Lightering	0.09	--
Ballasting	1.85	--
Marine Vessel Cleaning and Gas Freeing	0.72	--
Sterilizers	--	--
Marine Loading (Non-refinery)	0.22	--
Asphalt Paving	0.33	--
Other Organics Evaporation	0.67	--
Subtotal	***83.6***	***--***
COMBUSTION – STATIONARY SOURCES		
Fuels Combustion:		
Domestic	2.10	12.00
Cogeneration	0.76	6.16
Power Plants	0.17	30.20
Oil Refineries External Combustion	0.40	32.90
Glass Melting Furnaces – Natural Gas	--	4.21
Reciprocating Engines	0.34	4.83
Turbines	0.14	2.37
Other External Combustion	1.18	21.80
Subtotal	***5.1***	***114.5***
Burning of Waste Material:		
Incineration	0.75	1.30
Planned Fires	0.10	0.01
Subtotal	***0.9***	***1.3***

Table 3.6.2 - Continued
2000 Planning Inventory for the Bay Area

Source Category	VOC (tpd)	NO_z (tpd)
COMBUSTION – MOBILE SOURCES		
Off-Highway Mobile Sources:		
Lawn, Garden, and Other Utility Equipment	6.57	1.29
Transportation Refrigeration Units	0.23	1.84
Farm Equipment	1.28	6.55
Heavy Duty Industrial/Construction Equipment	2.37	22.40
Light Duty Industrial/Construction Equipment	22.20	72.10
Locomotive Operations	0.48	10.60
Off-Road Motorcycles	1.18	0.12
All Terrain Vehicles	0.46	0.02
Four-Wheel Drive Vehicles	0.10	0.08
Ships Maneuvering	0.11	3.28
Ships Berthing	0.29	1.73
Ships In-Transit	0.15	5.70
Commercial Boats	0.69	4.33
Recreational Boats	16.40	1.71
Subtotal	***52.5***	***131.8***
Aircraft:		
Commercial Aircraft	3.16	15.00
General Aviation	0.91	0.21
Military Aircraft	6.06	4.55
Agricultural Aircraft	--	--
Airport Ground Support Equipment	0.17	0.49
Subtotal	***10.3***	***20.2***
On-Road Motor Vehicles:		
Light Duty Passenger	116.8	106.5
Light Duty Trucks	44.10	62.00
Medium Duty Trucks	7.98	13.20
Light Heavy Duty Trucks	2.09	14.40
Medium Heavy Duty Trucks	1.68	14.20
Heavy Heavy Duty Trucks	2.79	31.00
Heavy Duty Buses	0.52	4.82
Motorcycles	1.78	0.99
Subtotal	***177.7***	***247.1***
Further Reductions due to Reformulated Gasoline	2.5	--
Subtotal	***175.3***	
MISCELLANEOUS OTHER SOURCES		
Construction Operations	--	--
Farming Operations	--	--
Entrained Road Dust	--	--
Accidental Fires	0.41	0.13
Animal Waste	4.00	--
Wind Blown Dust	--	--
Agricultural Pesticides	2.95	--
Non-Agricultural Pesticides	1.53	--
Consumer Products (No pesticides)	41.70	--
Other Miscellaneous Sources	0.19	0.07
Subtotal	***50.8***	***0.2***
TOTAL	**438**	**527**
Banking Emissions:	7.56	7.69
GRAND TOTAL:	**445**	**534**

Source: BAAQMD. 1999. SF Bay Area Ozone Attainment Plan

Table 3.6.3

State and Federal Ambient Air Quality Standards

(as of January 2002)

Pollutant	Averaging Time	California Standards	National Standards	Bay Area State Status/ Classification	Bay Area National Status/Classification
Photochemical Oxidants	8 hour	--	0.08 ppm	--	Unclassified/Not Designated
	1 hour	0.09 ppm	0.12 ppm	Nonattainment	Nonattainment/ Unclassified
Carbon Monoxide	8 hour	9.0 ppm	9 ppm	Attainment	Attainment
	1 hour	20 ppm	35 ppm	Attainment	Attainment
Nitrogen Dioxide	Annual Mean	--	0.053 ppm	--	Attainment
	1 hour	0.25 ppm	--	Attainment	--
Sulfur Dioxide	Annual Mean	--	0.03 ppm	--	Attainment
	24 hour	0.04 ppm	0.14 ppm	Attainment	Attainment
	1 hour	0.25 ppm	--	Attainment	--
Fine Particulate Matter (PM_{10})	Annual Arithmetic Mean	--	50 $\mu g/m^3$	--	Attainment
	Annual Geometric Mean	30 $\mu g/m^3$	--	Nonattainment	--
	24 hour	50 $\mu g/m^3$	150 $\mu g/m^3$	Nonattainment	Unclassified/Not Designated
Fine Particulate Matter ($PM_{2.5}$)	Annual Arithmetic Mean	--	15 $\mu g/m^3$	--	Unclassified/Not Designated
	24 hour	--	65 $\mu g/m^3$	--	Unclassified/Not Designated

Notes:

1. California standards for ozone, carbon monoxide (except Lake Tahoe), sulfur dioxide (1-hour and 24-hour), nitrogen dioxide, suspended particulate matter - PM_{10}, and visibility reducing particles are values that are not to be exceeded. The standards for sulfates, lead, hydrogen sulfide, and vinyl chloride are not to be equaled or exceeded. If the standard is for a 1-hour, 8-hour or 24-hour average (i.e., all standards except for lead and the PM_{10} annual standard), then some measurements may be excluded. In particular, measurements are excluded that CARB determines would occur less than once per year on the average.
2. National standards other than for ozone, particulates, and those based on annual averages are not to be exceeded more than once a year. The 1-hour ozone standard is attained if, during the most recent three-year period, the average number of days per year with maximum hourly concentrations above the standard is equal to or less than one. The 8-hour ozone standard is attained when the 3-year average of the 4th highest daily concentrations is 0.08 ppm or less. The 24-hour PM_{10} standard is attained when the 3-year average of the 99th percentile of monitored concentrations is less than 150 µg/m3. The 24-hour $PM_{2.5}$ standard is attained when the 3-year average of 98th percentiles is less than 65 µg/m3. Except for the national particulate standards, annual standards are met if the annual average falls below the standard at every site. The national annual particulate standard for PM_{10} is met if the 3-year average falls below the standard at every site. The annual $PM_{2.5}$ standard is met if the 3-year average of annual averages spatially-averaged across officially designed clusters of sites falls below the standard.
3. National air quality standards are set at levels determined to be protective of public health with an adequate margin of safety. Each state must attain these standards no later than three years after that state's implementation plan is approved by the Environmental Protection Agency.
4. A 1999 federal court ruling blocked the implementation of the 8-hour ozone standard. Its status is unclear as of January 2002.
5. In August 1998, the Bay Area was redesignated to nonattainment-unclassified for the national 1-hour ozone standard.
6. In April 1998, the Bay Area was redesignated to attainment for the national 8-hour carbon monoxide standard.
7. Statewide VRP Standard (except Lake Tahoe Air Basin): Particles in sufficient amount to produce an extinction coefficient of 0.23 per kilometer when the relative humidity is less than 70 percent. This standard is intended to limit the frequency and severity of visibility impairment due to regional haze and is equivalent to a 10-mile nominal visual range.

Table 3.6.4

Summary of Ferry Power Usage

FERRY POWER RATING AND HOURS OF OPERATION

Year 2025 No Project	
Ferry Power Rating (kW) - Service Speed	
Larkspur	4,296.9
Alcatraz	2,147.7
Sausalito	872.5
Tiburon	2,148
Vallejo	3,548
Alameda	2,148
Oakland	2,148
Harbor Bay	1,383
Ferry Power Rating (kW) - Slow Speed	
Larkspur	339
Alcatraz	170
Sausalito	127
Tiburon	170
Vallejo	280
Alameda	170
Oakland	170
Harbor Bay	202
Total Transit Hours (hr/day)	
Larkspur	19.6
Alcatraz	4.4
Sausalito	15.7
Tiburon	10.3
Vallejo	19.4
Alameda	8.7
Oakland	7.2
Harbor Bay	4
Total Daily Power Usage (kW-hr)	
Larkspur	65,680
Alcatraz	7,389
Sausalito	10,889
Tiburon	17,178
Vallejo	53,674
Alameda	14,502
Oakland	12,046
Harbor Bay	4,929
SUM:	186,288
Total Idle Hours (hr/day)	22.6

Year 2025 Proposed Project		
Large Ferry Power Rating (kW)		
	- Service Speed	5,369.1
	- Slow Speed	424.2
Small Ferry Power Rating (kW)		
	- Service Speed	1,946.3
	- Slow Speed	284.2
Total Transit Hours (hr/day)		
	large ferry	115.0
	small ferry	180.0
Total Power Usage (kW-hr)		
	large ferry	480,800
	small ferry	278,515
Total Idle Hours (hr/day)		68.7

Notes: Power at service speed is 90% of rated power. Slow speed power is between 8% and 14% of service speed power.

Table 3.6.5

Criteria Pollutant Emission Factors for Ferries

Running Emission Factors (lb/kW-hr)	**Year 2025 No Project[1]**	**Year 2025 Proposed Project[2]**
NO_x Emission Factor	0.0157	0.0016
SO_2 Emission Factor	0.0005	0.0007
PM Emission Factor	0.0009	0.0000
CO Emission Factor	0.0009	0.0009
VOC Emission Factor	0.0008	0.0004
Idle Emission Factors		
NO_x Emission Factor	0.1250	0.0131
PM Emission Factor	0.0057	0.0003
CO Emission Factor	0.2086	0.2086
VOC Emission Factor	0.0278	0.0149

Notes:
1) EPA Tier II
2) With SCR and Particulate Traps

Table 3.6.6

Summary of Criteria Pollutant Emissions from Ferries

Emissions (lb/day)	**Year 2025 No Project**	**Year 2025 Proposed Project**	**Increase in Emissions from Future Baseline (lb/day)**
NO_x Emissions (lb/day)	2,929	1,249	**-1,680**
SO_2 Emissions (lb/day)	101	550	**449**
PM Emissions (lb/day)	175	37	**-137**
CO Emissions (lb/day)	169	684	**515**
VOC Emissions (lb/day)	155	338	**183**

