4.5 AIR QUALITY

This section addresses issues related to air pollutant emissions, including "criteria air pollutants" and "toxic air contaminants." "Criteria air pollutants" refers to those pollutants that are pervasive in urban environments and for which health-based state or national ambient air quality standards have been established. "Toxic air contaminants" refers to those pollutants that occur at relatively low concentrations and are associated with carcinogenic and other adverse health effects, but for which no ambient air quality standards have been established.

4.5.1 SETTING

Both the rate and location of pollutant emissions affect air quality and are affected by meteorological conditions, which influence movement and dispersal of pollutants. Atmospheric conditions such as wind speed, wind direction, and air temperature gradients, along with local topography, provide the link between air pollutant emissions and air quality.

NATURAL GAS

As described in the Project Description (Chapter 2), the three fossil-fuel plants to be divested by PG&E are configured to burn natural gas almost exclusively. Of the various fossil fuels that can be burned in power plants to generate electricity – natural gas, oil, or coal -- natural gas is the cleanest burning. Combustion of natural gas results in lower emissions of sulfur dioxide, particulate matter, carbon monoxide, reactive hydrocarbons, nitrogen oxides, and carbon dioxide than combustion of other fossil fuels.

Natural gas burns cleaner than other fossil fuels because it is composed chiefly of methane, the least complex organic molecule. Methane is comprised of only one carbon atom and four hydrogen atoms. When methane is burned, the principal products of combustion are carbon dioxide and water vapor. In comparison, coal and oil are made up of compounds having much more complicated molecular structures that include higher ratios of carbon as well as various sulfur and nitrogen compounds. These compounds do not burn as cleanly as methane. In addition, coal and fuel oil combustion produces ash particles that can be carried into the atmosphere. Relative emissions of natural gas and oil are provided later in this section.

CLIMATE AND METEOROLOGY

The State of California is divided into discrete air basins that are defined partly by their meteorological and topographical characteristics. The Potrero, Contra Costa, and Pittsburg Power Plants are located within the San Francisco Bay Area Air Basin (Bay Area), which includes San Francisco, San Mateo, Santa Clara, Alameda, Contra Costa, Napa, and Marin counties and portions of Sonoma and Solano counties. The Geysers are located along the ridgeline that separates Sonoma County from Lake County, and power plant facilities associated with the Geysers are located in both counties. The northern half of Sonoma County is located within the North Coast Air Basin while Lake County lies within its own air basin. These three air basins

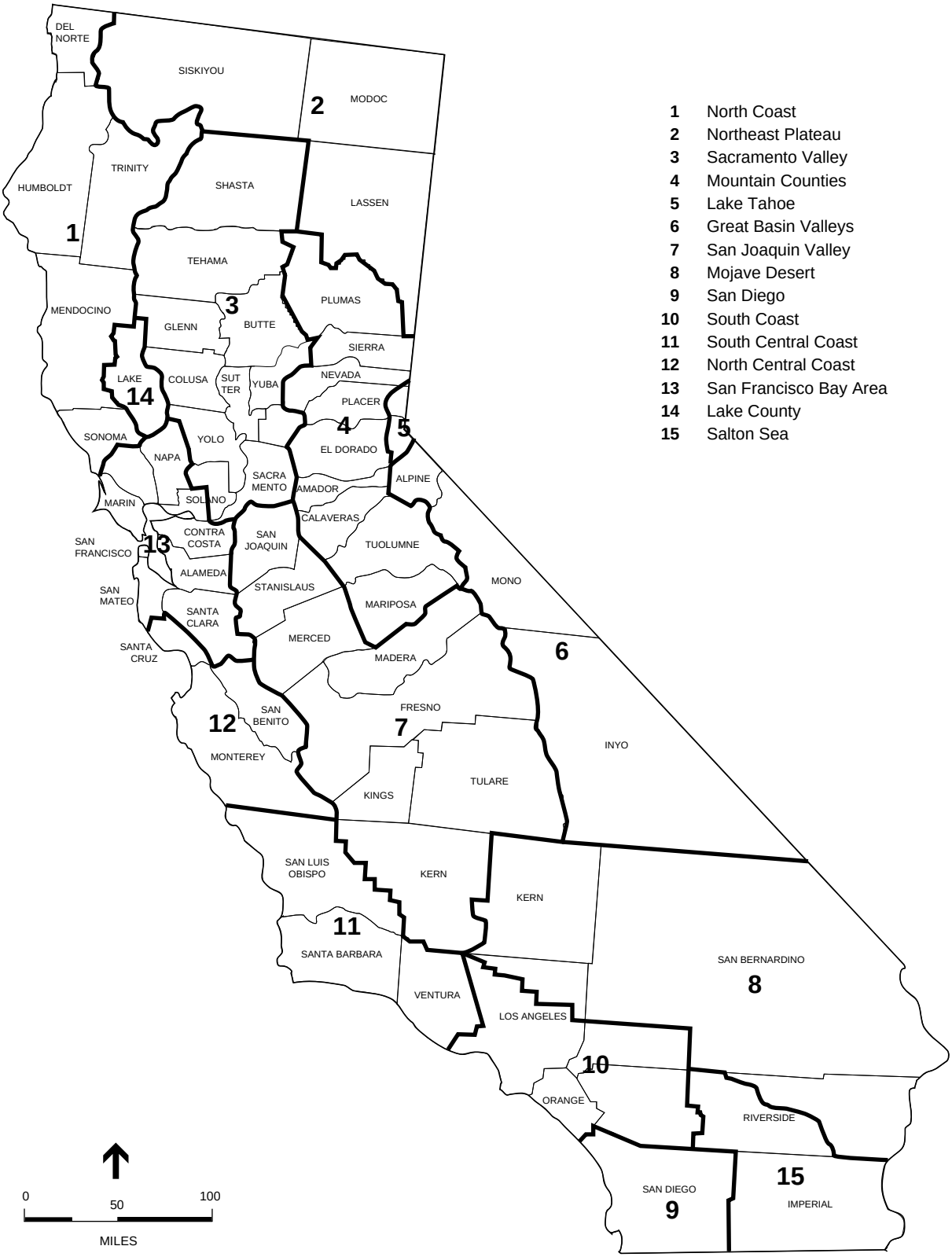
(Bay Area, North Coast, and Lake County) are shown in Figure 4.5-1 along with the other California Air Basins.

The climate of all three air basins is determined largely by a semi-stationary Pacific high pressure system that is almost always present off the west coast of North America. This broad region of descending air is normally warm, dry and stable. In winter, the Pacific high pressure system shifts southward, allowing storms to pass through the region.

The Potrero Power Plant is located within San Francisco, which lies at the northern end of the peninsula climatological subregion of the Bay Area. The peninsula climatological subregion extends from northwest of San Jose to the Golden Gate. The Santa Cruz Mountains run up the center of the peninsula, with elevations exceeding 2,000 feet at the southern end, decreasing to 500 feet in South San Francisco. Because most of San Francisco's topography is below 200 feet, marine air is able to flow easily across most of the City, making its climate cool and windy. On the east side of the subregion, winds are generally from the west. At the northern end of the subregion, pollutant emissions are high, especially from motor vehicle congestion. Localized pollutants, such as carbon monoxide, can build up in "urban canyons." However, winds are generally fast enough to carry the pollutants away before they can accumulate (Bay Area Air Quality Management District, 1996a).

The Pittsburg and Contra Costa Power Plants are located within the Carquinez Strait climatological subregion of the Bay Area. The Carquinez Strait is the only sea-level gap between San Francisco Bay and the Central Valley. This subregion includes the lowlands bordering the strait to the north and south, and includes the area adjoining Suisun Bay and the western part of the Sacramento-San Joaquin Delta as far east as Bethel Island. Prevailing winds are from the west in the Carquinez Strait. Afternoon wind speeds of 15 to 20 miles per hour are common throughout the strait region. Sometimes atmospheric conditions cause air to flow from the east. Summer mean maximum temperatures reach approximately 90 (in degrees Fahrenheit) in the subregion. Mean minimum temperatures in the winter are in the high 30s. While many industrial facilities with substantial air pollutant emissions are located within the Carquinez Strait subregion, the pollution potential of this area is often moderated by high wind speeds (Bay Area Air Quality Management District, 1996a).

As described above, the Geysers are located in both the North Coast Air Basin and the Lake County Air Basin. While the regional weather patterns that affect the Bay Area also affect these two air basins, there are long periods when regional systems are weak and locally-generated wind systems predominate. In the Geysers portion of the North Coast Air Basin, the mountains of the Mayacmas Range affect both surface-wind direction and speed. Wind directions and wind speeds are often different at the operating units because of the varying terrain features. These terrain features can result in up-valley winds during the day and down-valley winds during the night. Wind speeds typically increase with elevation. In the Lake County Air Basin, the steep mountains and valleys that channel the wind affect local wind patterns. Anderson Springs, a sheltered location in Lake County, experiences calm conditions often (approximately 75 percent of the time), while open locations, such as Middletown, experience calm conditions less



Divestiture of Electric Generation Assets / 980125 ■

SOURCE: California Air Resources Board, 1997, *Proposed Maps of Area Designations for the State and National Ambient Air Quality Standards.*

Figure 4.5-1
California Air Basins

frequently (approximately 18 percent of the time). The predominant regional northwest winds tend to flush out air pollutants from Lake County Air Basin. When local winds dominate, air pollutants tend to become entrained within the lake-mountain-valley circulations, resulting in reduced air quality.

While air quality in a given air basin is usually determined by emission sources within the Basin, the air quality in some air basins can also be affected by pollutants transported from upwind air basins by prevailing winds. For instance, emissions generated within the Bay Area are known to adversely affect air quality in the San Joaquin Valley Air Basin, the metropolitan Sacramento area, Mountain Counties Air Basin, and the North Central Coast Air Basin (California Air Resources Board, 1996). Air quality in the Bay Area itself is occasionally adversely affected by pollutant transport from the metropolitan Sacramento area.

REGULATORY AGENCIES

California Air Resources Board

The California Air Resources Board is the state agency responsible for approving the air quality plans developed by air districts to meet both the national standards and state standards. The California Air Resources Board also has primary responsibility for regulating mobile and area source emissions and for overseeing the activities of regional and local air districts called Air Pollution Control Districts (APCDs) or Air Quality Management Districts (AQMDs).

Air Quality Management Districts / Air Pollution Control Districts

In addition to having primary responsibility for preparing air quality plans for the areas within their jurisdiction, APCDs and AQMDs are also responsible for regulating stationary sources. Stationary sources, such as power plants, are regulated through a permitting process in which applicants must secure an Authority to Construct (ATC) and a Permit to Operate (PTO) from the applicable APCD or AQMD prior to operation of new or modified equipment that may affect air quality. Stationary sources can also be subject to retrofit requirements imposed by the applicable APCD and AQMD.

The three power plants located in the San Francisco Bay Area Air Basin lie within the jurisdiction of the Bay Area Air Quality Management District. The local air district in Lake County is the Lake County Air Quality Management District. The local air district in northern Sonoma County is the Northern Sonoma County Air Pollution Control District. (The southern half of Sonoma County lies within the jurisdiction of the Bay Area Air Quality Management District.)

CRITERIA AIR POLLUTANTS

The federal Clean Air Act requires the U.S. Environmental Protection Agency (EPA) to list air pollutant compounds which may endanger public health or welfare; to publish air quality "criteria" describing the latest scientific knowledge on these compounds, their pollutant interactions, and control techniques; and to identify National Ambient Air Quality Standards

(national standards) protective of public health and welfare. Currently, EPA has established national standards for ozone, carbon monoxide, nitrogen dioxide, sulfur dioxide, particulate matter (PM-10 and PM-2.5), and lead. California has adopted more stringent standards for most of the criteria air pollutants (referred to as State Ambient Air Quality Standards, or state standards) and has adopted ambient air quality standards for some pollutants for which there are no corresponding national standards. Both sets of ambient air quality standards (i.e., national and state) are presented in Table 4.5-1.

State and national ambient air quality standards alike consist of two parts: an allowable concentration of a pollutant, and an averaging time over which the concentration is to be measured. The allowable concentrations are based on the results of studies of the effects of the pollutants on human health, crops and vegetation, and, in some cases, damage to paint and other materials. The averaging times are based on whether the damage caused by the pollutant is more likely to occur during exposures to a high concentration for a short time (e.g., one hour), or to a relatively lower average concentration over a longer period (e.g., eight hours, 24 hours, or one month). For some pollutants, there is more than one air quality standard, reflecting both its short-term and long-term effects.

Ozone

Ozone is a reactive pollutant, which is not emitted directly into the atmosphere, but is a secondary air pollutant produced in the atmosphere through a complex series of photochemical reactions involving reactive organic gases (ROG) and oxides of nitrogen (NO_x). ROG and NO_x are known as precursor compounds for ozone. Significant ozone production generally requires ozone precursors to be present in a stable atmosphere with strong sunlight for approximately three hours. Ozone is a regional air pollutant because it is not emitted directly by sources, but is formed downwind of sources of ROG and NO_x under the influence of wind and sunlight. Short-term exposure to ozone can irritate the eyes and cause constriction of the airways (Bay Area Air Quality Management District, 1996a). Besides causing shortness of breath, ozone can aggravate existing respiratory diseases such as asthma, bronchitis and emphysema.

Carbon Monoxide

Carbon monoxide is a non-reactive pollutant that is a product of incomplete combustion. Ambient carbon monoxide concentrations generally follow the spatial and temporal distributions of vehicular traffic and are also influenced by meteorological factors such as wind speed and atmospheric mixing. Under inversion conditions, carbon monoxide concentrations may be distributed more uniformly over an area out to some distance from vehicular sources. When inhaled at high concentrations, carbon monoxide combines with hemoglobin in the blood and reduces the oxygen-carrying capacity of the blood (Bay Area Air Quality Management District, 1996a). This results in reduced oxygen reaching the brain, heart, and other body tissues. This condition is especially critical for people with cardiovascular diseases, chronic lung disease or anemia, as well as fetuses.

TABLE 4.5-1
STATE AND NATIONAL AMBIENT AIR QUALITY STANDARDS

Pollutant	Averaging Time	National[b,c]	State of California[a,c]
Ozone[d]	1 hour	0.12 ppm (235 $\mu g/m^3$)	0.09 ppm (180 $\mu g/m^3$)
	8 hour	0.08 ppm (160 $\mu g/m^3$)	NA
Carbon Monoxide	1 hour	35 ppm (40,000 $\mu g/m^3$)	20 ppm (23,000 $\mu g/m^3$)
	8 hour	9 ppm (10,000 $\mu g/m^3$)	9.0 ppm (10,000 $\mu g/m^3$)
Nitrogen Dioxide	1 hour	NA	0.25 ppm (470 $\mu g/m^3$)
	Annual	0.053 ppm (100 $\mu g/m^3$)	NA
Sulfur Dioxide	1 hour	NA	0.25 ppm (655 $\mu g/m^3$)
	3 hour	0.5 ppm (1,300 $\mu g/m^3$)	NA
	24 hour	0.14 ppm (365 $\mu g/m^3$)	0.04 ppm (105 $\mu g/m^3$)
	Annual	0.03 ppm (80 $\mu g/m^3$)	NA
Particulate Matter (PM-10)	24 hour	150 $\mu g/m^3$	50 $\mu g/m^3$
	Annual	50 $\mu g/m^3$	30 $\mu g/m^3$
Particulate Matter (PM-2.5) [d]	24 hour	65 $\mu g/m^3$	NA
	Annual	15 $\mu g/m^3$	NA
Sulfates	24 hour	NA	25 $\mu g/m^3$
Lead	30 day	NA	1.5 $\mu g/m^3$
	Calendar Quarter	1.5 $\mu g/m^3$	NA
Hydrogen Sulfide	1 hour	NA	0.03 ppm (42 $\mu g/m^3$)
Vinyl Chloride	24 hour	NA	0.010 ppm (26 $\mu g/m^3$)

a California standards for ozone, carbon monoxide, sulfur dioxide, nitrogen dioxide, particulate matter (PM-10) are values that are not to be exceeded. All other California standards shown are values not to be equaled or exceeded.

b National standards, other than for ozone and particulate matter and those based on annual averages, are not to be exceeded more than once per year. For the one-hour ozone standard, the ozone standard is attained when the expected number of days per calendar year with maximum hourly average concentrations above the standard is equal to or less than one. The eight-hour ozone standard is met at a monitoring site when the three-year average of the annual fourth-highest daily maximum eight-hour average ozone concentration is less than or equal to 0.08 ppm.

c ppm = parts per million by volume; $\mu g/m^3$ = micrograms per cubic meter.

d New standards effective September 16, 1997 (40 CFR 50.7 and 40 CFR 50.10).

NA: Not Applicable.

SOURCE: California Air Resources Board, *Maps and Tables of the Area Designations for the State and National Ambient Air Quality Standards and Expected Peak Day Concentrations and Designation Values*, January 1998.

Particulate Matter (PM-10 and PM-2.5)

PM-10 consists of particulate matter that is 10 microns or less in diameter (a micron is one-millionth of a meter), and PM-2.5 consists of particulate matter 2.5 microns or less in diameter. Both PM-10 and PM-2.5 represent fractions of particulate matter, which can be inhaled into the air passages and the lungs and can cause adverse health effects. Particulate matter in the atmosphere results from many kinds of dust- and fume-producing industrial and agricultural operations, combustion, and atmospheric photochemical reactions. Some of these operations, such as demolition and construction activities, contribute to increases in local PM-10 concentrations, while others, such as vehicular traffic, affect regional PM-10 concentrations.

National ambient air quality standards for particulate matter were first established in 1971. The standards covered total suspended particulate matter (TSP), or particles that are 30 microns or smaller in diameter. In 1987, EPA changed the standards from TSP to PM-10 as the new indicator. The new standards were based on a comprehensive study of information on the health effects from inhaling particulate matter. In December 1994, EPA began a long review process to determine if the PM-10 standards set in 1987 provide a reasonable margin of safety, and if a new standard should be established for finer particles.

Based on numerous epidemiological studies and other health and engineering related information, EPA established new standards for fine particulate matter (PM-2.5) in 1997. Before establishing the new PM-2.5 standards, discussions were conducted with the Clean Air Scientific Advisory Committee (CASAC). CASAC is a group of nationally recognized experts in the fields related to air pollution, environmental health, and engineering. CASAC reviewed and commented on the information generated by EPA regarding proposed particulate matter standards.

Subsequent to these discussions and reviews, EPA established PM-2.5 standards of 65 micrograms per cubic meter, 24-hr average concentration, and 15 micrograms per cubic meter, annual average concentration. EPA also confirmed the national PM-10 standards of 150 micrograms per cubic meter, 24-hr average, and 50 micrograms per cubic meter, annual average, as providing an adequate margin of safety for limiting exposure to larger particles. The recommendations for new PM-2.5 standards and for maintaining the PM-10 standards were released in a staff report (U.S. Environmental Protection Agency, 1996) that presents the conclusions of the Agency and of the review committee, CASAC.

Several studies that EPA relied on for their staff report have shown an association between exposure to particulate matter, both PM-10 and PM-2.5, and respiratory ailments or cardiovascular disease (Pope *et al.,* 1992; Thurston *et al.,* 1992; Burnett *et al.,* 1995). Other studies have related particulate matter to increases in asthma attacks (Whittemore and Korn, 1980; Pope *et al.,* 1991). In general, these studies have shown that short-term and long-term exposure to particulate matter can cause acute and chronic health effects. Fine particulate matter (PM-2.5), which can penetrate deep into the lungs, causes more serious respiratory ailments. These studies, along with information provided by EPA in the 1996 staff report, were used as the basis for evaluating the impacts of PG&E emissions of PM-10 and PM-2.5, on public health.

Nitrogen Dioxide and Sulfur Dioxide

Nitrogen dioxide and sulfur dioxide are two gaseous compounds within a larger group of compounds, NO_x and sulfur oxides (SO_x), respectively, which are products of the combustion of fuel. NO_x and SO_x emission sources can elevate local NO_2 and SO_2 concentrations, and both are regional precursor compounds to particulate matter. As described above, NO_x is also an ozone precursor compound and can affect regional visibility. (Nitrogen dioxide is the "whiskey brown" colored gas readily visible during periods of heavy air pollution.) Elevated concentrations of these compounds are associated with increased risk of acute and chronic respiratory disease.

Sulfur dioxide and nitrogen oxides emissions can be oxidized in the atmosphere to eventually form sulfates and nitrates, which contribute to acid rain. Large power plants with high emissions of these substances because of the use of coal or oil are subject to emissions reductions under the Phase I Acid Rain Program of Title IV of the 1990 Clean Air Act Amendments. Other power plants that use natural gas or other fuels with low sulfur content such as the PG&E plants, are subject to the Phase II Program of Title IV. The Phase II program requires plants to install Continuous Emissions Monitoring Systems (CEMS) in accordance with the Code of Federal Regulations (40 CFR Part 75) and report annual emissions of sulfur oxides and nitrogen oxides. PG&E has installed CEMS at the fossil fuel burning plants in compliance with the Phase II program.

Lead

Gasoline-powered automobile engines used to be the major source of airborne lead in urban areas. Excessive exposure to lead concentrations can result in gastrointestinal disturbances, anemia, kidney disease, and in severe cases of neuromuscular and neurologic dysfunction. The use of lead additives in motor vehicle fuel has been eliminated in California, and lead concentrations have declined substantially as a result.

Hydrogen Sulfide

Hydrogen sulfide (H_2S) is a naturally occurring gas contained in geothermal steam from the Geysers. H_2S has a "rotten egg" odor at concentration levels as low as 0.005 parts per million (ppm). The state 1-hour standard of 0.03 ppm is set to reduce the potential for substantial odor complaints. At concentrations of approximately 10 ppm, exposure to H_2S can lead to health effects such as eye irritation.

Attainment/Non-attainment Designations

Under amendments to the federal Clean Air Act, EPA has classified air basins, or portions thereof, as either "attainment" or "non-attainment" for each criteria air pollutant, based on whether or not the national standards have been achieved. The project involves power plants located in three air basins: the San Francisco Bay Area Air Basin, the Lake County Air Basin, and the North Coast Air Basin. In 1988, the State Legislature passed the California Clean Air Act, which is patterned after the federal Clean Air Act to the extent that areas are required to be designated as "attainment" or "non-attainment" for the state standards, rather than the national

standards. Thus, areas in California have two sets of attainment/non-attainment designations: one set with respect to the national standards and one set with respect to the state standards. Table 4.5-2 shows the current attainment/non-attainment status of the three applicable air basins for the various criteria air pollutants.

TABLE 4.5-2
AIR BASIN ATTAINMENT/NON-ATTAINMENT DESIGNATIONS

Pollutant	National	State
San Francisco Bay Area Air Basin		
Ozone[a]	Non-attainment[b]	Non-attainment
Carbon Monoxide	Attainment[c]	Attainment
Nitrogen Dioxide	Attainment	Attainment
Sulfur Dioxide	Attainment	Attainment
Lead	Unclassified	Attainment
Particulate Matter (PM-10)[d]	Unclassified	Non-attainment
Hydrogen Sulfide	Not applicable	Unclassified
Lake County Air Basin		
Ozone[a]	Attainment	Attainment
Carbon Monoxide	Attainment	Attainment
Nitrogen Dioxide	Attainment	Attainment
Sulfur Dioxide	Unclassified	Attainment
Lead	Unclassified	Attainment
Particulate Matter (PM-10)[d]	Unclassified	Attainment
Hydrogen Sulfide	Not applicable	Attainment
North Coast Air Basin / Northern Sonoma County Subregion		
Ozone[a]	Attainment	Attainment
Carbon Monoxide	Attainment	Unclassified
Nitrogen Dioxide	Attainment	Attainment
Sulfur Dioxide	Unclassified	Attainment
Lead	Unclassified	Attainment
Particulate Matter (PM-10)[d]	Unclassified	Non-attainment
Hydrogen Sulfide	Not applicable	Attainment

a The designations for ozone relate to the one-hour average state and national standards. Air Basins will not be classified with respect to the new eight-hour national ozone standard for several years.
b On June 25, 1998, EPA announced its final decision to re-designate the San Francisco Bay Area Air Basin to non-attainment for the national ozone standard.
c Attainment designation is effective on June 1, 1998 (see *Federal Register*, March 31, 1998).
d Since monitoring for PM-2.5 only began in 1998, air basins will not be classified with respect to the new national PM-2.5 standard until 2000 or later.

SOURCE: California Air Resources Board, *Maps and Tables of the Area Designations for the State and National Ambient Air Quality Standards and Expected Peak Day Concentrations and Designation Values*, January 1998.

Air Quality Monitoring Data

Table 4.5-3 summarizes the past three years of monitoring data collected in the three applicable air basins. As shown in Table 4.5-3, exceedences of state standards for ozone and PM-10 are recorded on occasion in the San Francisco Bay Area Air Basin and are recorded less frequently in the North Coast Air Basin. Exceedences of any ambient air quality standard are very infrequent in Lake County.

TABLE 4.5-3
BASIN-WIDE POLLUTANT SUMMARY, 1994-1996[a]

Pollutant	Days Over State Standard		
	1994	**1995**	**1996**
San Francisco Bay Area Air Basin			
Ozone	13	28	34
Carbon Monoxide	0	0	0
Nitrogen Dioxide	0	0	0
Sulfur Dioxide	0	0	0
Lead	0	0	0
Particulate Matter (PM-10)[b]	10/91	7/89	3/88
Hydrogen Sulfide	ND	ND	ND
Lake County Air Basin			
Ozone	0	0	0
Carbon Monoxide	ND	ND	ND
Nitrogen Dioxide	ND	ND	ND
Sulfur Dioxide	ND	ND	ND
Lead	ND	ND	ND
Particulate Matter (PM-10)[b]	0/61	0/61	0/61
Hydrogen Sulfide	0	1	0
North Coast Air Basin			
Ozone	1	1	0
Carbon Monoxide	ND	0	0
Nitrogen Dioxide	0	0	0
Sulfur Dioxide	0	ND	ND
Lead	ND	ND	ND
Particulate Matter (PM-10)[b]	8/85	3/101	5/113
Hydrogen Sulfide	ND	ND	ND

a This table shows that for each air basin the number of days in which at least one air monitoring station recorded a violation of the state standard.

b PM-10 measurements are not taken every day. The table shows the number of days during which PM-10 concentrations exceeded the State standard at one or more of the monitoring stations in the air basin and the number of days during the year during which PM-10 measurements were recorded. Since monitoring for PM-2.5 only began in 1998, air basins will not be classified with respect to the new national PM-2.5 standard until 2000 or later.

NOTE: ND = no data.

SOURCE: California Air Resources Board, *Air Quality Data Summary, 1994, 1995, and 1996.*

TOXIC AIR CONTAMINANTS

Regulatory Context

"Toxic air contaminants" are air pollutants that are believed to have carcinogenic or adverse non-carcinogenic effects but do not have a corresponding ambient air quality standard. There are hundreds of different types of toxic air contaminants, with varying degrees of toxicity. Sources of toxic air contaminants include industrial processes such as petroleum refining, electric utility and chrome plating operations, commercial operations such as gasoline stations and dry cleaners, and motor vehicle exhaust.

Toxic air contaminants are regulated under both state and federal laws. Federal laws use the term "Hazardous Air Pollutants" (HAPs) to refer to the same types of compounds referred to as "Toxic Air Contaminants" (TACs) under State law. Both terms encompass essentially the same compounds. For the sake of simplicity, this report will use TACs when referring to these compounds rather than HAPs. Under the 1990 Clean Air Act Amendments, approximately 190 substances are regulated under a two-phase strategy. The first phase involves requiring facilities to install Maximum Achievable Control Technology (MACT); EPA has established MACT standards for 20 industries that emit toxic air contaminants and will develop MACT standards for others over the next several years. Electric Utility Boilers were omitted from the list of industries to be considered pending an EPA study that will determine if MACT is required. Even if MACT is established for a given source category, a facility in that category is subject to MACT only if the TAC emissions are 10 tons per year or more for any substance or 25 tons per year or more for any combination of TACs. Since TAC emissions from the PG&E plants are less than one ton per year per facility, none of the plants being divested would be subject to MACT.

The second phase of control involves determining the residual health risk represented by TAC emissions sources after implementation of MACT standards. EPA will determine residual risks within eight years after MACT standards for a source category are set. Results of this analysis will be used to determine if the residual risks allow for a reasonable margin of safety for public health.

With respect to State law, in 1983 the State legislature adopted Assembly Bill 1807 (AB 1807), which established a process for identifying toxic air contaminants and provided the authority for developing retrofit air toxics control measures on a statewide basis. In 1992, the State legislature adopted Assembly Bill 2728 to provide a legal framework for the integration of the existing State air toxics programs, including those developed under AB 1807, with the new federal program discussed above. Air toxics in California may also be regulated because of another state law, the Air Toxics "Hot Spots" Information and Assessment Act of 1987, Assembly Bill 2588 (AB 2588). Under AB 2588, toxic air contaminant emissions from individual facilities are required to be quantified by the facility and reported to the local air pollution control agency. The facilities are prioritized by the local agencies based on the quantity and toxicity of these emissions, and their proximity to areas where the public may be exposed. High priority facilities are required to perform a health risk assessment, and if specific risk thresholds are exceeded, they are required to communicate the results to the public in the form of notices and public meetings.

Depending on the health risk levels, emitting facilities can be required to implement varying levels of risk reduction measures.

Introduction to Risk Assessment

Health effects resulting from exposure to toxic air contaminants can be categorized as either carcinogenic (cancer-causing), or non-carcinogenic. Health effects from carcinogenic air toxics are usually described in terms of individual cancer risk. "Individual cancer risk" is the likelihood that a person exposed to concentrations of toxic air contaminants over a lifetime will contract cancer, based on the use of standard risk assessment methodology established for AB 2588. These cancer risks are based on the best estimates of plausible cancer potencies as determined by the State Office of Environmental Health Hazard Assessment.[1] When exposure to more than one potential carcinogen is evaluated, the risks posed by the various individual air toxics is summed; this sum is the overall cancer risk estimate.[2] Incremental risks estimated through standard methods are typically compared to risks estimated by the same methods for other facilities, and to standards selected to define the acceptable incremental risk from a project or facility (e.g., the Proposition 65 standard risk of 10 in a million). Non-carcinogenic health effects associated with air toxics vary depending on the types and quantities of air toxics exposure. Adverse effects on health, as well as the potential for nuisance and other forms of irritation, depend largely on the susceptibility of the individual, and are evaluated for two different periods of exposure: acute (short-term exposure) and chronic (long-term exposure). Non-cancer health effects (both acute and chronic) are considered by comparing estimated exposure levels to known or estimated thresholds (termed "reference exposure levels"). Information on risk assessment methodology is presented in the discussion of the Potrero Power Plant setting.

Air Toxics Monitoring Data

The Bay Area Air Quality Management District (BAAQMD) operates a regional network of monitoring stations that measure ambient concentrations of the specific toxic air contaminants that are believed to contribute most to the risk-associated toxic air contaminants emitted to the atmosphere in the Bay Area. Based on monitoring data, the BAAQMD estimates that the incremental cancer risk due to lifetime exposure to average ambient concentrations of toxic air contaminants in the Bay Area in 1995 was 303 in one million (Bay Area Air Quality Management District, 1996b). The average cancer risk has decreased over recent years; this same estimate was 339 in one million based on 1993 data, and 356 in one million based on 1991 data.

Of the pollutants for which monitoring data are available, benzene and 1,3-butadiene contribute most significantly to the ambient cancer risk in the Bay Area. These two pollutants together

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1 In the U.S. approximately 400,000 of each million people will develop cancer in their lifetimes (American Cancer Society,1995). Cancer can result from a number of causes, including chemical exposures.

2 The summation of cancer risks for various chemicals is an approximation because either synergistic (i.e., cooperative, producing greater effect than expected) or antagonistic (i.e., opposing, producing less effect than expected) effects may occur as a result of exposure to various air toxics. Because sufficient data are not available to predict such health effects, health risk assessment guidelines, including federal and California procedures, assume that health risks are additive (California Air Pollution Control Officers Association, 1993).

account for nearly two thirds of the total risk. Over 90 percent of the total benzene and butadiene emissions are from mobile sources.

The contaminant 1,3-butadiene has not been reported in power plant emissions in the Bay Area. The only toxic air contaminants attributed to the power plants to be divested are benzene and formaldehyde. These two compounds together accounted for 100 percent of the toxic air contaminants emitted from the power plants.

Formaldehyde

Formaldehyde (HCHO) is the toxic air contaminant emitted from power plant stacks in the largest quantities. Formaldehyde is a simple organic substance that can be generated by incomplete combustion of natural gas. Pure formaldehyde is a colorless volatile liquid with a characteristic pungent odor. It is soluble in water. Formaldehyde is considered to be a toxic substance and a carcinogen. The primary pathway of exposure to formaldehyde in stack emissions would be inhalation.

Benzene

Benzene (C_6H_6) is emitted from Bay area power plant stacks in smaller quantities than formaldehyde. Benzene is a trace contaminant, but it can be detected in stack emissions where natural gas is burned. Benzene, an organic compound, is a common industrial solvent and also is a component of unleaded gasoline. Chemically, the benzene molecule is the simplest aromatic hydrocarbon. Pure benzene is a clear, colorless, volatile liquid with a sweet aroma. The trace amounts of benzene in stack gases are too dilute to be detected by its aroma. Benzene is considered to be a toxic substance and a carcinogen. The primary pathway of exposure to benzene in stack emissions would be inhalation.

At trace concentrations, benzene does not pose an acute health hazard. Over the long term, benzene exposure might produce headaches or respiratory problems. The carcinogenic nature of benzene is its greatest health threat. Benzene attacks the liver and can alter genetic matter in bone marrow, causing leukemia.

FALLOUT TYPE PARTICULATE (FTP)

In addition to criteria air pollutants and toxic air contaminants, larger-sized particulate matter can be emitted by power plants. These particles, which are more of a nuisance than a health hazard, are known by several different names: fallout type particulates (FTP), fallout, or acid smut fallout. This EIR will use the term "FTP." This emission consists of large-size particles of dirt or soot that quickly fall from the air by virtue of their large size and weight and are deposited on horizontal surfaces. FTP, and its effects on boats and cars, has been a historically reported public concern at both the Pittsburg and Contra Costa power plants.

FTP tends to contain acidic iron containing particles 50 microns and larger in size that are formed in combustion devices (i.e., kilns, ovens, boilers, and internal combustion engines) when a sulfur-containing fuel is used. The sulfur in the fuel is oxidized to sulfur trioxide (SO_3). When this

compound combines with water of combustion, sulfuric acid (H_2SO_4) is formed. The sulfuric acid reacts with the metal surfaces on the combustion device creating metal sulfates, predominately iron sulfate ($FeSO_4$), corrosion products and other elements contained in the fuel ash (Moss Landing AMPAC, 1996). To minimize FTP releases, PG&E routinely inspects and cleans the boilers and stacks at each plant during scheduled boiler outages, emergency shutdowns, and extended maintenance outages.

Once FTP is released to the atmosphere from an elevated release point (i.e., exhaust stack or vent), the relatively large size of FTP causes the particles to fall to ground quickly, within a short distance. This distance depends on several factors, such as the height of the release point, the temperature of the gas, and the ambient wind speed. FTP released from a source such as a power plant with a tall stack could be reasonably expected to affect a region within 1 to 1.5 miles downwind from the power plant site (Moss Landing AMPAC, 1996). When deposited on surfaces, FTP can become aesthetically bothersome and appear as rust-colored stains when moistened or wet. Horizontal surfaces of boats and cars are the most susceptible receptors and, in general, white or light colored surfaces are more affected by FTP stains than other surfaces. FTP is typically not found on vertical surfaces. When wetted, FTP forms stains that require determined scrubbing efforts to remove. In the case of fossil-fueled power plants such as those being discussed in this report, FTP can occur regardless of the fuel burned (fuel oil or natural gas), but is much more prevalent with fuel oil (Moss Landing AMPAC, 1996). Additionally, aside from the nuisance effect, there are no known environmental health impacts resulting from FTP (Kendig, 1998).

Existing FTP Program

More than 20 years ago, at PG&E's Contra Costa and Pittsburg Power Plants, due to complaints from local boat owners, PG&E implemented a FTP program to regularly wash boats (typically several times per month and periodic detailing of the vessels) to remove FTP-caused stains on boats. PG&E set up a "Harbor Claims Office" to administer this program. At the time, these power plant's primary source of fuel was fuel oil. Since the end of 1994, use of fuel oil at these plants has ended and, in response to BAAQMD Regulation 9, Rule 11, only natural gas is burned in these plants. While the switching of fuels at the plants from fuel oil to natural gas has reduced this FTP problem, it has not eliminated it, and FTP-related claims continue to be reported today. (The overall cost of this fallout program is included in PG&E's current rates.)

PG&E's existing fallout program (FTP/Harbor Claims Program) is designed to respond to claims resulting from emissions of FTP from PG&E's existing fossil-fueled power plants where FTP has been a historical problem for nearby property owners (PG&E, 1998c). This program offers a variety of means to assist claimants with the maintenance of property that is approved for the program, typically including pleasure and commercial vessels, motor homes, and automobiles. At the present time, PG&E maintains these programs on a voluntary basis. The programs at the Pittsburg plant are the Self-Wash Program, the Canvas Program, the Vehicle Maintenance Program, and the As-Needed Program. The programs at the Contra Costa plant are the Self-Wash Program, the Vendor Maintenance Program, the Canvas Program, and the Vehicle Maintenance Program.

Under the Self-Wash Program, vessel owners receive direct compensation for washing the exterior surfaces of their vessels to an acceptable standard. Owners are compensated monthly if they are permanently berthed or stored in close proximity to the plants. Vessels are inspected regularly to verify their condition. In the Canvas Program, vessel owners are provided custom covers to protect the vessels from FTP. The owner signs a five-year contract with PG&E; at its expiration, the cover becomes the owner's property and the owner is eligible to participate in the Self-Wash Program. Under the Vendor Maintenance Program, vessel owners take their vessels to local vendors or brokers, who are compensated by PG&E for washing boats. The Vehicle Maintenance Program is similar to the Vendor program but is specific to motor vehicles. The As-Needed Program is not a regular program, but the claims are processed in the same manner as a regular third-party claim. Should FTP affect a vessel owned by someone not participating in the FTP/Harbor Claims Program, the claim is processed as a third-party claim. Boat and autos comprise the regular programs. Claims for damages to buildings or awnings are handled as third-party claims (PG&E, 1998c).

It should be noted that there are no specific BAAQMD rules or regulations that require PG&E to address FTP. If any district rules apply to FTP impacts at all, the BAAQMD's regulation 1-301, Public Nuisance, would be the most applicable. PG&E has historically operated its Harbor Claim Office as a good neighbor policy (although for several years this program was mandated by out of court settlements), and not in response to any BAAQMD mandated actions. Over the years PG&E has, in response to complaints from locally affected parties and changes in plant operations, changed both the frequency of FTP-stain removal actions and the amount of monetary compensation to affected parties for these removal actions. Currently, PG&E's FTP fallout program is applied to impacts that occur within loosely defined fallout zones surrounding both the Contra Costa and Pittsburg power plants. These fallout zones are dependent on wind conditions (speed and direction), who or what is in the area, the amount of FTP released, and plant operating conditions, etc. While no formal definitions of these fallout zones exists, historical experience has shown PG&E that certain areas located in close proximity to these power plants tend to be more affected than others. PG&E employees administering these programs are familiar with these areas (PG&E, 1998c). Through these FTP cleanup programs, the potential nuisance effects from FTP-stains appear to be abated.

There are no FTP programs in place at the Potrero plant; however, claims arising from FTP from this plant would be treated on an as-needed basis (PG&E, 1998c). There also are no FTP programs in place at the Geysers Geothermal plant since fossil fuel is not burned at the Geysers units.

4.5.2 REGIONAL SETTING

BAY AREA AIR QUALITY MANAGEMENT DISTRICT

Regulations, Plans and Policies

As discussed above and shown in Table 4.5-2, the Bay Area has been classified "attainment" or "non-attainment" for the criteria air pollutants. Under the federal Clean Air Act Amendments, air quality plans (known as State Implementation Plans, or SIPs) were required to be prepared for

areas classified as "non-attainment" for any of the national standards. These plans were to contain a strategy to improving air quality and achieving the national standards.

Based on monitoring data in the 1970s, the Bay Area was designated "non-attainment" with respect to the national standards for ozone and carbon monoxide, and a SIP for the Bay Area was prepared (Association of Bay Area Governments, 1982). This 1982 SIP was intended to bring the Bay Area into compliance with the national standards by 1987. Under the federal Clean Air Amendments of 1990, SIPs were required to be revised to meet new requirements for those areas, like the Bay Area, that did not meet the 1987 deadline.

With respect to ozone, a SIP revision for the Bay Area was prepared pursuant to the federal Clean Air Act Amendments of 1990. This ozone SIP, the *Ozone Maintenance Plan* (Association of Bay Area Governments, 1994a), was developed for the Bay Area in anticipation of a change in designation to "attainment." In 1995, EPA approved the BAAQMD's request to change the Bay Area's designation to "attainment" for the national standard for ozone based on monitoring data which indicated that the Bay Area had achieved the national standard (*Federal Register*, 1995). At the same time, U.S. EPA also approved the *Ozone Maintenance Plan*, which then became part of the current ozone SIP for the Bay Area. EPA also incorporated additional NO_x rules into the Bay Area's ozone SIP (*Federal Register*, 1997), including BAAQMD Regulation 9, Rule 9, discussed below, which relates to power plants. As indicated in Table 4.5-2, EPA recently announced its final decision to change the designation back to "non-attainment" based on monitored violations in 1995 and 1996, and as a result of that decision, a revised SIP will be required.