Note: Transit Hours (hrs/day) x Ferry Power (kW) x Emission Factor (lb/kW-hr) + Idle Hours (hrs/day) x Idle Emission Factor (lb/hr) = Pollutant Emissions (lbs/day)

Table 3.6.7

Existing (Year 2000) Bay Area Emissions Inventory-

Total Bay Area Summer Average Emissions (tons/day)

Source	Year 2000[1]					Predicted Year 2006[2]				
	PM_{10}	ROG	NO_x	SO_2	CO	PM_{10}	ROG	NO_x	SO_2	CO
Petroleum Refining Processes	1	25	3	36	--	1	14	1	N/A	N/A
Other Industrial/Commercial Processes	18	13	3	9	--	16	12	3	N/A	N/A
Organic Compounds Evaporation	--[3]	121	--	--	--	--	132	--	N/A	N/A
Combustion	9	5	82	10	72	44	6	56	N/A	N/A
Off-Highway Mobile Sources[4]	12	70	179	25	541	9	54	154	N/A	N/A
Aircraft	2	11	21	1	57	3	12	25	N/A	N/A
On-Road Motor Vehicles	10	238	353	2	2,317	9	176	207	N/A	N/A
Other Miscellaneous Sources	173	70	8	4	15	103	49	--	N/A	N/A
Total	**225**	**553**	**648**	**88**	**3,002**	**185**	**455**	**446**		

Notes:
1) Source: BAAQMD Website http://www.baaqmd.gov
2) Source: BAAQMD 2001
3) "--" means less than 0.1%
4) Construction and farming operations, entrained road dust, and wind-blown dust.

Table 3.6.8

Emission Estimates for Year 2025 No Project vs. Proposed Project (lbs/day)

FERRIES			
Emission	**Year 2025 No Project**	**Year 2025 Proposed Project**	**Increase over No Project (difference)**
NO_x	2,929	1,249	**-1,680**
SO_2	101	550	449
PM_{10}	175	37	**-137**
CO	169	684	515
CO_2	226,000[a]	796,000[a]	570,000
ROG	155	338	183
PASSENGER VEHICLES			
Emission	**Year 2025 No Project**	**Year 2025 Proposed Project**	**Decrease over No Project (difference)**
NO_x	63,830	63,779	**-51**
SO_2	N/A	N/A	
PM_{10}	6108	6,104	**-5**
CO	709,019	708,449	**-570**
CO_2	N/A	N/A	**-144,000**[b]
ROG	71,181	71,123	**-58**
BUSES TO NEW FERRY TERMINALS			
Emission	**Year 2025 No Project**		**Emissions Increase over No Project (lb/day)**
NO_x	N/A		7
SO_2	N/A		
PM_{10}	N/A		1
CO	N/A		48
CO_2	N/A		
ROG	N/A		8
FERRY + PASSENGER VEHICLES + BUSES NET INCREASE/DECREASE OVER NO PROJECT (lbs/day):			
	NO_x	**-1,723**	
	SO_2	449	
	PM_{10}	**-141**	
	CO	**-7**	
	CO_2	426,000	
	ROG	134	

[a] Based on fuel consumption rates of 340 gal/hr at service speed for large ferries and 123 gal/hr at service speed for small ferries. Fuel consumption decreases at slow speed and idle.

[b] Based on a vehicle mile traveled reduction of 142,460 miles per day

Table 3.6.9

Criteria Pollutant Emissions from Dredging at Hercules/Rodeo

Diesel Engine Emission Factors (g/hp-hr)					
	HC	NOx	CO	PM_{10}	SO_2
Tug Engine	0.3	5.3	0.3	0.3	0.2
Dredging Engine	1.0	6.9	8.5	0.4	0.2

Tug emission factors the same as those used in the EIR.
Dredging engine factors from CARB Off-Road Engine Standards for engines
larger than 750 hp. (http://www.arb.ca.gov/msprog/offroad/offroadstandards.pdf)

Pollutant Emissions Associated with Dredging					
	HC	NOx	CO	PM10	SO2
Tug Engine (lb/day)	9.5	187.3	10.7	10.7	6.0
Dredging Engine (lb/day)	17.6	121.7	149.9	7.1	3.5
TOTAL (lb/day)	**27.2**	**309.0**	**160.7**	**17.8**	**9.5**
Tug Engine (ton)	0.06	1.17	0.07	0.07	0.04
Dredging Engine (ton)	0.11	0.76	0.94	0.04	0.02
TOTAL (ton)	**0.17**	**1.93**	**1.00**	**0.11**	**0.06**

Tug engine assumed to be 4,000 hp, and the dredging engine 800 hp.
Tug will operate 4 hours per day round trip and the dredge assumed to operate 10 hours per day.
Total dredging operation assumed to last for 12.5 days.