With respect to carbon monoxide, EPA recently announced its decision to approve a redesignation request for the Bay Area to "attainment" for the national carbon monoxide standard and to approve a *Carbon Monoxide Maintenance Plan* (Association of Bay Area Governments, 1994b), which is the new carbon monoxide SIP for the Bay Area.

Under the California Clean Air Act, areas designated as "non-attainment" for the state standards were required to develop air quality plans in addition to those required under federal laws. In 1991, an air quality plan, *Bay Area '91 Clean Air Plan* (*'91 Clean Air Plan*), was developed to address the Bay Area's (then) designation of "non-attainment" for the state ozone and carbon monoxide standards (Bay Area Air Quality Management District, 1991).[3] The goal of the *'91 Clean Air Plan* was to improve air quality in the 1990s through tighter industry controls, cleaner cars and trucks, cleaner fuels, and increased commute alternatives. Power plants were among the industries targeted in the *'91 Clean Air Plan* for more stringent controls, and two control measures described in that plan were adopted as BAAQMD Regulation 9, Rules 9 and 11, discussed below. The *'91 Clean Air Plan* has been updated on a triennial basis. The most recent update is the *Bay Area '97 Clean Air Plan*, which contains additional control strategies but none that relate directly to power plants (Bay Area Air Quality Management District, 1997).

[3] Subsequent to issuance of the '91 Plan, the Bay Area did achieve attainment status for carbon monoxide.

As is the case with most other stationary sources, power plants in the Bay Area operate subject to permits issued by the BAAQMD as well as specific standards set forth in BAAQMD's *Rules and Regulations*. Two of the most important *Rules and Regulations* that apply to power plants are Regulation 9, Rule 9 (Nitrogen Oxides from Stationary Gas Turbines) and Regulation 9, Rule 11 (Nitrogen Oxides and Carbon Monoxide from Utility Electric Power Generation Boilers).

The purpose of BAAQMD Regulation 9, Rule 9 is to limit emissions of nitrogen oxides from "stationary gas turbines." BAAQMD Rules and Regulations define "stationary gas turbines" as any gas turbine system that is attached to a foundation and that is gas and/or liquid fueled with or without power augmentation. In this section of the EIR, such turbines are referred to as "combustion turbines" to distinguish them from "steam boilers," which are the subject of Regulation 9, Rule 11, which is described below.[4] The combustion turbines described in this section are fired with distillate fuel rather than natural gas.

Regulation 9, Rule 9 sets forth emission concentration limits[5] for nitrogen oxides from combustion turbines; these limits differ depending upon the size of the combustion turbine, the fuel used to fire the turbine, and the presence or absence of selective catalytic reduction (SCR) abatement technology. The rule distinguishes between combustion turbines with ratings below 10 MW and those with ratings above 10 MW, with the more stringent requirements applying to the larger-sized units. The combustion turbines discussed in this report are rated higher than 10 MW are thus subject to the more stringent requirements of the rule. However, the rule allows for more relaxed emission concentration limits so long as the combustion turbine is used less than 10 percent of the year (i.e., less than 10 percent gross annual capacity, which is equivalent to 877 hours).

The purpose of BAAQMD Regulation 9, Rule 11 is to limit emissions of nitrogen oxides and carbon monoxide from utility electric power generating steam boilers. Under this rule, there are two compliance options. Under the first option, the rule specifies boiler-specific standards; boilers in each of three size classes (referred herein as small, intermediate and large) must achieve specified NO_x emission concentration levels. All boilers are required to achieve the final emission concentration levels, substantially below current levels, by 2005. The NO_x limits are more stringent when burning natural gas than when burning oil. The small and intermediate size boilers are never allowed to burn oil except under *force majeure* natural gas curtailment.[6] The large size boilers are not permitted to burn fuel oil during the summer ozone season except under *force majeure* natural gas curtailment. The lack of a year-round prohibition on burning oil in the large-size steam boilers (with an exception for *force majeure* natural gas curtailment) is one of the distinguishing features between this first compliance option and the alternative compliance option discussed below.

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4 It is noted that exhaust from the combustion turbines is not emitted from the same stacks as the exhaust from the boilers. At the Potrero Power Plant, emissions from the combustion turbines are released to the atmosphere from stacks that are 32 feet high while the boiler emissions (flue gas) are released to the atmosphere from a stack 300 feet in height.

5 Emissions concentration limits are typically defined in terms of parts per million volume (ppmv) in the exhaust stream. As such, these limits can be understood as an emissions cap (e.g., described in terms of pounds per day or tons per year) if a combustion turbine were to operate at full capacity at the emissions limit.

6 *Force majeure* natural gas curtailment refers to an interruption in natural gas service due to an unforeseen failure or malfunction, an unexpected and uncontrollable event such as a natural disaster, or a curtailment pursuant to CPUC rules or orders.

Regulation 9, Rule 11 also provides an alternative option for compliance by the steam boilers, and PG&E has selected this alternative option for its boilers in the Bay Area. BAAQMD determined that this option, referred to as the "bubble" option, would provide emission rates and ultimate levels of NO_x reduction comparable to those provided by the class-specific boiler limits noted above. Under the "bubble " option, when hourly fuel inputs and NO_x emissions are summed over all of PG&E's Bay Area boilers combined (as if the power plants at Potrero, Hunters Point, Contra Costa and Pittsburg are all under a "bubble"), the resulting calculated pounds of NO_x emissions per million Btu of fuel input must not exceed a limit that declines over time to an ultimate level of 0.018 pounds per million Btu (lb/MMBtu) (equivalent to 15 ppmv) by 2005.

Under the "bubble" option, there are less stringent limits on each boiler class's NO_x emissions when burning oil instead of gas, and NO_x emissions when burning oil are excluded from the calculation of the overall pounds per million Btu emission factor achieved in any hour. However, other than very limited testing, oil burn is entirely prohibited except under *force majeure* natural gas curtailment. The declining NO_x emission rate limits under the "bubble" option of Regulation 9, Rule 11 are:

Year	Emissions in terms of pounds per million Btu
1997	0.188
1998	0.160
1999	0.115
2000	0.105
2002	0.057
2004	0.037
2005	0.018

Air Quality Trends for Criteria Pollutants

Table 4.5-4 shows the trends in emissions of ozone precursors (ROG and NO_x) and PM-10 for power plants in the Bay Area as predicted in the *'97 Clean Air Plan* and compares those emissions with total emissions for the Bay Area.[7] These emissions estimates reflect BAAQMD rules and regulations. Accordingly, NO_x emissions from power plants are predicted to decrease substantially from current levels due to the declining emissions limitations set forth in Regulation 9, Rule 11. The *'97 Clean Air Plan* also shows that ROG and PM-10 emissions from power plants decreased substantially between 1990 and 1997, because the compliance option selected by PG&E to comply with Regulation 9, Rule 11 includes a year-round prohibition on the use of fuel oil in the boilers as of 1995. The Plan predicts that ROG and PM-10 emissions from power plants will then increase slightly in the future because, unlike NO_x, emissions of these pollutants, would be roughly proportional to increases in electricity generation.

[7] The *'97 Clean Air Plan* reports emissions trends for the pollutants for which the Bay Area is "non-attainment," i.e., ozone and PM-10. The air quality impact analysis in this report also evaluates the other applicable criteria air pollutants, such as carbon monoxide and sulfur dioxide, that are not included in the *'97 Clean Air Plan* because the Bay Area is "attainment" with respect to ambient air quality standards for them.

TABLE 4.5-4
BAY AREA POWER PLANT AND REGION-WIDE EMISSIONS ESTIMATES, 1990, 1994, 1997, 2000, AND 2003

Source Category	Pollutant	1990	1994	1997	2000	2003
Emissions (tons per day)						
Power Plants	ROG	0.16	0.18	0.07	0.08	0.09
	NO_X	30.2	33.3	23.9	13.5	7.3
	PM-10	1.16	1.02	0.37	0.42	0.46
Total Bay Area	ROG	676	572	488	446	410
	NO_X	743	692	632	555	491
	PM-10	196	187	198	209	217
Power Plant Emissions (as percent of Bay Area)						
	ROG	0.02	0.03	0.01	0.02	0.02
	NO_X	4.06	4.81	3.78	2.43	1.49
	PM-10	0.59	0.55	0.19	0.20	0.21

SOURCE: Bay Area Air Quality Management District, *Bay Area '97 Clean Air Plan*, December 1997.

LAKE COUNTY AIR QUALITY MANAGEMENT DISTRICT

Two of the 14 operating units of the Geysers geothermal plant are located within the Lake County Air Basin (LCAB) under the jurisdiction of the Lake County Air Quality Management District (LCAQMD).

Regulations, Plans and Policies

As was shown in Table 4.5-2, Lake County is designated "attainment" for all state and national ambient air quality standards and for state visibility standards (California Air Resources Board, 1998). Lake County is alone among California counties with this status. The good air quality of the County is documented in Table 4.5-3, which summarizes the last three years of monitoring data. Due to its "attainment" status, LCAQMD has not been required to develop a regional air quality plan such as a SIP or Clean Air Plan. With regard to the new Federal PM-2.5 standards, the County believes that they are in attainment of the new standards, since measured PM-10 levels are below the allowed PM-2.5 levels. This will be verified in the next two years, when the County will be setting up a PM-2.5 monitoring station and will be comparing measured ambient air levels with the standards.

Lake County's *Comprehensive General Plan* recognizes good air quality as one of Lake County's most valuable resources and also recognizes the potential for degraded air quality in the Basin given that the topography of the Lake County Air Basin makes dispersion of pollutants difficult

under inversion conditions (Lake County, 1981). To protect and preserve Lake County's air quality, the *Comprehensive General Plan* calls for the County to encourage the use of the best available air pollution control technologies to maintain healthful air quality and high visibility standards.

LCAQMD regulates emissions from geothermal power plants through its permitting authority over stationary sources. Local regulations limit emissions of particulate matter for each operating unit to 40 pounds per hour, and hydrogen sulfide emissions are limited to 15 pounds per hour.

Air Quality Trends for Criteria Pollutants

Emissions trends for the Lake County Air Basin are shown in Table 4.5-5. The trends show that there will be emission reductions for most of the criteria pollutants in the region, mainly because of the use of less polluting vehicles in the future. The only pollutant showing an increase is PM-10, which is due principally to increases in area source emissions due to increases in vehicle-miles-traveled (VMT) and associated entrainment of dust from paved and unpaved roads.

TABLE 4.5-5
LAKE COUNTY POWER PLANT AND COUNTY-WIDE EMISSIONS ESTIMATES, 1995 AND 2010

Pollutant	Electric Utilities	Total Stationary Sources	Total Area Sources[a]	Total Mobile Sources	Total Natural Sources	Total
1995 Emissions (tons per year)						
Carbon Monoxide	0	3,103	5,110	20,805	5,110	34,128
Total Organic Gases	913	1,497	1,606	2,519	365	5,986
Reactive Organic Gases	110	548	1,059	2,300	365	4,271
Nitrogen Oxides	0	73	146	1,898	0	2,117
Sulfur Oxides	0	73	37	73	0	183
Particulate Matter (PM-10)	37	146	3,468	73	730	4,417
2010 Emissions (tons per year)						
Carbon Monoxide	0	3,285	6,205	14,600	5,110	29,200
Total Organic Gases	1,095	1,825	1,825	1,825	365	5,840
Reactive Organic Gases[b]	132	862	1,095	1,825	365	4,147
Nitrogen Oxides	0	73	365	1,095	0	1,533
Sulfur Oxides	0	73	37	73	0	183
Particulate Matter (PM-10)[b]	44	409	5,110	146	730	6,395

[a] Area-wide sources include such sources as solvent evaporation, residential fuel combustion, farming operations, construction and demolition, paved and unpaved road dust, fires, and waste burning and disposal.
[b] Data from the California Air Resources Board for electric utilities was adjusted to correct for missing values.

SOURCES: California Air Resources Board, California Emission Inventory Development and Reporting System (CEIDARS), updated through October 1997; California Air Resources Board, *Emission Inventory 1995*, November 1997.

NORTHERN SONOMA COUNTY AIR POLLUTION CONTROL DISTRICT

Regulations, Plans and Policies

Twelve of the operating units of the Geysers geothermal plant are located within the southern portion of the North Coast Air Basin under the jurisdiction of the Northern Sonoma County Air Pollution Control District (NSCAPCD). The Sonoma County portion of the North Coast Air Basin is "attainment" or "unclassified" for all state and national ambient air quality standards except for state standards for PM-10, for which it has been designated "non-attainment" (California Air Resources Board, 1998). State law does not require preparation of air quality plans to address "non-attainment" issues related to the state ambient standard for PM-10, and due to its "attainment" or "unclassified" status for the other criteria air pollutants, NSCAPCD has not been required to develop a regional air quality plan such as a SIP or Clean Air Plan. With regard to the new PM-2.5 standards, the air district cannot evaluate the attainment status of the region until PM-2.5 monitoring data are collected. This will be carried out when the County receives PM-2.5 monitoring equipment from the CARB. Since the region has been placed in the second tier for attainment classification by CARB, a PM-2.5 monitoring station will not be issued to the County until 1999 or 2000, after which the County will establish the attainment status.

The *Sonoma County General Plan* recognizes the importance of maintaining the good air quality that exists in the County (Sonoma County, 1989). Sonoma County identifies geothermal power plants in the Geysers as the largest stationary air pollutant source in the County and encourages adoption of standards, development of new technology, and retrofitting to reduce the air pollution resulting from geothermal development. Local NSCAPCD regulations limit emissions of particulate matter for each operating unit to 40 pounds per hour and hydrogen sulfide to 0.44 pounds per gross megawatt hour.

Air Quality Trends for Criteria Pollutants

Emissions trends for the North Coast Air Basin are shown in Table 4.5-6. The trends show that emissions of criteria pollutants, except for PM-10, will be reduced significantly by the year 2010. Similar to Lake County, PM-10 emissions are predicted to increase slightly because of growth in area source activities, including entrained road dust.

4.5.3 LOCAL SETTING

POTRERO POWER PLANT

Existing Local Air Quality

The BAAQMD operates a network of monitoring stations in the Bay Area that provide concentration data for both criteria air pollutants and toxic air contaminants.

Table 4.5-7 summarizes the past five years of criteria air pollutant concentration data collected at the closest air quality monitoring station, which is located on Arkansas Street in San Francisco, and compares that data with the corresponding state ambient air quality standards. This station is

TABLE 4.5-6
NORTH COAST AIR BASIN POWER PLANT AND REGION-WIDE EMISSIONS ESTIMATES, 1995 AND 2010

Pollutant	Electric Utilities	Total Stationary Sources	Total Area Sources[a]	Total Mobile Sources	Total Natural Sources	Total
1995 Emissions (tons per year)						
Carbon Monoxide	1,825	6,205	80,300	113,150	9,855	209,510
Total Organic Gases	5,475	24,455	11,680	11,680	1,460	49,275
Reactive Organic Gases	621	4,745	8,395	10,585	730	24,455
Nitrogen Oxides	694	2,665	621	16,060	0	19,345
Sulfur Oxides	365	730	146	803	0	1,679
Particulate Matter (PM-10)	402	1,679	23,725	657	1,460	27,521
2010 Emissions (tons per year)						
Carbon Monoxide	1,825	6,570	94,900	43,800	4,015	149,285
Total Organic Gases[b]	5,475	25,185	10,950	4,015	365	40,515
Reactive Organic Gases[b]	621	4,636	6,935	3,650	365	15,586
Nitrogen Oxides[b]	694	2,884	730	8,760	0	12,374
Sulfur Oxides[b]	365	730	0	730	0	1,460
Particulate Matter (PM-10)[b]	402	1,862	26,645	365	730	29,602

a Area-wide sources include such sources as solvent evaporation, residential fuel combustion, farming operations, construction and demolition, paved and unpaved road dust, fires, and waste burning and disposal.
b Data from the California Air Resources Board for electric utilities was adjusted to correct for missing values

SOURCES: California Air Resources Board, California Emission Inventory Development and Reporting System (CEIDARS), updated through October 1997; California Air Resources Board, *Emission Inventory 1995*, November 1997.

located approximately 1.1 miles northwest of the Potrero Power Plant. Table 4.5-7 indicates that, with the exception of PM-10, background concentrations do not currently violate ambient air quality standards. Exceedences of the state 24-hour PM-10 standard are recorded on occasion in San Francisco.

Based on a compilation of the past five years of PM-10 monitoring data from the Arkansas Street station, background 24-hour average PM-10 concentrations in San Francisco are less than or equal to 30 $\mu g/m^3$ approximately 69 percent of the time, less than or equal to 40 $\mu g/m^3$ approximately 85 percent of the time, and less than or equal to 50 $\mu g/m^3$ approximately 95 percent of the time. Concentrations of 30, 40 and 50 $\mu g/m^3$ correspond to 60 percent, 80 percent, and 100 percent of the state standard, respectively. This data compilation also indicates that nearly all exceedences of the state standard (i.e., concentrations higher than 50 $\mu g/m^3$) occur during the winter months of November, December, January and February, which do not correspond with the high load months, which are typically August and September.

TABLE 4.5-7
SAN FRANCISCO CRITERIA AIR POLLUTANT CONCENTRATIONS, 1993-1997

Pollutant	State Standard[c]	Monitoring Data by Year[a] 1993	1994	1995	1996	1997
Ozone:						
Highest 1-hr. average, ppm[b]	0.09	0.08	0.06	0.09	0.07	0.07
Number of exceedences[d]		0	0	0	0	0
Carbon Monoxide:						
Highest 1-hr. average, ppm	20	7	6	5	5	ND
Number of exceedences		0	0	0	0	
Highest 8-hr. average, ppm	9.0	5.1	4.5	4.4	3.9	3.5
Number of exceedences		0	0	0	0	0
Nitrogen Dioxide:						
Highest 1-hr. average, ppm	0.25	0.08	0.09	0.09	0.08	0.07
Number of exceedences		0	0	0	0	0
Sulfur Dioxide:						
Highest 1-hr. average, ppm	0.25	0.04	0.02	0.04	0.04	ND
Number of exceedences		0	0	0	0	
Particulate Matter (PM-10):						
Highest 24-hr. average, $\mu g/m^3$[b]	50	**69**	**93**	50	**71**	**81**
Exceedences/Samples[e]		5/61	6/61	0/61	2/61	3/61
Annual Geometric Mean, $\mu g/m^3$	30	25.1	24.7	22.1	21.4	22.5
Lead (Pb):						
Highest monthly average, $\mu g/m^3$[b]	1.5	0.02	0.03	0.02	0.01	0.01
Number of Exceedences[e]		0	0	0	0	0

a Data for all pollutants are from the Arkansas Street air quality monitoring station in San Francisco, which is located approximately 1.1 miles northwest of the Potrero Power Plant and 2.4 miles north-northwest of the Hunters Point Power Plant.

b ppm = parts per million; $\mu g/m^3$ = micrograms per cubic meter.

c State standard, not to be exceeded.

d Except for ozone, "number of exceedences" refers to the number of measured violations in a given year of the applicable standard. For ozone, "number of exceedences" refers to the number of days in a given year during which at least one hour exceeded the standard.

e PM-10 and Pb is usually measured every sixth day (rather than continuously like the other pollutants). For PM-10, "exceedences/samples" indicates the number of exceedences of the state standard that occurred in a given year and the total number of samples that were taken that year.

NOTE: ND = No data available. Values shown in **bold** type exceed the applicable standard.

SOURCE: California Air Resources Board, *California Air Quality Data*, 1993, 1994, 1995, 1996; Bay Area Air Quality Management District, *Contaminant & Weather Summary*, January through December 1997.

Table 4.5-8 summarizes the past two years of toxic air contaminant concentration data collected at the air quality monitoring station located on Arkansas Street in San Francisco and compares the data with the concentration data based on the entire regional network of toxic air contaminant monitoring stations in the Bay Area. Table 4.5-8 indicates that toxic air contaminant concentrations at the Arkansas Street station are similar to, or less than, the average concentrations of those pollutants measured at other stations in the Bay Area.

TABLE 4.5-8
SAN FRANCISCO TOXIC AIR CONTAMINANT CONCENTRATIONS, 1994-1995

Toxic Air Contaminant	San Francisco Station[a] Mean Concentration (ppb)[b,c] 1994	1995	As Percent of Bay Area Mean Concentration 1994	1995
Methylene Chloride	0.69	0.61	99%	35%
Chloroform	0.01	0.02	100%	100%
Methyl Chloroform	0.41	0.34	64%	76%
Carbon Tetrachloride	0.11	0.11	100%	100%
Trichloroethylene	< 0.08	< 0.08	100%	100%
Benzene	1.16	1.01	89%	91%
Perchloroethylene	0.17	0.14	68%	74%
Toluene	3.69	2.71	137%	115%
1,3-Butadiene	< 0.45	0.18	100%	95%

a Data for San Francisco is from the air quality monitoring station on Arkansas Street in San Francisco, which is located approximately 1.1 miles northwest of the Potrero Power Plant.
b ppb = parts per billion.
c "Mean Concentration" is the arithmetic average of the air samples collected in each of the given years at the 15 monitoring stations in the Bay Area. In calculating the mean, samples with concentrations less than the "level of detection" (LOD) were assumed to be equal to one-half the LOD concentration. Percentages below 100 percent indicate San Francisco levels are below the average levels in the Bay Area region. Percentages above 100 percent indicate San Francisco levels above the average for the Bay Area region.

SOURCES: Bay Area Air Quality Management District, Toxic Air Contaminant Control Program, *Annual Report, 1994*, August 1995; Bay Area Air Quality Management District, Toxic Air Contaminant Control Program, *Annual Report, 1995*, November 1996.

General Plant Characteristics

The Potrero power plant consists of four electricity-generating units. Unit 3 is a steam boiler, and Units 4, 5, and 6 are combustion turbines. (Units 1 and 2 have been retired.) Unit 3 is coupled to a single boiler, which is capable of burning natural gas or fuel oil; however, since 1995, only natural gas has been burned because of Regulation 9, Rule 11. Units 4, 5, and 6 burn only distillate. The power plant also includes a switchyard, a control building, fuel oil tanks, and a firewater tank. Each of these smaller sources emitted less than half a ton per year of any single

criteria pollutant and less than 50 pounds per year of any single toxic air contaminant in 1993 (Pacific Gas and Electric Company, 1995c).

Wind speeds at the plant average about eight miles per hour and are predominantly from the west. The area surrounding the project site includes heavy and light industrial land uses. The closest residences are located on Potrero Hill, approximately one-half mile to the west of the site.

Existing Emissions and Local Concentrations

Criteria Air Pollutant Emissions Estimates

The primary source of air pollutant emissions from the Potrero Power Plant is the combustion of fuel by the one steam boiler and three combustion turbines. Table 4.5-9 summarizes emissions estimates for the boiler and combustion turbines at the power plant for 1995, 1996, and 1997. The emissions from the plant depend on the capacity factor of each unit, which varies from year to year, and the emission rate of each unit, which is itself dependent upon the fuel that is combusted and the type of emissions control technology that has been installed.

TABLE 4.5-9
POTRERO POWER PLANT CRITERIA AIR POLLUTANT EMISSIONS, 1995, 1996, 1997

Pollutant	Emissions Estimates(tons per year)[a]			1997 Emissions As Percent[b] of:	
	1995	1996	1997	County	Region
Carbon Monoxide	356	413	373	0.6	0.05
Reactive Organic Gases	38	46	52	0.3	0.03
Nitrogen Oxides	766	883	609	4.9	0.37
Sulfur Oxides	14	24	66	1.9	0.17
Particulate Matter	34	41	49	0.4	0.03

a Emissions estimates are based on SERASYM™ results for 1999 described in Chapter 3 and Attachment G, as adjusted to reflect the types of emissions controls that were in place during the 1995-1997 period [based on a tentative schedule for implementation of retrofit controls (Pacific Gas and Electric Company, 1998a)] and to reflect the capacity factor of each unit during that period.

b Percentages are based on emissions inventory data for 1995 and 2000 (interpolated to 1997) that is included in the *BAAQMD CEQA Guidelines* (April 1996).

From 1991 to 1997, the annual capacity factor for Unit 3 (steam boiler) has varied from 39 percent to 68 percent, and the annual capacity factor for Units 4, 5, and 6 (combustion turbines) has varied from 0.3 percent to 6.0 percent. In 1997, Unit 3 was used approximately 39 percent of the time; Units 4, 5, and 6 were used approximately 5.4 percent of the time, collectively. Currently, the steam boiler burns only natural gas; fuel oil consumption by the boiler has dropped from 375,000 equivalent barrels (of energy) in 1989 to zero barrels in 1995.

With respect to emissions control technology, Unit 3 is subject to the requirements of BAAQMD Regulation 9, Rule 11, and under that rule, combustion modifications have been made to reduce NO_x emissions from that unit. Units 4, 5, and 6 are subject to the requirements of BAAQMD Regulation 9, Rule 9, and under that rule, they have been equipped with water injection systems. With these systems in place, Units 4, 5, and 6 comply with the rule by meeting a NO_x stack gas concentration limit of 65 ppm and by limiting the number of hours of operation per year to less than 877 (i.e., less than 10 percent capacity factor).

Table 4.5-9 also compares 1997 emissions from the plant with county-wide and regional emissions for that year. As shown in Table 4.5-9, the Potrero Power Plant accounted for under 1 percent of the County and Region's 1997 inventories of CO, ROG, and particulate matter, under 1 percent of the Region's inventory for NO_x and sulfur oxides, approximately 2 percent of the County's inventory for SO_x, and approximately 5 percent of the County's 1997 inventory of NO_x.

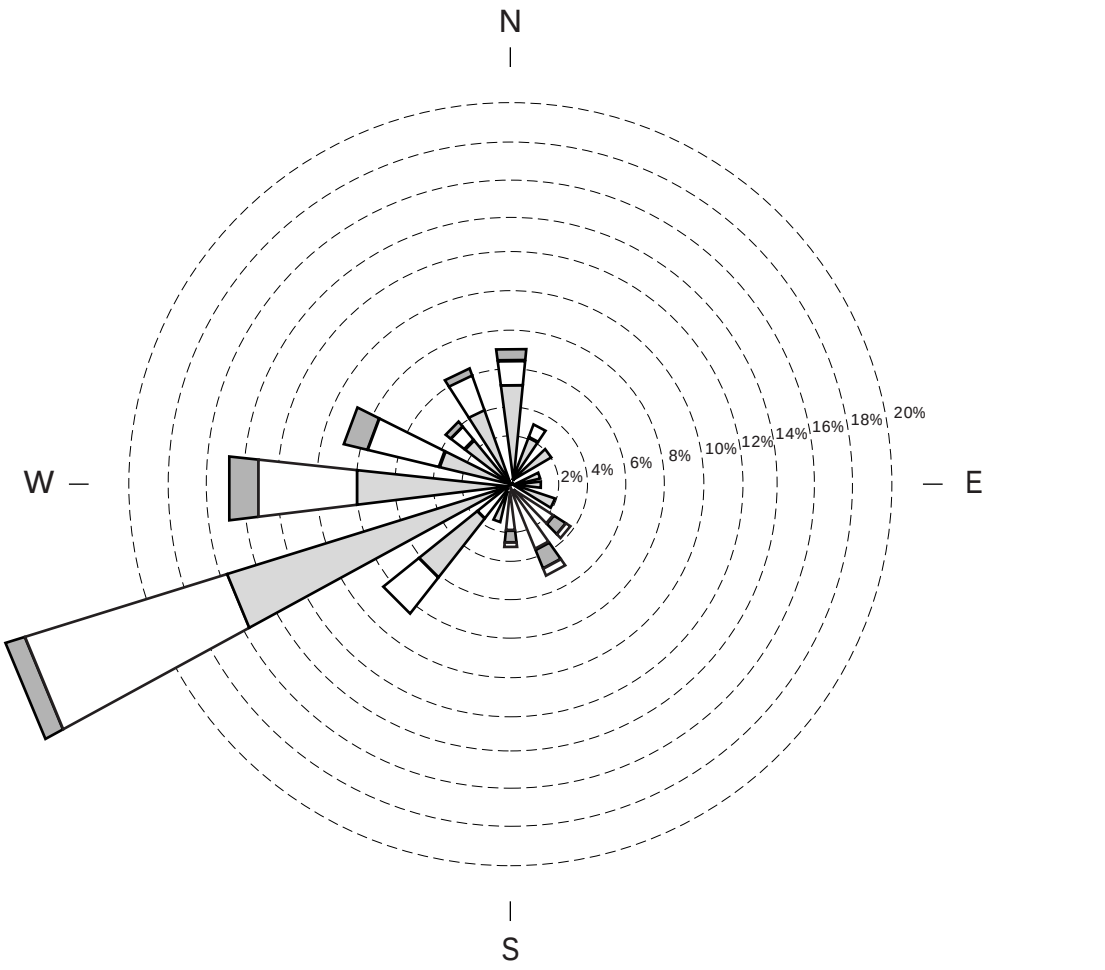
Local Criteria Air Pollutant Concentration Estimates

The power plant emissions contribute to ambient pollutant concentrations of criteria air pollutants in the plant vicinity. This local effect depends upon stack characteristics (such as the number of stacks, stack heights, stack gas exit temperature and velocity), local meteorology, as well as the overall amount of pollutants released. Figure 4.5-2 is a "wind rose" plot for the Potrero Power Plant showing the percentage of time from which the wind blows a given direction during a year. Impact 4.5-2, provided later in this Air Quality section, analyzes local pollutant concentrations with and without the project. As shown in the wind rose, the prevailing winds are from the southwest.

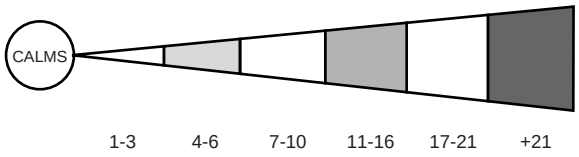
Toxic Air Contaminant Emissions and Associated Risk Level Estimates

Power plant emissions include toxic air contaminants as well as criteria air pollutants. Table 4.5-10 shows the trend in toxic air contaminant emissions from the power plant since 1987 and presents 1995 emissions as a percentage of county-wide emissions. As shown in Table 4.5-10, emissions of most types of toxic air contaminants from the power plant have decreased substantially since 1987, because of the reduction in the use of fuel oil.

Generally, the effects of emissions of toxic air contaminants are evaluated by preparing a health risk assessment, and a health risk assessment was carried out for the power plant in 1993 to comply with AB 2588, the Air Toxics "Hot Spots" regulation. Health risk assessments estimate the risk of cancer due to exposure to toxic air contaminant emissions and evaluates the potential for other (non-cancer) acute or chronic health effects that may be caused by facility emissions. The calculated health risk is the worst-case reasonably foreseeable risk, considering the inherent uncertainties and assumptions made for the assessment. Preparing a health risk assessment requires four analytical steps: (1) hazard identification (determining the hazardous emissions resulting from a facility), (2) dose-response assessment (evaluating the health effects of exposure to these emissions), (3) exposure assessment (estimating the possible level of exposure), and (4) risk characterization (integration of the first three steps to estimate risk). Each step of the



Calm Winds .60%



1-3 4-6 7-10 11-16 17-21 +21

Wind Speed Class (knots)

Plot shows direction winds are blowing from.

Figure 4.5-2
Annual Wind Rose Potrero
Power Plant 9/28/91 - 9/28/92

TABLE 4.5-10
POTRERO POWER PLANT TOXIC AIR CONTAMINANT EMISSIONS, 1987, 1990, 1992, 1995

Pollutant	Emissions (pounds per year)				1995 Emissions[a] As Percent of:	
	1987	1990	1992	1995	County	Region
Arsenic	18	4	2	--	ND	ND
Benzene	430	14	14	14	0.004	0.0005
Beryllium	5	--	0.06	--	ND	ND
Cadmium	17	--	0.19	--	ND	ND
Chromium (hexavalent)	< 1	0.4	0.23	--	ND	ND
Formaldehyde	530	230	190	150	0.01	0.002
Lead	28	--	--	--	ND	ND
Manganese	27	--	--	--	ND	ND
Mercury	4	--	--	--	ND	ND
Nickel	1,200	210	110	--	ND	ND
PAHs[b]	14	--	1	--	ND	ND

a County-wide and regional totals used to calculate these percentages include both stationary and mobile sources. Stationary source emissions are from the 1996 BAAQMD source listed below. Toxic air contaminant emissions estimates for mobile sources were made using regional volatile organic compound (VOC) emissions estimates and California Air Resources Board VOC speciation data.

b PAHs refer to polycyclic aromatic hydrocarbons.

NOTE: -- refers to emissions that were either zero or less than reportable quantities; ND = not determined.

SOURCES: Bay Area Air Quality Management District, *Air Toxics Emission Inventory for the San Francisco Bay Area, Status Report,* March 1989; Bay Area Air Quality Management District, Toxic Air Contaminant Control Program, *Annual Report, 1991*, August 1991; Bay Area Air Quality Management District, Toxic Air Contaminant Control Program, *Annual Report, 1993*, December 1993; Bay Area Air Quality Management District, Toxic Air Contaminant Control Program, *Annual Report, 1995*, November 1996.

process involves making assumptions that lead to uncertainties in the risk assessment. Due to the use of conservative assumptions, the final calculated risk number is likely to be an overestimate of the actual risk.

The first step in the analysis is to estimate the type and amounts of toxic air contaminant emissions. The plant's 1993 health risk assessment was based on 1989 emission data (Pacific Gas and Electric Company, 1993). The estimated emissions assumed that 17 percent of the total fuel consumed at the plant was oil (the maximum oil usage over the period of 1983 to 1991). In order to determine the health risks associated with the existing, 1999 baseline, 1999 A-Max and 2005 Cumulative A-Max scenarios, the emissions estimates of PG&E's 1993 health risk assessment were revised to reflect actual current, and projected conditions of fuel oil replaced by natural gas in the boilers because of BAAQMD Regulation 9, Rule 11.

The second step, dose-response assessment, consists of identifying the chronic and acute health effects of these hazardous emissions. This step in the assessment is done by using unit risk

values (for carcinogens) and acute and chronic reference exposure levels (for non-carcinogens) developed by government agencies. The updated health risk assessment presented in this EIR has used the latest available unit risk values and chronic-hazards reference exposure levels from the California Air Pollution Control Officer's Association and the latest acute-hazards reference exposure levels from the California EPA Office of Environmental Health Hazard Assessment.

The third step in the analysis, exposure assessment, is to determine the manner in which the public would be exposed to toxic air contaminants generated by the facility and the extent to which they would be exposed. The most direct exposure to toxic air emissions from the power plant would be via inhalation of ambient air. Other routes of exposure to toxic air contaminants include non-inhalation pathways such as dermal contact, ingestion of contaminated soil, and ingestion of contaminated crops.

The health risk assessments reported in this document for existing conditions, for the 1999 baseline, and for the 1999 and 2005 A-Max scenarios were calculated using dispersion models approved by the California Air Pollution Control Officers Association (CAPCOA).The modeling effort used actual meteorological data collected at each project site. For the purposes of the health risk assessment, the computer modeling seeks to find the location with the highest calculated ground-level concentration of the contaminants. A person at this point would have the greatest exposure to emissions from the plant. The hypothetical maximally exposed individual (MEI), whose exposure is used to evaluate the worst-case exposure level, would be located at this point. In residential areas, this MEI is assumed to be exposed to toxic air contaminant emissions for 24 hours per day, 365 days per year, for 70 years. In non-residential areas, where the exposure relates to an occupational setting, the MEI is assumed to be exposed for eight hours per day, 240 days per year, for 46 years. These levels of exposure are highly unlikely in actual situations, and are typical of standard conservative health risk assessment assumptions (California Air Pollution Control Officers Association, 1993).

For carcinogens, the health risk at the MEI receptor is normally expressed as the chance in a million that an individual would contract cancer if he or she were exposed to the estimated concentration for 46 or 70 years, depending on whether the MEI is a worker or a resident. If there were a one percent chance that an individual would contract cancer from exposure, the risk would be ten thousand in a million.

For non-cancer health effects, the potential for human health hazards is evaluated by calculating ratios ("hazard quotients") between the estimated level of exposure to reference doses for various substances. Reference doses for non-carcinogens are levels established by the scientific community and by State and Federal agencies responsible for protecting human health. Reference doses for some substances are based on observed effects on laboratory animals. Others have been derived from observed health effects on humans.

Reference doses for some substances are defined in the EPA's Integrated Risk Information System (IRIS). Others are based on calculations conducted by the California Office of Environmental Health Hazard Assessment, in which a 100-fold safety factor is applied to the threshold for "no observed effects level" (NOEL). When the ratio of the estimated concentration

level to the reference dose is less than 1.0, no health effect would be anticipated. In a conservative analysis, the ratios for the various substances considered are added together to obtain a "hazard index," which, when less than 1.0, would indicate no health effect. This method is intended to account for the possibility that more than one chemical could contribute to the same health effect. The final step, risk characterization, combines the information about pollutant concentrations and health effects of those pollutants to determine the potential cancer risk and chronic and acute health hazards that would result from a facility.

The updated health risk assessment conducted for this EIR adjusts the risks portrayed in PG&E's 1993 health risk assessment to reflect the changes from fuel oil to natural gas. under existing conditions. Applying this adjustment, the current estimate of the maximum cancer risk from existing plant emissions at offsite locations is significantly lower than one in a million (0.173 in a million). The contributions of the individual sources to cancer risks are shown in Table 4.5-11. There is no standard significance threshold for acceptable cancer health risks. However, several air pollution agencies in California, including the BAAQMD and the California Air Pollution Control Officer's Association (CAPCOA), consider an incremental risk from an existing facility to be acceptable if it is less than ten in a million. The ten in a million risk is therefore considered to be the significance threshold.

TABLE 4.5-11
POTRERO POWER PLANT HEALTH RISK ASSESSMENT

Source	Cancer Risk (in a million)[a]		Chronic Effects Hazard Index (HI)		Acute Effects HI
	Residential	Non-residential	Residential	Non-residential	Non-residential
Unit 3 (steam boiler)[b]	0.004911	0.001	—	—	—
Unit 4 (combustion turbine)	0.069	0.083	—	—	—
Unit 5 (combustion turbine)	0.039	0.029	—	—	—
Unit 6 (combustion turbine)	0.06	0.019	—	—	—
Total	0.173	0.132	<0.0165[c]	<0.0165[c]	<0.18[c]

a Pacific Gas and Electric Company, Potrero Power Plant, Air Toxics Hot Spots Risk Assessment, 1993.
b Adjusted to current condition of 100 percent natural gas use in Unit 3.
c Detail, by unit, was not provided in background document. Because of the low levels, only the total was reported.

SOURCE: Environmental Science Associates.

A study conducted by the San Francisco Department of Health (1995) reported that there were higher incidences than expected of breast and cervical cancer in the Bayview-Hunters Point Area in the years 1988-1992. A follow-up to the findings of this study was carried out by the California Department of Health Services (Glazer *et al.*, 1998). This follow-up study evaluated

the incidence of cancer in the same area for the period 1993-1995. The findings state that, for 1993-1995, the observed numbers of cancer among Bayview-Hunters Point residents were very similar to other regions of the Bay Area. According to the study, the observed increase during 1988-1992 may of been explained by increased breast cancer screening that was started in the late 1980s, in order to provide more opportunity for early detection.

For non-carcinogenic pollutants, the maximum exposure levels (adjusted for natural gas) beyond the plant boundaries were well below the level associated with adverse effects. The chronic hazard index for non-carcinogenic effects from the entire plant were estimated to be less than 0.02 at the location of maximum pollutant concentrations. Since this total level is well below the "safe level" index of 1.0, the contributions of the individual units at the plant were not reported in the Table 4.5-11. The maximum hazard index for acute exposure to non-carcinogenic substances was calculated to be less than 0.18, which also is well below the significance threshold of 1.0.

Health Effects from Particulate Matter Emissions

Over the past 10 to 20 years, there have been a number of health studies that show relationships between exposure to particulate matter in the ambient air and adverse health outcomes including: respiratory and cardiac hospital admissions, emergency room visits, lower-respiratory illness for children, asthma attacks, chronic disease, and in some cases, mortality. Most of these studies have shown relationships between particulate matter exposure and respiratory effects during air pollution episodes in major metropolitan areas, where daily ambient air concentrations exceeded 300 $\mu g/m^3$. The relationship is not as clear for exposure to moderate levels of particulate matter as are measured in San Francisco.

A draft study released by the Bayview Hunters Point Health and Environmental Assessment Task Force (Aragon and Grumbach, 1997) reported that hospitalization rates for asthma, hypertension, diabetes and congestive heart failure are higher in this area than any other part of San Francisco. However, the draft study does not identify the cause(s) of the observed increased respiratory problems, and does not consider individual pollutant exposure. To better understand the causes of the increased incidences, a detailed study would have to be carried out that can characterize individual exposure. Without a detailed study, only inferences can be made regarding the relationship between industrial emissions, vehicle emissions, other sources, and respiratory problems in the area. Because the Potrero Power Plant is close to the Bayview-Hunters Point area and to other nearby sensitive receptors, a detailed dispersion modeling analysis of PM-10 emissions was conducted to determine the respiratory effects on residents in the area. These impacts are reported in Impact 4.5-2 (impacts of criteria pollutant emissions).

Studies cited by EPA (Schwartz, 1996; Pope *et al.*, 1992; Dockery *et al.*, 1992; Schwartz, 1993; Ito and Thurston, 1996; Kinney *et al.*, 1995) show significant relationships between respiratory illness and symptoms and exposure to total suspended particulates (TSP) and some studies show similar relationships from exposure to smaller particles, including particulate matter less than 10 microns in size (PM-10) and fine particles (PM-2.5).

As stated earlier, emissions from the combustion of natural gas and distillate at the PG&E plants are particulate matter typically less than 2.5 microns in size. There are no data on background ambient air concentrations of PM-2.5 in the area, because the new Federal Standard has only recently been adopted by EPA, and monitoring for PM-2.5 has not been undertaken yet. Since background levels of PM-2.5 are not known, the impacts of particulate matter emissions on ambient air standards will be evaluated with respect to estimated PM-10 levels instead of PM-2.5. However, the effects on health through changes in hospitalizations from respiratory effects can be evaluated for PM-2.5, because of recent studies reported by EPA on the health effects from increased exposure to PM-2.5. will be evaluated with respect to acceptable levels for PM-10 and for PM-2.5.

With regard to PM-10, an EPA staff report summarized the relative risk values based on increased hospital admissions for the elderly for increases in 24-hr PM-10 concentrations at a number of U.S. cities (U.S. Environmental Protection Agency, 1996). The relative risk values showed a 6 to 8 percent increase in hospitalizations for respiratory disease per 50 $\mu g/m^3$increase in ambient air concentrations. Typical annual average concentrations of PM-10 at these cities ranged from 18 to 58 $\mu g/m^3$, and maximum daily concentrations ranged from 80 to 365 $\mu g/m^3$.

With regard to fine particles (PM-2.5), several studies cited in the EPA report indicate that significant increased hospitalization and respiratory symptoms occur when PM-2.5 24-hour concentrations increase by 20 to 25 $\mu g/m^3$ (Schwartz *et al.*, 1994; 1996; Thurston *et al.*, 1992, 1994). More recent information has shown increases in hospitalizations for an annual average increase of 10 $\mu g/m^3$ (private communication with N. Schwartz, Harvard School of Public Health, July 1998).

The maximum 24-hr average contribution of PM-10 and of PM-2.5 are assumed to be the same, because nearly all particles emitted from natural gas combustion in boilers and from distillate combustion in CTs are smaller than 2.5 microns. Estimated contributions of PM-10 from the fossil fuel plants under baseline conditions, and under the 1999 A-Max scenarios are reported under impacts, later in this section.

CONTRA COSTA POWER PLANT

Existing Local Air Quality

Table 4.5-12 summarizes the past five years of criteria air pollutant concentration data collected at the air quality monitoring station located on Bethel Island Road, east of Oakley in eastern Contra Costa County and compares the data with the corresponding state ambient air quality standards. The pollutant concentrations measured at this station reflect local pollutant sources as well as emissions sources to the west and south whose emissions are blown into the Delta region by prevailing winds. This station is located on Bethel Island Road, which is located approximately seven miles east of the Contra Costa Power Plant. Table 4.5-12 shows that violations of the state ambient ozone standard occur on an average of approximately 5 days per year. Table 4.5-12 also shows that background PM-10 concentrations violate the state 24-hour standard on occasion.

TABLE 4.5-12
BETHEL ISLAND CRITERIA AIR POLLUTANT CONCENTRATIONS, 1993-1997

Pollutant	State Standard[c]	Monitoring Data by Year[a] 1993	1994	1995	1996	1997
Ozone:						
Highest 1-hr. average, ppm[b]	0.09	**0.11**	**0.11**	**0.13**	**0.14**	**0.10**
Number of exceedences[d]		3	3	6	6	1
Carbon Monoxide:						
Highest 1-hr. average, ppm	20	3	2	3	3	ND
Number of exceedences		0	0	0	0	
Highest 8-hr. average, ppm	9.0	2.0	1.9	1.9	1.5	1.5
Number of exceedences		0	0	0	0	0
Nitrogen Dioxide:						
Highest 1-hr. average, ppm	0.25	0.07	0.07	0.06	0.06	0.05
Number of exceedences		0	0	0	0	0
Sulfur Dioxide:						
Highest 1-hr. average, ppm	0.25	0.02	0.02	0.02	0.01	ND
Number of exceedences		0	0	0	0	
Particulate Matter (PM-10):						
Highest 24-hr. average, $\mu g/m^3$[b]	50	**71**	**65**	**73**	**76**	**77**
Exceedences/Samples[e]		6/61	3/60	3/61	1/61	2/61
Annual Geometric Mean, $\mu g/m^3$	30	19.4	19.6	19.4	18.8	19.6
Lead (Pb):						
Highest monthly average, $\mu g/m^3$[b]	1.5	0.01	0.01	ND	ND	ND
Number of Exceedences[e]		0	0			

a Data for all pollutants are from the air quality monitoring station on Bethel Island Road, which is located approximately 7 miles east of the Contra Costa Power Plant.
b ppm = parts per million; $\mu g/m^3$ = micrograms per cubic meter.
c State standard, not to be exceeded.
d Except for ozone, "number of exceedences" refers to the number of measured violations in a given year of the applicable standard. For ozone, "number of exceedences" refers to the number of days in a given year during which at least one hour exceeded the standard.
e PM-10 and Pb are usually measured every sixth day (rather than continuously like the other pollutants). For PM-10, "exceedences/samples" indicates the number of exceedences of the state standard that occurred in a given year and the total number of samples that were taken that year.

NOTE: ND = No data available. Values shown in **bold** type exceed the applicable standard.

SOURCE: California Air Resources Board, *California Air Quality Data*, 1993, 1994, 1995, 1996; Bay Area Air Quality Management District, *Contaminant & Weather Summary*, January through December 1997.

Based on a compilation of the past five years of PM-10 monitoring data from the Bethel Island Road station, background 24-hour average PM-10 concentrations in the Delta region are less than or equal to 30 $\mu g/m^3$ approximately 82 percent of the time, less than or equal to 40 $\mu g/m^3$ approximately 89 percent of the time, and less than or equal to 50 $\mu g/m^3$ approximately 95 percent of the time. Concentrations of 30, 40 and 50 $\mu g/m^3$ correspond to 60 percent, 80 percent, and 100 percent of the state standard, respectively. This data compilation also indicates that nearly all exceedences of the state standard (i.e., concentrations higher than 50 $\mu g/m^3$) occur late in the year during the months of October, November, and December.

Table 4.5-13 summarizes the past two years of toxic air contaminant concentration data collected at the air quality monitoring station located on West 10th Street in Antioch and compares the data with the concentration data based on the entire regional network of toxic air contaminant monitoring stations in the Bay Area. The monitoring station in Antioch is located approximately 3.1 miles west of the Contra Costa Power Plant (and 4.3 miles east-southeast of the Pittsburg Power Plant). Table 4.5-13 indicates that toxic air contaminant concentrations at the Antioch station are similar to the average concentrations of those pollutants measured at other stations in the Bay Area. Average concentrations in Antioch are higher than the Bay Area average for some toxic air contaminants, such as chloroform and carbon tetrachloride, and are lower for others, such as methylene chloride and methyl chloroform.

General Plant Characteristics

The Contra Costa Power Plant consists of two operational electricity-generating units. Unit 6 and Unit 7 are both steam turbines, and they are each coupled to a single boiler. Units 1 through 5 are retired and are incapable of operating to generate electricity; however, Units 4 and 5 have been reconfigured to operate as synchronous condensers to help the electrical grid respond to changing system conditions and upsets. Units 4 and 5 do not generate air pollution or electricity when operating in synchronous mode. The Contra Costa Power Plant also includes an electric switchyard, buildings for offices and turbine generators, cooling water intake structures and discharge canals, and a fuel tank farm consisting of fuel oil tanks, pipelines, and an inactive marine terminal. Units 6 and 7 are capable of burning natural gas or fuel oil; however, fuel oil is no longer used at the plants except in the event of a natural gas curtailment.

Wind speeds at the plant average about 8 miles per hour in Martinez and 9 to 10 mph farther east, and prevailing winds are from the west. The area surrounding the project site includes industrial, commercial, and agricultural land uses. A yacht harbor borders the plant to the east, and a Pacific Service Employees Association recreational facility lies to the northeast. The City of Antioch is located to the east of the site, and the City of Oakley is located to the west.

Existing Emissions

Criteria Air Pollutant Emissions Estimates

The primary source of air pollutant emissions from the Contra Costa power plant is the combustion of fuel by the boilers. Other contributors to air emissions include lube oil and distillate storage tanks, a gasoline dispensing facility, boiler standby equipment (distillate fire

TABLE 4.5-13
ANTIOCH TOXIC AIR CONTAMINANT CONCENTRATIONS, 1994-1995

Toxic Air Contaminant	Antioch Station[a] Mean Concentration (ppb)[b,c] 1994	1995	As Percent of Bay Area Mean Concentration[c,d] 1994	1995
Vinyl Chloride	< 0.30	< 0.30	100%	100%
Methylene Chloride	0.35	0.33	50%	19%
Chloroform	0.02	0.03	200%	150%
Ethylene Dichloride	< 0.10	< 0.10	100%	100%
Methyl Chloroform	0.27	0.25	42%	56%
Carbon Tetrachloride	0.13	0.14	118%	127%
Trichloroethylene	0.04	0.08	80%	133%
Benzene	1.10	0.73	85%	66%
Ethylene Dibromide	< 0.02	< 0.02	100%	100%
Perchloroethylene	0.12	0.07	48%	37%
Toluene	1.85	1.34	69%	57%
1,3-Butadiene	0.29	0.16	88%	84%

a Data for Antioch is from the air quality monitoring station on West 10th Street, which is located approximately 4.3 miles east-southeast of the Pittsburg Power Plant and 3.1 west of the Contra Costa Power Plant.
b ppb = parts per billion.
c "Mean Concentration" is the arithmetic average of the air samples collected in each of the given years at the 15 monitoring stations in the Bay Area. In calculating the mean, samples with concentrations less than the "level of detection" (LOD) were assumed to be equal to one-half the LOD concentration.
d Percentages below 100 percent indicate Antioch levels are below the average levels in the Bay Area region. Percentages above 100 percent indicate Antioch levels above the average for the Bay Area region.

SOURCES: Bay Area Air Quality Management District, Toxic Air Contaminant Control Program, *Annual Report, 1994*, August 1995; Bay Area Air Quality Management District, Toxic Air Contaminant Control Program, *Annual Report, 1995*, November 1996.

engine and mobile combustion turbine), solvent cleaning operations, maintenance coating operations, a wastewater treatment facility, sandblasting, and miscellaneous sources. Each of these minor sources emit less than a half ton per year of any single criteria pollutant and less than 50 pounds per year of any single toxic air contaminant under existing operations in the year 1993 (Pacific Gas and Electric Company, 1995a).

Table 4.5-14 shows emissions estimates for the boilers at Contra Costa power plant for 1995, 1996, and 1997. The emissions from the plant depend on the capacity factor of each unit, which varies from year to year, and the emission rate of each unit, which is itself dependent upon the fuel that is consumed and the type of emission control technology that has been installed. From 1991 through 1997, the average annual capacity factor for Units 6 and 7 was approximately 38 percent, with a range from approximately 20 percent to 58 percent. In 1997, the capacity factor was 24 percent. Currently, the boilers associated with Units 6 and 7 burn only natural gas;

TABLE 4.5-14
CONTRA COSTA POWER PLANT CRITERIA AIR POLLUTANT EMISSIONS, 1995, 1996, 1997

Pollutant	Emissions Estimates (tons per year)[a]			1997 Emissions As Percent[b] of:	
	1995	1996	1997	County	Region
Carbon Monoxide	498	608	585	0.4	0.07
Reactive Organic Gases	51	62	60	0.2	0.03
Nitrogen Oxides	744	922	593	1.3	0.36
Sulfur Oxides	6	8	7	< 0.1	0.02
Particulate Matter	46	56	54	0.2	0.03

a Emissions estimates are based on SERASYM™ results for 1999 described in Chapter 3 and Attachment G, as adjusted to reflect the types of emissions controls that were in place during the 1995-1997 period [based on a tentative schedule for implementation of retrofit controls (Pacific Gas and Electric Company, 1998a)] and to reflect the capacity factor of each unit during that period.

b Percentages are based on emissions inventory data for 1995 and 2000 (interpolated to 1997) that is included in the *BAAQMD CEQA Guidelines* (April 1996).

fuel oil consumption at Contra Costa power plant has dropped from 667,000 equivalent barrels (of energy) in 1989 to zero barrels in 1995.

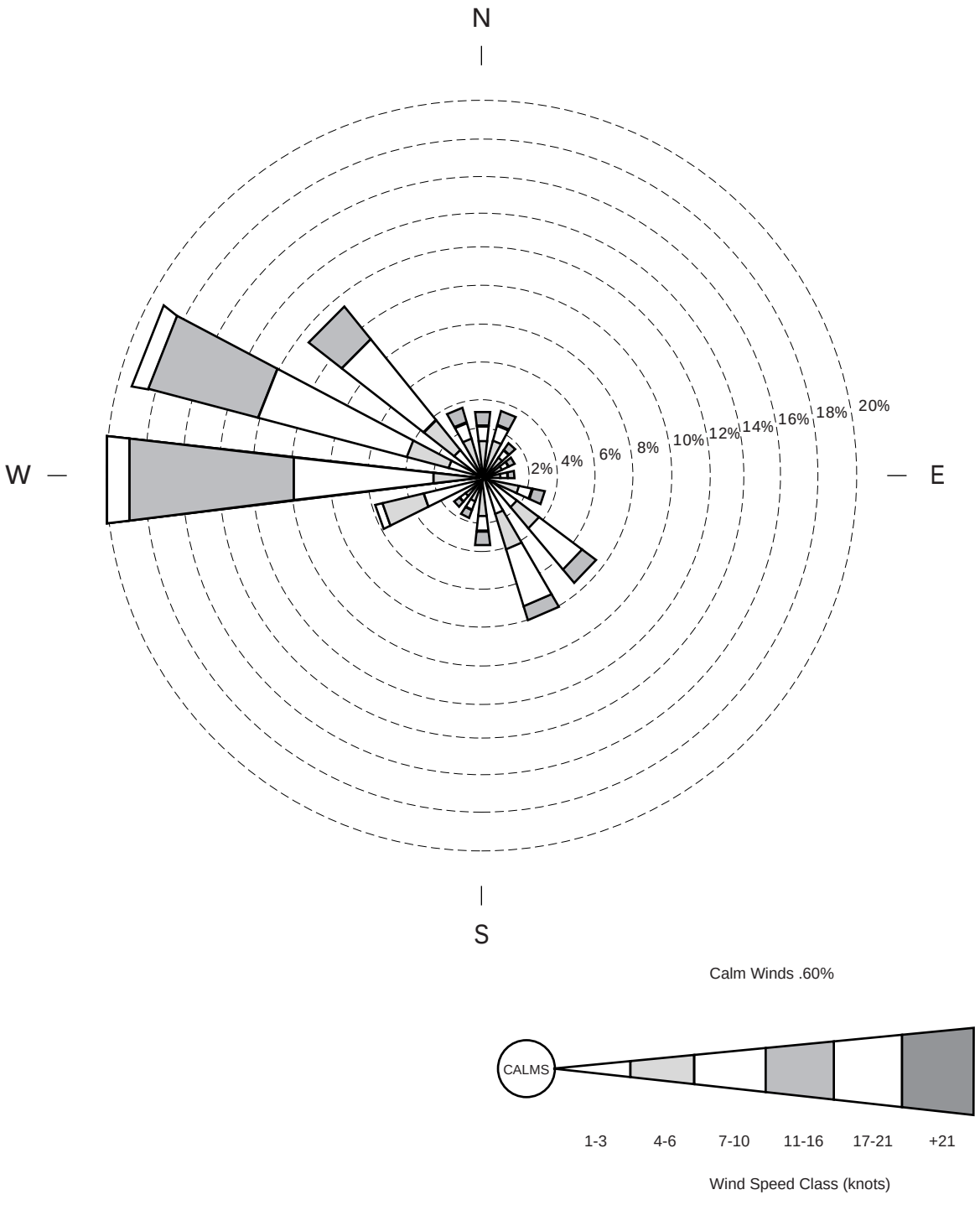
With respect to emissions control technology, Units 6 and 7 are subject to the requirements of BAAQMD Regulation 9, Rule 11. Specifically, low-NO_x burners were installed on the boiler associated with Unit 7 in 1997, and combustion modifications are planned for installation on the boiler associated with Unit 6 in 1998.

Table 4.5-14 also compares 1997 emissions from the plant with county-wide and regional emissions for that year. As indicated in Table 4.5-14, the Contra Costa Power Plant accounted for approximately 1.3 percent of Contra Costa County's 1997 inventory of NO_x.

Local Criteria Air Pollutant Concentration Estimates

The power plant emissions contribute to ambient pollutant concentrations of criteria air pollutants in the plant vicinity. This local effect depends upon stack characteristics (such as the number of stacks, stack heights, stack gas exit temperature and velocity), local meteorology, as well as the overall amount of pollutants released.

Figure 4.5-3 is a wind rose plot of the Contra Costa Power Plant showing the percentage of time from which the wind blows a given direction during a year. Impact 4.5-2, provided later in this Air Quality section, analyzes local concentrations of criteria air pollutants with and without the project.



NOTE: Measurements taken at Louisiana Pacific Facility

Figure 4.5-3
Annual Wind Rose Contra Costa
Power Plant 1983 Met Data

Toxic Air Contaminant Emissions and Associated Risk Level Estimates

Table 4.5-15 shows the trend in toxic air contaminants from the Contra Costa power plant since 1987 and presents 1995 emissions as a percentage of county-wide and region-wide emissions. As shown in Table 4.5-15, emissions of most types of toxic air contaminants have decreased substantially since 1987, primarily due to the reduced use of fuel oil to operate the boilers.

TABLE 4.5-15
CONTRA COSTA POWER PLANT TOXIC AIR CONTAMINANT EMISSIONS, 1987, 1990, 1992, 1995

Pollutant	Emissions (pounds per year) 1987	1990	1992	1995	1995 Emissions[a] As Percent of: County	Region
Arsenic	15	28	5	--	ND	ND
Benzene	220	410	36	39	0.009	0.001
Beryllium	3	--	0.15	--	ND	ND
Cadmium	12	3	0.47	--	ND	ND
Chromium (hexavalent)	< 1	3	0.56	--	ND	ND
Formaldehyde	320	1,000	490	410	0.03	0.005
Lead	22	66	--	--	ND	ND
Manganese	20	--	--	--	ND	ND
Mercury	3	72	--	--	ND	ND
Nickel	980	1,500	280	--	ND	ND
PAHs[b]	7	--	3	--	ND	ND
Toluene	--	1,900	--	--	ND	ND
Xylene	--	410	--	--	ND	ND
Zinc	--	440	--	--	ND	ND

a County-wide and regional totals used to calculate these percentages include both stationary and mobile sources. Stationary source emissions are from the 1996 BAAQMD source listed below. Toxic air contaminant emissions estimates for mobile sources were made using regional volatile organic compound (VOC) emissions estimates and California Air Resources Board VOC speciation data.

b PAHs refers to polycyclic aromatic hydrocarbons.

NOTE: -- refers to emissions that were either zero or less than reportable quantities; ND = not determined.

SOURCES: Bay Area Air Quality Management District, *Air Toxics Emission Inventory for the San Francisco Bay Area, Status Report*, March 1989; Bay Area Air Quality Management District, Toxic Air Contaminant Control Program, *Annual Report, 1991*, August 1991; Bay Area Air Quality Management District, Toxic Air Contaminant Control Program, *Annual Report, 1993*, December 1993; Bay Area Air Quality Management District, Toxic Air Contaminant Control Program, *Annual Report, 1995*, November 1996.

PG&E conducted a health risk assessment to comply with AB 2588. The health risk assessment for the plant was based on 1989 emission data (Pacific Gas and Electric Company, 1992a). Dispersion modeling in the health risk assessment used hourly meteorological measurements that were taken for a year at the nearby Louisiana Pacific plant. Figure 4.5-3 shows a wind rose plot for this location.

The AB 2588 health risk assessment assumed that 12.8 percent of the total fuel consumed at the plant was oil (the maximum oil usage over the period of 1983 to 1991).

Results of the health risk assessment indicate that the maximum impact from toxic air contaminant emissions occurs within the plant site. The maximum cancer risk for off-site exposure was calculated to be 0.17 in a million. This occurred in an industrial area. Over 99.7 percent of the excess cancer risk was attributed to benzene from gasoline storage and dispensing, rather than from electricity generation (Pacific Gas and Electric Company, 1992a). Since 1996, benzene emissions from gasoline have been reduced by 25 percent to 40 percent because of the State Clean Fuels program. Thus, exposure to benzene would be reduced significantly, resulting in the total cancer risk at the maximum receptor to be reduced to 0.1 in a million. The maximum contribution from the steam boilers was estimated to be significantly lower than from gasoline handling. Adjusting the AB 2588 study for the use of natural gas results in a maximum risk from the steam boilers of 0.05 in a million, at a different location approximately one-half mile east of the plant.

The AB 2588 health risk assessment found both the chronic and acute hazard indices to be approximately 0.02, well below the significance threshold of 1.0.

PITTSBURG POWER PLANT

Existing Local Air Quality

Table 4.5-16 summarizes the past five years of criteria air pollutant concentration data collected at the air quality monitoring station located on West 10th Street in Pittsburg, and compares the data with the corresponding state ambient air quality standards. The pollutant concentrations measured at this station reflect local pollutant sources as well as emissions sources to the west and south whose emissions are blown into the Carquinez Strait by prevailing winds. This station is located approximately 0.7 miles south of the Pittsburg Power Plant. Table 4.5-16 shows that ozone concentrations are similar to those measured on Bethel Island and that violations of the ambient ozone standard occur on an average of approximately four to five days per year. While PM-10 is not measured at the Pittsburg station, background PM-10 concentrations probably violate the state 24-hour standard on occasion given the region-wide extent of PM-10 exceedences (see Table 4.5-3).

General Plant Characteristics

The Pittsburg power plant consists of seven electricity-generating units. Each of these units is a steam turbine with is coupled to a single boiler. Other facilities at the plant include an electric switchyard, cooling water intake structures, a cooling water canal and a cooling tower, and a fuel farm consisting of fuel oil tanks, an offsite pipeline terminus, and a marine terminal. While two of the seven boilers are permitted to burn either natural gas or fuel oil, all of them currently burn only natural gas (because of restrictions in BAAQMD Regulation 9, Rule 11).

TABLE 4.5-16
PITTSBURG CRITERIA AIR POLLUTANT CONCENTRATIONS, 1993-1997

Pollutant	State Standard[c]	Monitoring Data by Year[a] 1993	1994	1995	1996	1997
Ozone:						
Highest 1-hr. average, ppm[b]	0.09	**0.13**	**0.11**	**0.12**	**0.12**	0.07
Number of exceedences[d]		4	3	8	5	0
Carbon Monoxide:						
Highest 1-hr. average, ppm	20	6	6	6	7	ND
Number of exceedences		0	0	0	0	
Highest 8-hr. average, ppm	9.0	2.8	3.5	2.8	2.9	3.5
Number of exceedences		0	0	0	0	0
Nitrogen Dioxide:						
Highest 1-hr. average, ppm	0.25	0.08	0.08	0.08	0.07	0.07
Number of exceedences		0	0	0	0	0
Sulfur Dioxide:						
Highest 1-hr. average, ppm	0.25	0.05	0.03	0.04	0.03	ND
Number of exceedences		0	0	0	0	
Lead (Pb):						
Highest monthly average, $\mu g/m^3$[b]	1.5	0.06	0.04	0.06	0.02	0.01
Number of exceedences		0	0	0	0	0

a Data for all pollutants are from the air quality monitoring station in Pittsburg, which is located approximately 0.7 miles south of the Pittsburg Power Plant. PM-10 is not monitored at the station in Pittsburg.
b ppm = parts per million; $\mu g/m^3$ = micrograms per cubic meter.
c State standard, not to be exceeded.
d Except for ozone, "number of exceedences" refers to the number of measured violations in a given year of the applicable standard. For ozone, "number of exceedences" refers to the number of days in a given year during which at least one hour exceeded the standard.

NOTE: ND = No data available. Values shown in **bold** type exceed the applicable standard.

SOURCE: California Air Resources Board, *California Air Quality Data*, 1993, 1994, 1995, 1996; Bay Area Air Quality Management District, *Contaminant & Weather Summary*, January through December 1997.

Wind speeds at the plant average about 8 miles per hour in Martinez and 9 to 10 mph farther east, and prevailing winds are from the west. The area surrounding the project site includes light industry, residential property, commercial property, and boat harbors.

Existing Emissions

Criteria Air Pollutant Emissions Estimates

The primary source of air pollutant emissions from the Pittsburg power plant is the combustion of fuel by the boilers. Other contributors to air emissions include storage tanks for organic liquids, a gasoline service station, sandblasting operations, solvent cleaning operations, maintenance coating operations, oil-water separating operations, and miscellaneous sources. Each of these other sources (i.e., not including the boilers) emitted less than a ton per year of any single criteria pollutant and less than 50 pounds per year of any single toxic air contaminant in the year 1993 (Pacific Gas and Electric Company, 1995c).

Table 4.5-17 shows emissions estimates for the boilers at the Pittsburg power plant for 1995, 1996, and 1997. The emissions from the plant depend on the capacity factor of each unit, which varies from year to year, and the emission rate of each unit, which is itself dependent upon the fuel that is combusted and the type of emissions control technology that has been installed.

TABLE 4.5-17
PITTSBURG POWER PLANT CRITERIA AIR POLLUTANT EMISSIONS, 1995, 1996, 1997

Pollutant	Emissions Estimates (tons per year)[a]			1997 Emissions As Percent[b] of:	
	1995	1996	1997	County	Region
Carbon Monoxide	1,619	1,278	1,795	1.3	0.22
Reactive Organic Gases	162	129	180	0.5	0.10
Nitrogen Oxides	2,019	1,671	1,944	4.4	1.19
Sulfur Oxides	19	15	21	0.1	0.06
Particulate Matter	145	115	161	0.6	0.09

a Emissions estimates are based on SERASYM™ results for 1999, as adjusted to reflect the types of emissions controls that were in place during the 1995-1997 period [based on a tentative schedule for implementation of retrofit controls (Pacific Gas and Electric Company, 1998a)] and to reflect the capacity factor of each unit during that period.

b Percentages are based on emissions inventory data for 1995 and 2000 (interpolated to 1997) that is included in the *BAAQMD CEQA Guidelines* (April 1996).

From 1991 through 1997, the annual capacity factor for Units 1 through 4 (i.e., the 170 MW steam turbines) varied from 4 to 36 percent; the annual capacity factor for Units 5 and 6 (the 330 MW steam turbines) varied from 25 to 59 percent; and the annual capacity factor for Unit 7 (the 720 MW steam turbine) varied from 17 to 71 percent. Over that same period, the average annual capacity factor was approximately 18 percent for Units 1 through 4, 36 percent for Units 5 and 6, and 46 percent for Unit 7. In 1997, the utilization rate was approximately 5 percent for Units 1 through 4; 25 percent for Units 5 and 6, and 37 percent for Unit 7. Currently, the boilers at the Pittsburg power plant burn only natural gas, although two of the boilers are permitted to burn fuel oil. Fuel oil consumption by the boilers at the Pittsburg plant has dropped from 1.5 million equivalent barrels of energy in 1989 to zero barrels in 1995.

With respect to emissions control technology, all of the units at the Pittsburg power plant are subject to the requirements of BAAQMD Regulation 9, Rule 11. Under this Rule, combustion modifications have been made to Units 5 (in 1997), 6 (in 1996), and 7 (in 1997). Similar combustion modifications are planned for installation in 1998 for Units 1 through 4.

Table 4.5-17 also compares 1997 emissions from the plant with county-wide and regional emissions for that year. The Pittsburg Power Plant accounted for approximately four percent of Contra Costa County's 1997 inventory of NO_x.

Local Criteria Air Pollutant Concentration Estimates

The existing power plant emissions contribute to ambient pollutant concentrations of criteria air pollutants in the plant vicinity. This local effect depends upon stack characteristics (such as the number of stacks, stack heights, stack gas exit temperature and velocity), local meteorology, as well as the overall amount of pollutants released.

Toxic Air Contaminant Emissions and Associated Risk Level Estimates

Power plant emissions include toxic air contaminants as well as criteria air pollutants. Table 4.5-18 shows emissions of toxic air contaminants from the Pittsburg plant for previous years. Most of the toxic metal emissions reported in Table 4.5-18 for the years 1987 to 1992 were the result of burning oil rather than natural gas. With the elimination of fuel oil and the increased use of natural gas, toxic metal emissions decreased significantly, and emissions of formaldehyde increased. As shown in Table 4.5-18, formaldehyde emissions, which are a by-product of natural gas combustion, generated at the Pittsburg Power Plant in 1995 have been estimated to represent approximately one percent of County-wide formaldehyde emissions. Figure 4.5-4 is a wind rose plot for the Pittsburg Power Plant.

The plant's health risk assessment was based on 1989 emission data (Pacific Gas and Electric Company, 1992b). The dispersion modeling in the health risk assessment used hourly meteorological measurements taken at the Pittsburg Power Plant. The assessment assumed that 11.7 percent of the total fuel consumed at the plant was oil (the maximum oil usage over the period of 1983 to 1991). Results of the health risk assessment indicate that the maximum impacts from toxic air contaminant emissions occur within the plant site, for which the maximum lifetime exposure duration is considered to be eight hours/day, 240 days/year, for 46 years, or 14.4 percent of the maximum residential lifetime exposure of 24 hours/day, 365 days/year for 70 years.

The excess cancer risk attributed to plant emissions for 1989 emissions was calculated to be 4.5 excess cancer cases per million workers exposed for a lifetime at the location of maximum non-residential exposure. Most of this incremental worker risk was due to exposure to gasoline vapors from a vehicle refueling station on the property.

For the maximum residential exposure (lower concentration, but longer exposure) the maximum individual excess cancer risk was calculated to be 0.50 in a million.

TABLE 4.5-18
PITTSBURG POWER PLANT TOXIC AIR CONTAMINANT EMISSIONS, 1987, 1990, 1992, 1995

Pollutant	Emissions (pounds per year) 1987	1990	1992	1995	1995 Emissions[a] As Percent of: County	Region
Arsenic	55	29	2	--	ND	ND
Benzene	630	220	180	240	0.06	0.008
Beryllium	12	--	0.03	--	ND	ND
Cadmium	45	3	0.28	--	ND	ND
Chromium (hexavalent)	< 1	3	0.21	--	ND	ND
Formaldehyde	1,200	13,000	11,000	14,000	1.1	0.2
Lead	81	68	--	--	ND	ND
Manganese	75	--	--	--	ND	ND
Mercury	9	73	--	--	ND	ND
Nickel	3,700	1,600	230	--	ND	ND
PAHs[b]	24	--	4	--	ND	ND
Zinc	--	450	--	--	ND	ND

a County-wide and regional totals used to calculate these percentages include both stationary and mobile sources. Stationary source emissions are from the 1996 BAAQMD source listed below. Toxic air contaminant emissions estimates for mobile sources were made using regional volatile organic compounds (VOC) emissions estimates and California Air Resources Board VOC speciation data.

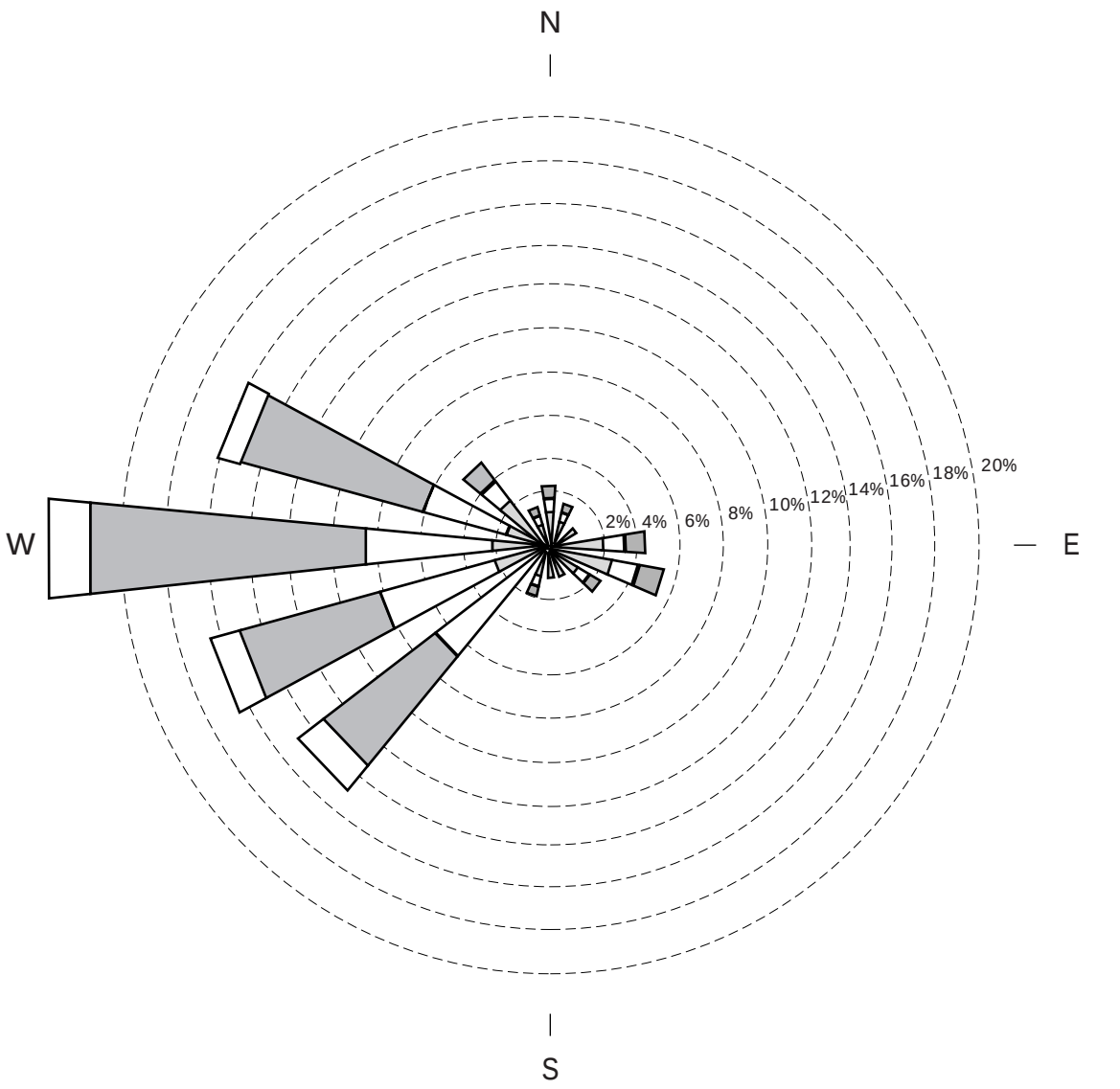
b PAHs refers to polycyclic aromatic hydrocarbons.

NOTE: -- refers to emissions that were either zero or less than reportable quantities; ND = not determined.

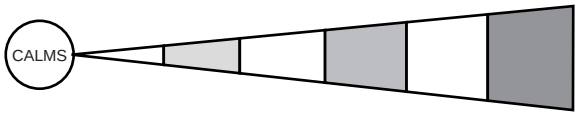
SOURCES: Bay Area Air Quality Management District, *Air Toxics Emission Inventory for the San Francisco Bay Area, Status Report*, March 1989; Bay Area Air Quality Management District, Toxic Air Contaminant Control Program, *Annual Report, 1991*, August 1991; Bay Area Air Quality Management District, Toxic Air Contaminant Control Program, *Annual Report, 1993*, December 1993; Bay Area Air Quality Management District, Toxic Air Contaminant Control Program, *Annual Report, 1995*, November 1996.

The main contributors to this calculated cancer risk were hexavalent chromium and nickel, both of which are emitted only when burning oil (Pacific Gas and Electric Company, 1992b). Since the burning of oil in the steam boilers was discontinued at the end of 1994, the excess individual cancer risk for existing operations are estimated to be 1.3 in a million for workers and 0.1 in a million for residential exposure.

For exposure to non-carcinogenic pollutants, the maximum exposure levels beyond the plant were well below the level associated with adverse chronic effects. The chronic hazard index for non-carcinogenic effects was calculated to be less than 0.02 at the location of maximum pollutant concentrations. An index of less than 1.0 is considered to be a "safe" level. The main contributor to this chronic non-carcinogenic hazard index was nickel, accounting for over half the calculated risk, with the second highest contributor being hexavalent chromium. Thus, the chronic hazard index is less than 0.01.



Calm Winds .60%



1-3 4-6 7-10 11-16 17-21 +21

Wind Speed Class (knots)

Plot shows direction winds are blowing from.

Figure 4.5-4
Annual Wind Rose Pittsburg
Power Plant 1988

GEYSERS POWER PLANT

Existing Local Air Quality

The Geysers Air Monitoring Program (GAMP) is an agreement among the geothermal industry participants for sharing the costs of ambient air monitoring. Established in 1983, GAMP collects meteorological data and ambient air concentration data for hydrogen sulfide (H_2S) and other air contaminants to document the long-term air quality trends in the Geysers area. GAMP is currently in its fifth phase of operation (GAMP V), which took effect July 1, 1998, and goes to June 30, 2002. Participation in an air monitoring program such as GAMP is required by air permits of the Lake County Air Quality Management District (Kauper, 1998) and the Northern Sonoma County Air Pollution Control District (Erdman, 1998). PG&E's participation in GAMP is assignable to a new owner or owners(s) if the Geysers plant were sold.[8] While participation in GAMP per se is not required, an alternative air monitoring program would have to meet the satisfaction of the air pollution control officer, as required by the air permits. It is assumed that a program other than GAMP is likely to be less cost effective and more problematic (Erdman, 1998).

GAMP V consists of three meteorological and H_2S monitoring stations, two meteorological (only) monitoring stations (one of which is located at PG&E Unit 13), and two PM-10 monitoring stations (located at two of the three H_2S stations). The PM-10 monitoring stations provide data that can be analyzed for various compounds, including arsenic, mercury, sulfur, vanadium, and others. Table 4.5-19 presents a summary of five years of H_2S monitoring data from the three GAMP stations monitoring that pollutant at locations in the prevailing downwind direction from the Geysers units. Table 4.5-19 also presents ozone and PM-10 data from Lakeport. No ambient concentration data is presented for northern Sonoma County because such data would not be representative of conditions in the Geysers vicinity. This is because prevailing northwest winds tend to transport Geysers plant emissions towards Lake County, rather than towards Sonoma County, and because the locations of monitoring stations in northern Sonoma County (such as Cloverdale, Healdsburg, and Guerneville) are many miles from the Geysers plant.

During September 1995, a one-hour hydrogen sulfide concentration of 0.05 ppm, exceeding the state standard of 0.03 ppm, was measured at one of the monitoring stations. On the same day, a level of 0.03 was measured at another station. Investigation of the exceedance by California Air Resources Board revealed that over a three year period surrounding this exceedance, 1994-1996, no other exceedences were observed. The California Air Resources Board staff, therefore, recommended that the area remain designated as being in attainment of the hydrogen sulfide ambient air standard (California Air Resources Board, 1997a).

General Plant Characteristics

The Geysers Power Plant consists of 14 steam-powered generating units in operation at 11 sites. The steam used to operate these units originates from a fractured reservoir above a magma heat source that lies beneath an area of several hundred square miles near the south and east end of

TABLE 4.5-19
LAKE COUNTY AIR BASIN CRITERIA AIR POLLUTANT CONCENTRATIONS, 1992-1996

Pollutant	State Standard[c]	Monitoring Data by Year[a] 1992	1993	1994	1995	1996
Ozone:						
Highest 1-hr. average, ppm[b]	0.09	0.08	0.08	0.09	0.07	0.09
Number of exceedences		0	0	0	0	0
Particulate Matter (PM-10):						
Highest 24-hr. average, $\mu g/m^3$[b]	50	22	30	21	30	26
Exceedences/Samples[d]		0/58	0/61	0/61	0/61	0/61
Annual Geometric Mean, $\mu g/m^3$	30	11.1	9.9	10.1	9.6	9.1
Hydrogen Sulfide (H_2S):						
Highest 1-hr. average, ppm						
(Anderson Springs station)	0.03	0.01	0.01	0.01	0.01	0.01
(Glenbrook - High Valley Road station)	0.03	0.01	0.02	0.01	0.03	0.01
(Hobergs – Pine Summit station)	0.03	0.01	0.01	0.01	0.05	0.01

a Data for ozone and PM-10 are from the air quality monitoring station in Lakeport. The hydrogen sulfide data are listed with the applicable monitoring station.
b ppm = parts per million; $\mu g/m^3$ = micrograms per cubic meter.
c State standards for ozone and PM-10 are not to be exceeded; the state standard for hydrogen sulfide is not to be equaled or exceeded.
d PM-10 is usually measured every sixth day (rather than continuously like the other pollutants). For PM-10, "exceedences/samples" indicates the number of exceedences of the state standard that occurred in a given year and the total number of samples that were taken that year.

SOURCE: California Air Resources Board, *California Air Quality Data*, 1992, 1993, 1994, 1995, and 1996.

Clear Lake. The dry steam in this reservoir is at a pressure of several hundred pounds per square inch at a temperature of approximately 450 degrees Fahrenheit. It is produced from wells ranging in depth from 6,000 to more than 12,000 feet, gathered and transported by pipelines to the generating units.

Existing Emissions

Geothermal steam contains small amounts of naturally occurring non-condensable gases, including carbon dioxide, H_2S, ammonia, methane, hydrogen, nitrogen, and trace amounts of other gases, including reactive organic gases. Geothermal air pollutants are generally emitted from steam wells, steam transmission lines and steam stacking, and non-condensable gas treatment facilities at power plants. Well bleeds and well maintenance steam releases are

8 The process and mechanics of assigning PG&E's participation in GAMP have been worked out, including the possibility that different units could be sold to different parties.

currently the largest steam field emission sources. Most of the air pollutant emissions from the Geysers Plant are due to naturally occurring constituents of the geothermal steam released to the air during condensation of the steam after it passes through the turbine. One significant constituent is H_2S, and all the units are equipped with H_2S abatement systems.

In terms of quantities, the major emissions from the plant consist of total organic gases (primarily methane), particulate matter (including PM-10 and PM-2.5), H_2S, ammonia, and hydrogen. "Permitted" emissions levels relate to particulate matter and H_2S. H_2S emissions can occur as a result of steam stacking, which is the term used to describe a buildup of steam pressure in a geothermal field due to a temporary slowdown in use of the steam wells. The steam buildup may result in an unscheduled release of steam from the field to release the excess pressure.

In the mid 1980s, a pipe manifold network was installed, and pressure was regulated with an automatic steam distribution system. The distribution system links several units together through a manifold piping system. By using automatically activated valves, the manifold distributes the steam according to need, thereby relieving pressure in the line. Also, the manifold system increases the overall volume of the piping network, allowing for the accumulation of more steam in the line before pressure relief would have to occur. Since the system was installed, stacking has been reduced significantly.

The Geysers Plant also generates relatively minor quantities of emissions of nitrogen oxides, sulfur oxides and carbon monoxide that result primarily from the use of a burner/scrubber system. Because geothermal steam may contain radon gas, measurements were carried out to determine levels in the area. The measurements indicated levels of radon ranging from 3 to 5 pico-curies per liter of air, which is above typical background levels of 1 pico-curie per liter (1998, personal communication with Lake County APCD).

Other emissions sources associated with the Geysers Plant include ovens (used to dry "solventless" insulation coatings on electric motor parts and to remove old coatings in preparation for repair), parts washing stations, a solvent recovery distillation facility, gasoline dispensing facilities, a spray painting booth, emergency distillate generators, and solvent cleaning and painting maintenance activities. Emissions from such sources are relatively minor.

The plant's emissions are dependent on the utilization rate of each unit and the emission rate of each unit, which is itself dependent upon the type of emissions control technology that has been installed. A variety of methods are used to reduce emissions of H_2S from the geothermal units. Table 4.5-20 summarizes the size, status, and abatement systems associated with each of the geothermal units. Because a number of units have been retired as the steam field becomes depleted, and through the application of hydrogen sulfide abatement systems on operating units, the expected emissions of hydrogen sulfide are expected to decrease in future years.

Table 4.5-21 shows criteria air pollutant emissions from the plant for 1995, 1996, and 1997 and compares the 1997 estimates with county-wide emissions for Lake County in that year. Table 4.5-22 shows the 1995, 1996, and 1997 criteria pollutant emissions and compares the values with county-wide and basin-wide emissions for Sonoma County. As indicated in

TABLE 4.5-20
GEYSERS POWER PLANT UNITS
HYDROGEN SULFIDE ABATEMENT SYSTEMS

Unit	Net (MW) Capacity	Year	Status / Location	H_2S Abatement Systems[a]
1	0		Retired.	
2	0		Retired.	
3	0		Retired.	
4	0		Retired.	
5	53	1971	Active/Sonoma Co.	Incinerator, Caustic, and Metal Chelate.
6	53	1971	Active/Sonoma Co.	Incinerator, Caustic, and Metal Chelate.
7	53	1972	Active/Sonoma Co.	Incinerator, Caustic, and Metal Chelate.
8	53	1972	Active/Sonoma Co.	Incinerator, Caustic, and Metal Chelate.
9	53	1973	Active/Sonoma Co.	Caustic and Metal Chelate.
10	53	1973	Active/Sonoma Co.	Caustic and Metal Chelate.
11	106	1975	Active/Sonoma Co.	Incinerator, Caustic, and Metal Chelate.
12	106	1979	Active/Sonoma Co.	Incinerator, Caustic, and Metal Chelate.
13	133	1980	Active/Lake Co.	Stretford and Metal Chelate.
14	109	1980	Active/Sonoma Co.	Stretford and Metal Chelate.
15	0		Retired.	
16	113	1985	Active/Lake Co.	Stretford and Metal Chelate.
17	113	1982	Active/Sonoma Co.	Stretford and Metal Chelate.
18	113	1983	Active/Sonoma Co.	Stretford and Metal Chelate.
19	0		Never built.	
20	113	1985	Active/Sonoma Co.	Stretford and Metal Chelate.
21	0		Never built.	
	1,224			

[a] The abatement systems are as follows:

Incinerator: This process burns H_2S to form SO_2, which is then scrubbed in a quench tower and dissolved into the quench water. The quench water is transferred to the cooling tower basin.

Caustic: Sodium hydroxide, which absorbs H_2S, is added to the cooling water at the inlet of the condenser.

Stretford: This process chemically oxidizes the H_2S to elemental sulfur.

Metal Chelate: This process involves an iron chelate solution and air, which are added to the circulating water. The solution, oxygen, and H_2S react to produce elemental sulfur, which is suspended in the circulating water.

SOURCE: Pacific Gas and Electric Company, *Proponent's Environmental Assessment: Pacific Gas and Electric Company's Proposed Sale of The Geysers Geothermal Power Plant,* January 14, 1998.

Table 4.5-22, the Geysers Power Plant accounted for relatively large portions of Sonoma County's 1997 inventory of PM-10.

LCAQMD and NSCAPCD calculated risk prioritization scores for the Geysers plants to determine if toxic pollutant emissions can be significant. The prioritization scoring uses the methodologies recommended by CAPCOA. A risk prioritization score, which is a screening

TABLE 4.5-21
EMISSIONS FROM GEYSERS POWER PLANT UNITS 13 AND 16, 1995, 1996, 1997

Pollutant	Emissions (tons per year)[a] 1995	1996	1997	1997 Emissions As Percent of Lake County
Total Organic Gases	570	550	572	9
Reactive Organic Gases	7	6	7	< 1
Particulate Matter (PM-10)	46	44	46	2

a Emissions estimates are based on annual generation rates for individual units and emissions factors developed on the basis of PG&E's Title V application to LCAQMD for Units 13 and 16.

TABLE 4.5-22
EMISSIONS FROM GEYSERS POWER PLANT UNITS 5, 6, 7, 8, 9, 10, 11, 12, 14, 17, 18, AND 20, 1995, 1996, 1997

Pollutant	Emissions (tons per year)[a] 1995	1996	1997	1997 Emissions As Percent of: Sonoma County[b]	Region
Total Organic Gases	1,893	2,289	2,183	24	4.6
Reactive Organic Gases	22	27	25	0.6	0.1
Particulate Matter (PM-10)	506	607	688	26	2.3

a Emissions estimates are based on annual generation rates for individual units and emissions factors developed on the basis of PG&E's Title V application to NSCAPCD for Units 5 through 12, 14, and 17, 18, and 20.
b In this context, power plant emissions are shown as a percentage of the total emissions generated within the portion of Sonoma County that lies within the North Coast Air Basin. "Region" refers to the North Coast Air Basin.

health risk assessment, is calculated for each plant based on the quantities of emissions, the potencies or toxicities of the emissions, and the proximity of potential receptors.

Generally, scores over 10 are typically considered "higher priority," and would require a detailed health risk assessment. For carcinogens, all of the Geysers units scored less than 1.0; the highest score was 0.58 for Unit 17 (Pacific Gas and Electric Company, 1998b). Scores of less than 1 are considered "low priority." The chronic non-carcinogenic effects risk scores for the Geysers units ranged from 0.43 to 4.3. Regulatory decisions on whether to require detailed health risk assessments where chronic effects scores are between 1 and 10 depend upon the consideration of

other factors in addition to the calculated risk. The acute effects risk scores were calculated only for the two Lake County Units, and they ranged from 0.52 to 1.03 (the higher score was for Unit 16). Both LCAQMD and NSCAPCD have requested data from the facilities every four years to update the prioritization scores.

4.5.4 SIGNIFICANCE CRITERIA

A project may be deemed to have a significant effect on the environment if it would violate any ambient air quality standard, contribute substantially to an existing or projected air quality violation, expose sensitive receptors to substantial pollutant concentrations, or conflict with adopted environmental plans and goals of the community where it is located (Governor's Office, 1997).

If an air emission meets the existing standard for a particular pollutant, the Lead Agency may presume that the emission or discharge of the pollutant will not be a significant effect on the environment. If other information is presented suggesting that the emission may cause a significant effect, the Lead Agency shall evaluate the effect and decide whether it may be significant (CEQA Guidelines 15064(i)) (Governor's Office, 1997); *BAAQMD CEQA Guidelines* restate this notion in the following way: "Sources of air pollutant emissions complying with all applicable District regulations generally will not be considered to have a significant air quality impact." However, *BAAQMD CEQA Guidelines* recommend that Lead Agencies make an exception to this presumption where special circumstances suggest that the emissions from the permitted source may cause a significant air quality impact.

With the above introduction, the following significance criteria are used herein to evaluate the impacts of the project:

1) Violation of an ambient air quality standard or substantial contribution to a projected violation of an ambient air quality standard. BAAQMD Regulation 2, Rule 2 identifies significant air quality impacts under its Prevention of Significant Deterioration program using pollutant-specific concentration-based standards, and these standards will be used herein to identify substantial contributions to projected violations of an ambient air quality standard. For PM-10, the incremental increase defined as significant is five $\mu g/m^3$ for a 24-hour average increment and 1 $\mu g/m^3$ for an annual average increment.

2) Increase of 80 pounds per day (or 15 tons per year) or more of ROG, NO_x, or PM-10 emissions from indirect sources (indirect sources do not include stationary sources covered by permit issued by the local AQMD or APCD (BAAQMD, 1996a);

3) Increase in carcinogenic risk from toxic air contaminant emissions of 10 in a million, or an increase in the chronic or acute hazard index (HI) of more than 1.0.

4) With regard to the potential for causing increased respiratory problems, the impact would be significant if the total contribution of PM-2.5 emissions from the plant (baseline operations plus added operations under A-Max conditions) would contribute to ambient air levels sufficiently to cause increased respiratory ailments. The levels shown to cause increased ailments are described earlier in this section under *Health Effects from Particulate Matter* and are based on cited studies. For short-term exposure, the contribution from the plant would be significant if the maximum 24-hour average

contribution exceeds 20 micrograms per cubic meter, or if the expected number of days exceeding 20 micrograms per cubic meter increases compared to the baseline. For chronic exposure, the contribution of PM-2.5 emissions from the plant would be significant if the maximum annual average contribution exceeds 10 micrograms per cubic meter.

5) Inconsistency with the regional air quality plan. For quantitative evaluation purposes in this context, inconsistency with the plan is defined as an increase in emissions (over those included in the plan) equivalent to one percent of the regional inventory.

4.5.5 IMPACTS AND MITIGATION MEASURES

The following air quality evaluation has been divided into five general impacts including: 1) changes in criteria air pollutant emissions, 2) changes in local criteria air pollutant concentrations, 3) changes in facility-specific health risks, 4) changes in fallout type particulate (FTP), and 5) consistency with regional air quality plans. Where appropriate, impacts are described for both analysis years, 1999 and 2005. In contrast, for the other types of potential impacts (traffic, noise, land use, etc.) identified in this EIR, the discussion of cumulative impacts in Year 2005 is presented in Chapter 5.

Impact 4.5-1: The project may result in an increase in criteria air pollutant emissions in the affected air basins. (Less than Significant)

GENERAL IMPACT DISCUSSION

The project would allow the transfer of ownership of the power plants from PG&E to some other entity. Construction emissions would be minimal; the only potential construction being activities necessary to separate sale and non-sale property, such as a switchyard and generating unit. Indirect emissions sources, such as power plant employee motor vehicle trips, would be essentially unchanged since the number of employees could increase, but only to a minor degree. While the transfer itself would not have air quality effects, the change in ownership could theoretically lead to changes in emissions generated by the power plants due to changes in the amount or pattern of electricity generation at the plant, changes in the type of fuel used, or changes in pollution control technologies employed.

Changes in the Amount and Pattern of Electricity Generation

The first factor that could influence future power plant emissions is the amount and pattern of electricity generation. This EIR assumes, for conservative purposes, that new owners would operate the plants at their Analytical Maximum capacities (see Chapter 3, Approach to Environmental Analysis). The Analytical Maximum capacities were used as the basis for the emissions estimates presented later in this section.

Changes in Fuel Type

The second factor that could influence power plant emissions is the type of fuel that would be consumed. Under existing conditions, the Bay Area power plants use two types of fuel: the

combustion turbines burn distillate, and the steam boilers burn natural gas. The steam boilers burn natural gas rather than fuel oil due to both economic and regulatory factors. Even if regulatory conditions were to change with respect to BAAQMD Regulation 9, Rule 11, economic factors could tend to dictate use of natural gas rather than fuel oil in the boilers. Therefore, the emissions estimates presented in this section reflect the continued use of distillate by the combustion turbines and natural gas by the steam boilers. For informational purposes, it is noted that, on an equal-energy basis (i.e., pounds of pollution per million BTU), fuel oil combustion results in approximately 3 to 4 times more PM-10 than natural gas combustion based on the latest EPA emissions factors. Also, fuel oil combustion generates higher emissions than natural gas for most of the applicable toxic air contaminants, including arsenic (50 times more), chromium (four times more), mercury (three times more), and nickel (200 times more). The Geysers units are, and would continue to be, powered by geothermal steam.

Changes in Pollution Control Technologies

The third factor that could influence future power plant emissions relates generally to the regulatory context under which the plants operate. Under the project, PG&E would "transfer" its existing air quality permits for the power plants to the new owners. Typically, Air District regulations technically prohibit transfer of permits from one owner to another upon change of ownership of a facility. However, state law requires the air districts to provide a mechanism for reissuing a permit to a new owner or operator and prohibits the imposition of more stringent controls or operating conditions solely as a result of a change of ownership (Health and Safety Code §42301(f)). Thus, the new owner of a power plant acquired as a result of the project would be required to apply for and obtain a new permit from the applicable air district, but the new permit cannot contain limitations or other requirements that are more stringent than those contained in the existing permits.

AIR-BASIN-SPECIFIC IMPACT DISCUSSION

San Francisco Bay Area Air Basin

Among the principal regulatory requirements that apply to PG&E's existing steam boilers are the emissions limitations set forth in BAAQMD Regulation 9, Rule 11. As discussed in the setting section, Regulation 9, Rule 11 contains a compliance strategy, which PG&E has selected for its steam boilers in the Bay Area, wherein system-wide NO_x emissions are subject to declining emissions rate limits. These limits are intended to reduce NO_x emissions rates by a factor of 10 between 1997 and 2005. However, under its current terms, BAAQMD Regulation 9, Rule 11 would not apply to the entity to which the power plants are divested. This is because the current BAAQMD rule applies to units "owned and/or operated by a California Public Utilities Commission (CPUC) regulated utility," and the future plant owner would most likely not fit that description. As a consequence, unless the BAAQMD rule is amended, the declining NO_x emission rate limits under BAAQMD Regulation 9, Rule 11 would probably not occur under divestiture.

If BAAQMD Regulation 9, Rule 11 were no longer to apply, the boilers would still be subject to Regulation 9, Rule 3, which specifies a maximum NO_x emissions rate of 175 ppm (roughly equivalent to 0.21 pound per million Btu). Also, it is conceivable that the divested boilers would become subject to the retrofit requirements of BAAQMD Regulation 9, Rule 7, which applies to non-utility boilers. If so, then the boilers would face the immediate task of installing retrofit technology suitable to attain a NO_x emissions limitation of 30 ppm (roughly equivalent to 0.04 pound per million Btu). This would accelerate the retrofit schedule developed to meet BAAQMD Regulation 9, Rule 11 for all of the boilers with the exception of Contra Costa Unit 7. However, there is substantial uncertainty as to whether Regulation 9, Rule 7 would be applied to the divested boilers since that rule was developed without those boilers in mind. Given this uncertainty, the air quality analysis assumes that Regulation 9, Rule 7 would not apply and that boiler emissions would be driven by the applicability or inapplicability of Regulation 9, Rule 11 alone.

In anticipation of the changes brought about by restructuring and divestiture, BAAQMD has expressed its intention to modify Regulation 9, Rule 11 to ensure its continued applicability to all of the electric utility steam boilers at the four Bay Area power plants (Garvey, 1998), regardless of whether they are utility-owned. In addition, several options for modifying the emissions limits of the rule are currently under consideration by the BAAQMD. These options include a modification of the "bubble" option that would apply the current "bubble" emissions limit at each of the four Bay Area plants (the three plants to be divested and the Hunters Point Power Plant), creating essentially four "bubbles," or a modification that would allow for an owner-based "bubble" option. An owner-based bubble option would apply the emissions "bubble" limit to as many steam boilers as would be under the control of a single owner, thereby creating the possibility for one, two, three, or four "bubbles" for one, two, three or four owners, respectively. The amended rule will also likely retain the individual boiler emissions limits as an option.

The BAAQMD's principal objective in modifying Regulation 9, Rule 11 will be to achieve at least equivalent emission reductions to those envisioned in the current rule (Garvey, 1998). As a general matter, power plant emissions would be higher under a multi-plant "bubble" and lower under four separate single-plant "bubbles" because four separate bubbles provide the least flexibility in meeting the system-wide average emissions limits. The flexibility in the current Regulation 9, Rule 11 allows owners to meet the limits by "over-controlling" the more efficient units and "under-controlling" the less efficient units. For instance, the electricity generation and emissions modeling results prepared for this report indicate that, by 2005, Unit 1 at the Pittsburg Power Plant would require more stringent NO_x emissions control or would be required to operate at a lower capacity under a single-plant bubble, in which the units at that single power plant would be required to meet the standard, than under a multi-plant bubble, in which the NO_x emissions from that unit would be averaged with the emissions from steam boilers at one or more other Bay Area power plant to meet the standard.

Since it is uncertain if, and how, BAAQMD would modify Regulation 9, Rule 11 to address the issues raised by divestiture and restructuring, the air quality analysis includes a set of estimates, which assume that BAAQMD modifies the rule and another set of estimates, which assume that BAAQMD does not modify the rule.

Emissions Estimates

Emissions estimates have been made for the Potrero, Contra Costa, and Pittsburg Power Plants, taking into account the three main factors discussed above. The following tables show estimates of criteria air pollutants for the Potrero (Table 4.5-23), Contra Costa (Table 4.5-24) and Pittsburg (Table 4.5-25) power plants. Each of these tables shows emissions estimates under two different operational scenarios (baseline and analytical maximum) and under two different regulatory scenarios (with modifications to BAAQMD Regulation 9, Rule 11 and without such modifications). Table 4.5-26 combines the emissions estimates for the three power plants and combines them with emissions estimates for Hunters Point (in 1999) and a new San Francisco power plant (in 2005) to provide estimates of total power plant emissions in the Bay Area in those analysis years.

TABLE 4.5-23
POTRERO POWER PLANT
CRITERIA AIR POLLUTANTS EMISSIONS ESTIMATES, 1999 AND 2005

	Estimated Emissions in Tons Per Year[a]			
Pollutant	**Existing[b]**	**1999 Baseline**	**1999 Analytical Maximum**	**2005 Cumulative Analytical Maximum**
With Continued Application of BAAQMD Regulation 9, Rule 11 (as modified):				
Carbon Monoxide	381	349	555	488
Reactive Organic Gases	45	41	61	73
Nitrogen Oxides	746	389	610	188
Sulfur Oxides	35	29	31	77
Particulate Matter (PM-10)	41	38	56	52
Without Continued Application of BAAQMD Regulation 9, Rule 11[c]:				
Nitrogen Oxides	746	389	877	906

a Baseline and analytical maximum emissions estimates were developed by Sierra Energy and Risk Assessment, Inc. for this report.
b Existing emissions reflect an average of emissions over the 1995 to 1997 period.
c For this case, only emissions of nitrogen oxides are shown. The other criteria pollutants shown above would be essentially the same with or without Regulation 9, Rule 11. Therefore, these emissions were not repeated for this case.

TABLE 4.5-24
CONTRA COSTA POWER PLANT
CRITERIA AIR POLLUTANTS EMISSIONS ESTIMATES, 1999 AND 2005

	Estimated Emissions in Tons Per Year[a]			
Pollutant	**Existing[b]**	**1999 Baseline**	**1999 Analytical Maximum**	**2005 Cumulative Analytical Maximum**
With Continued Application of BAAQMD Regulation 9, Rule 11:				
Carbon Monoxide	564	902	1,884	1,655
Reactive Organic Gases	58	93	193	170
Nitrogen Oxides	753	711	1,486	244
Sulfur Oxides	7	11	23	20
Particulate Matter (PM-10)	52	84	175	151
Without Continued Application of BAAQMD Regulation 9, Rule 11[c]:				
Nitrogen Oxides	753	711	1,486	1,389

a Baseline and analytical maximum emissions estimates were developed by Sierra Energy and Risk Assessment, Inc. for this report.
b Existing emissions reflect an average of emissions over the 1995 to 1997 period.
c For this case, only emissions of nitrogen oxides are shown. The other criteria pollutants shown above would be essentially the same with or without Regulation 9, Rule 11. Therefore, these emissions were not repeated for this case.

The operational scenarios include "baseline" estimates and "analytical maximum," or "A-Max" estimates.[9] Baseline estimates represent the condition whereby PG&E would continue to own and operate the three plants, i.e., the no project alternative. The A-Max estimates represent the condition whereby the plants would be run at their highest possible capacities in light of technical and demand constraints. The A-Max assumes that natural gas could be purchased in unlimited quantities at a 25 percent discount from the least expensive supply of gas assumed to be available to fuel California power plants. The purpose of this assumption was to remove, to a great degree, the cost of fossil fuel from the new owner's decision whether and when to generate power. Although it is extremely unlikely that such a reduced gas price could be obtained, this assumption further strengthens the conservative nature of the impact analysis. With a discounted price for natural gas, the power generated by the new owner would have a competitive advantage over other generators and would thus generate more power and higher corresponding emissions. The difference between the two values, i.e., between the baseline values and the A-Max values, represents the maximum possible impact of the project in 1999. The actual impact of the project

9 For a detailed explanation of the "analytical maximum," see Chapter 3, Approach to Environmental Analysis, of this EIR.

TABLE 4.5-25
PITTSBURG POWER PLANT
CRITERIA AIR POLLUTANTS EMISSIONS ESTIMATES, 1999 AND 2005

	Estimated Emissions in Tons Per Year[a]			
Pollutant	**Existing[b]**	**1999 Baseline**	**1999 Analytical Maximum**	**2005 Cumulative Analytical Maximum**
With Continued Application of BAAQMD Regulation 9, Rule 11:				
Carbon Monoxide	1,546	2,554	5,161	4,103
Reactive Organic Gases	157	255	516	420
Nitrogen Oxides	1,878	3,000	6,393	1,142
Sulfur Oxides	18	30	61	50
Particulate Matter (PM-10)	140	231	467	375
Without Continued Application of BAAQMD Regulation 9, Rule 11[c]:				
Nitrogen Oxides	1,878	3,000	7,444	4,922

a Baseline and analytical maximum emissions estimates were developed by Sierra Energy and Risk Assessment, Inc. for this report.
b Existing emissions reflect an average of emissions over the 1995 to 1997 period.
c For this case, only emissions of nitrogen oxides are shown. The other criteria pollutants shown above would be essentially the same with or without Regulation 9, Rule 11. Therefore, these emissions were not repeated for this case.

may be less and may approach zero (i.e., no difference between the emissions with a new owner and those with PG&E).

The A-Max emissions for 2005 estimate the high-end of the possible range of power plant emissions in that analysis year. The emissions estimates for 2005 take into account a number of cumulative projects and factors, including load growth and an emissions control installation schedule. Because of PG&E's recent agreement with the City and County of San Francisco to close Hunters Point Power Plant as soon as alternatives are available to meet reliability needs in San Francisco, this analysis assumes that Hunters Point Power Plant would be closed by 2005 and a new 480 MW power plant would be installed at an undetermined location to meet load growth and maintain reliability.

The two regulatory scenarios refer to two different assumptions about the applicability of BAAMQD Regulation 9, Rule 11. Under one scenario, the rule is assumed to be modified to achieve the same level of emissions reductions that had been expected under the existing rule. Under the second scenario, the rule is assumed to remain unchanged, with the result that NO_x emission rate limitations that had been expected under the rule would not be achieved. In

TABLE 4.5-26
BAY AREA POWER PLANT EMISSIONS SUMMARY, 1999 AND 2005

	Estimated Emissions in Tons Per Year[a]							
		Year 1999[c]						
Pollutant	**Existing[b]**	**Baseline**	**Analytical Maximum**	**Difference Between A-Max and 1999 Baseline**	**Differences as Percent of Region in 1999[d]**	**Year 2005 Cumulative A-Max[e]**	**Difference Between 2005 Cumulative A-Max and 1999 Baseline**	**Difference as Percent of Region in 2005[d]**
With Continued Application of BAAQMD Regulation 9, Rule 11:								
Carbon Monoxide	3,055	4,121	7,916	3,795	0.5%	6,396	2,275	0.3%
Reactive Organic Gases	316	421	802	381	0.2%	743	322	0.2%
Nitrogen Oxides	4,397	4,310	8,699	4,389	2.7%	1,758	-2,552	-1.6%
Sulfur Oxides	71	75	120	45	0.1%	159	84	0.2%
Particulate Matter (PM-10)	284	382	727	345	0.2%	679	297	0.2%
Without Continued Application of BAAQMD Regulation 9, Rule 11[f]:								
Nitrogen Oxides	4,397	4,310	10,017	5,707	3.5%	7,401	3,091	1.9%

a Baseline and analytical maximum emissions estimates were developed by Sierra Energy and Risk Assessment, Inc. for this report.

b Existing emissions reflect an average of emissions over the 1995 to 1997 period for the three Bay Area power plants proposed for divestiture (Potrero, Pittsburg and Contra Costa plants). They also include Hunters Point Power Plant emissions, which have been estimated to average 547 tons per year of carbon monoxide, 56 tons per year of ROG, 1,020 tons per year of NO_X, 11 tons per year of SO_X, and 50 tons per year of PM-10 over the 1995 to 1997 period.

c Year 1999 power plant emissions estimates reflect the three Bay Area power plants for which divestiture has been proposed as well as the Hunters Point Power Plant. The Hunters Point Power Plant is assumed to operate at minimum levels to meet the San Francisco Operating Criteria and to be in compliance with Regulation 9, Rule 11 NO_X emission rate limits. For 1999, Hunters Point emissions have been estimated to be 316 tons per year of carbon monoxide, 32 tons per year of ROG, 210 tons per year of NO_X, 5 tons per year of SO_X, and 29 tons per year of PM-10.

d Percentages are based on emissions inventories presented in *BAAQMD CEQA Guidelines* (April 1996).

e Cumulative year 2005 power plant emissions estimates reflect the three Bay Area power plants for which divestiture has been proposed as well as a new power plant (480 MW) located north of the Martin substation to serve San Francisco. Emissions for such new power plant have been estimated to be 150 tons per year of carbon monoxide, 80 tons per year of ROG, 184 tons per year of NO_X, 12 tons per year of SO_X, and 101 tons per year of PM-10. The Hunters Point Power Plant is assumed to be closed by 2005.

f For this case, only emissions of nitrogen oxides are shown. The other criteria pollutants shown above would be essentially the same with or without Regulation 9, Rule 11. Therefore, these emissions were not repeated for this case.

analysis year 1999, this second regulatory scenario would not apply to the baseline operational scenario since the baseline case assumes that PG&E would retain ownership, and, as a CPUC-regulated utility, would remain subject to the existing BAAQMD rule.

With the above introduction, the following conclusions can be made with respect to the potential changes in emissions estimated for the Potrero Power Plant shown in Table 4.5-23:

1) In 1999, annual emissions under the baseline case would be similar to those that occurred under existing conditions (i.e., the recent past), except for NO_x emissions, which would be substantially lower. The lower NO_x emissions would be the result of NO_x controls (over-fire air and flue gas recirculation) that are scheduled for installation by 1999.
2) In 1999, emissions under the A-Max case would be approximately 60 percent higher than the baseline case due to a higher capacity factor estimated for Unit 3 (i.e., the steam turbine).

3) In 2005, increases in ROG, SO_x, and PM-10 would be due to an estimated increase in capacity factors for the combustion turbines relative to the 1999 baseline case (see Chapter 3 for annual capacity factors of each unit).

4) With continued implementation of the declining NO_x emission rate limits under BAAQMD Regulation 9, Rule 11 (as modified), NO_x emissions at the Potrero Power Plant would decrease substantially by 2005. Without continued implementation of the requirements of that rule, NO_x emissions would increase over existing levels under a new owner in 2005.

The following conclusions can be made with respect to the estimated changes in annual emissions at the Contra Costa Power Plant shown in Table 4.5-24:

1) Substantially higher annual emissions are estimated for the 1999 A-Max case relative to the baseline case; these higher emissions correspond to a predicted higher capacity factor.

2) By 2005, under the A-Max case, NO_x emissions would be substantially lower than in 1999 assuming implementation of Regulation 9, Rule 11. Without implementation of the rule, NO_x emissions under the 2005 cumulative A-Max case would be similar to those predicted in 1999 under the A-Max case.

The following conclusions can be made with respect to the estimated changes in annual emissions at the Pittsburg Power Plant shown in Table 4.5-25:

1) Substantially higher annual emissions are estimated for the 1999 A-Max case relative to the baseline case; these higher emissions correspond to a predicted higher capacity factor.

2) By 2005, under the A-Max case, NO_x emissions would be substantially lower than in 1999 assuming implementation of Regulation 9, Rule 11. The reduction in NO_x emissions (without continued BAAQMD Regulation 9, Rule 11 scenario) from 1999 A-Max case (7,444 tons) to 2005 A-Max case (4,922 tons) would be the result of the expected retirement of Pittsburg Units 3 and 4 by 2005 rather than due to installation of additional emissions controls.

Table 4.5-26 combines the annual emissions projections shown in Tables 4.5-23 (Potrero), 4.5-24 (Contra Costa), and 4.5-25 (Pittsburg) with estimates for Hunters Point (in 1999) and a new San

Francisco power plant (in 2005). Table 4.5-26 then shows the difference between emissions estimates under the 1999 baseline case and the A-Max case, which is the maximum project effect in 1999. The maximum cumulative effect in 2005 is shown as the difference in annual emissions under the 2005 A-Max case and the 1999 Baseline case. In both instances, the difference in emissions is placed in a regional context by showing them as a percentage of the regional annual emissions inventory. As shown in Table 4.5-26, as a percentage of regional annual emissions, the most notable increase would be for annual NO_x emissions. For most of the criteria air pollutants, emissions would be less under the 2005 cumulative A-Max condition than under the 1999 A-Max condition due to such cumulative developments as the retirement of Pittsburg Power Plant Units 3 and 4 and the replacement of the Hunters Point Power Plant with a new 480 MW power plant north of the Martin Substation.

Cumulative (2015) Bay Area Analysis

The City and County of San Francisco uses 2015 as an analysis year for evaluating the long-term environmental impacts of cumulative development. Power plant emissions estimates have been made for 2015 based on the emissions estimates for 2005, as adjusted to reflect population growth projected for the Bay Area. In 2015, under the Analytical Maximum scenario and assuming that BAAQMD Regulation 9, Rule 11 would be modified, Bay Area power plants would emit approximately 6,803 tons per year of carbon monoxide, 790 tons per year of ROG, 1,870 tons per year of NO_x, and 169 tons per year of PM-10. If BAAQMD Regulation 9, Rule 11 were inapplicable, NO_x emissions in 2015 would be approximately 7,872 tons. As a percentage of regional emissions in 2015, the change in power plant emissions over 1999 baseline conditions would be less than one percent for carbon monoxide, ROG, SO_x, and PM-10. For NO_x, the change would be –1.5 percent assuming applicability of Regulation 9, Rule 11 and +1.6 percent assuming inapplicability of that rule. Therefore, with the modification of BAAQMD Regulation 9, Rule 11 as required by Mitigation Measure 4.5-5, this increase would be less than significant since no pollutant would increase by more than one percent of regional emissions.

Lake County Air Basin

The capacity factors for the Geysers units would not be affected by the project to the same degree as the Bay Area plants. Therefore, the emissions changes would be more modest. In addition, the types of issues raised by BAAQMD Regulation 9, Rule 11 are not relevant within the regulatory context in which the Geysers plant operates. Existing and projected emissions from the Lake County units of the Geysers plant are shown in Table 4.5-27. Based on the difference in emissions in 1999 between the “A-Max” case and the “baseline” case, emissions from the Lake County units are not expected to be change substantially due to divestiture. Furthermore, cumulative changes in emissions, as shown by the difference between emissions in 2005 under the A-Max case and the 1999 baseline, would not be substantial.

North Coast Air Basin

Existing and projected emissions from the northern Sonoma County units of the Geysers plant are shown in Table 4.5-28. This table shows that emissions of hydrogen sulfide would increase in the 1999 A-Max scenario compared with the 1999 Baseline scenario by approximately 40% and

TABLE 4.5-27
LAKE COUNTY GEYSERS POWER PLANTS
CRITERIA AIR POLLUTANT EMISSIONS, 1999 AND 2005

	Estimated Emissions in Tons Per Year[a]			
Pollutant	**Existing[b]**	**1999 Baseline**	**1999 Analytical Maximum**	**2005 Cumulative Analytical Maximum**
Carbon Monoxide	0	0	0	0
Reactive Organic Gases	7	6	6	5
Nitrogen Oxides	0	0	0	0
Hydrogen Sulfides	38	33	33	31
Particulate Matter (PM-10)	46	39	39	38

a Baseline and analytical maximum emissions estimates were developed using generation rates developed by Sierra Energy and Risk Assessment, Inc. for this report and emissions factors derived from the Title V applications (to the Lake County AQMD) for Units 13 and 16.

b Existing emissions reflect an average of emissions over the 1995 to 1997 period. The emissions estimates were made based on electricity generated during the 1995 to 1997 period and on emissions factors derived from the Title V applications (to the Lake County AQMD) for Units 13 and 16.

TABLE 4.5-28
NORTHERN SONOMA COUNTY GEYSERS POWER PLANTS
CRITERIA AIR POLLUTANT EMISSIONS, 1999 AND 2005

	Estimated Emissions in Tons Per Year[a]			
Pollutant	**Existing[b]**	**1999 Baseline**	**1999 Analytical Maximum**	**2005 Cumulative Analytical Maximum**
Carbon Monoxide	1	1	1	1
Reactive Organic Gases	25	24	30	30
Nitrogen Oxides	3	3	4	4
Hydrogen Sulfides	516	488	685	696
Particulate Matter (PM-10)	600	571	778	786

a Baseline and analytical maximum emissions estimates were developed using generation rates developed by Sierra Energy and Risk Assessment, Inc. for this report and emissions factors derived from the Title V applications (to the Northern Sonoma County APCD) for Units 5, 6, 7, 8, 9, 10, 11, 12, 14, 17, 18, and 20.

b Existing emissions reflect an average of emissions over the 1995 to 1997 period. The emissions estimates were made based on electricity generated during the 1995 to 1997 period and on emissions factors derived from the Title V applications (to the Northern Sonoma County APCD) for Units 5, 6, 7, 8, 9, 10, 11, 12, 14, 17, 18, and 20.

that increases of the other criteria air pollutants would be slightly less (on a percentage basis). Table 4.5-28 also shows that emissions in the cumulative 2005 A-Max scenario would be similar to those in the 1999 A-Max scenario. The increase in emissions (relative to the 1999 Baseline) would occur because of the estimated increase in annual capacities of individual units in Sonoma County under the A-Max scenario that would be expected to accompany the availability of relatively less expensive steam. (In contrast to many of the Sonoma County units, the Lake County units already use relatively less expensive steam and, therefore, for those units, there would be little difference between the Baseline case and the A-Max case.) The hydrogen sulfide

emissions estimates shown in Table 4.5-28 represent "controlled" emissions releases, which are the residual emissions subsequent to abatement by unit-specific hydrogen sulfide control systems (see Table 4.5-20). These emissions increases would occur within the limitations of existing air quality permits.

Conclusion

Tables 4.5-23 through 4.5-28 show increases in emissions for certain pollutants relative to existing and baseline cases. Since these emissions increases relate to "direct" sources, which are covered by air permits, rather than unpermitted "indirect" sources, the significance criterion of 15 tons per year for ROG, NO_x, and PM-10 would not apply. Furthermore, since these emissions increases would occur under air quality permits and would be consistent with all emissions limitations and standards, they are not considered to be significant unless they result in any significant increase in local concentrations of criteria air pollutants (see Impact 4.5-2), a significant increase in health risks in the vicinities of the plants (see Impact 4.5-3), or significant cumulative increases relative to emissions projections used in regional air quality plans, such as the *'97 Clean Air Plan* (see Impact 4.5-5).

Mitigation Measures Proposed as Part of Project

None.

Mitigation Measures Identified in This Report

None required.

Impact 4.5-2: The project may result in an increase in local concentrations of criteria air pollutants in the vicinities of the power plants. (Less than Significant)

Impacts from the Potrero, Contra Costa and Pittsburg fossil-fueled power plants were initially evaluated for baseline conditions and for the 1999 A-Max scenarios based on modeling that was performed by PG&E in the early 1990s using AB 2588 health risk assessment protocols. The impacts from these model runs were revised to account for emission changes at the plants as a result of the replacement of fuel oil in the boilers with natural gas. Also, emissions from the plants were changed to reflect new, more accurate data reported by EPA for combustion units at

the power plants (U.S. Environmental Protection Agency, 1998). When the updated emissions information was applied to the previously executed conservative modeling analyses, there were no air pollutant concentrations of concern for the Contra Costa plant. However, localized levels of PM-10 and NO_x were estimated to be higher at off-site receptors near the Potrero and Pittsburg power plants. Additional more detailed dispersion modeling was therefore conducted for these plants. No dispersion modeling was performed for the Geysers Power Plant since, with divestiture, emissions from the plant are not expected to change significantly, and ambient air quality monitoring data (Table 4.5-19) show that local levels are well below standards.

For Potrero and Pittsburg Power Plants, new atmospheric dispersion modeling was performed using an EPA approved dispersion model, ISCST3 (Industrial Source Complex Short Term 3, version 97363). The analysis for the Potrero plant utilized meteorological data from PG&E's on-site meteorological monitoring station for the year 1991. The analysis for the Pittsburg plant utilized meteorological data from PG&E's on-site meteorological monitoring station for the year 1994. Plant input parameters, such as topography, building configurations, and stack heights were provided by PG&E, and modeling was conducted using standard regulatory default modeling assumptions.

Impacts from the plant emissions on ambient air quality were determined by comparing the modeled maximum ambient air concentrations for the 1999 Baseline scenario with modeled A-Max scenarios. The incremental changes in air pollutant concentrations were compared with ambient air standards to determine whether the predicted concentrations would exceed the standards or would add to exceedances. For determining if the project may cause respiratory related effects because of changes in particulate matter emissions, the impacts were determined by evaluating the total contribution of PM-10/PM-2.5 emissions to ambient air levels for the A-Max scenario. The impacts for each plant are described below.

Potrero Power Plant

Maximum estimated concentrations for the Potrero Power Plant under the 1999 Baseline scenario conditions and under the 1999 Analytical Maximum scenario (the project) are shown in Table 4.5-29. The table shows that for nitrogen dioxide, sulfur dioxide and PM-10, the increases in maximum annual average concentrations are all less than 1 $\mu g/m^3$. Since the maximum concentrations plus the background are below the corresponding standard, the impacts are below the significance thresholds.

For short-term impacts, the maximum 24-hour concentration for PM-10 reported in Table 4.5-29 is predicted to increase by 0.5 micrograms per cubic meter over 1999 Baseline scenario conditions. For both the 1999 Baseline and the 1999 A-Max scenario, over 98 percent of the maximum level is contributed by emissions from the CTs at the plant (Units 4, 5, and 6). The maximum 24-hr concentrations of PM-10 for both the 1999 Baseline and for the 1999 A-Max scenario were determined from dispersion modeling runs of the maximum daily operating conditions. The maximum daily operating scenarios were extracted from a SERASYM™ modeling run of plant operations for an entire year. Table 4.5-29 shows that the maximum impact for the 1999 A-Max scenario is the difference between the Baseline and A-Max

TABLE 4.5-29
POTRERO POWER PLANT CONCENTRATION ESTIMATES[a]

		Concentrations in Micrograms per Cubic Meter ($\mu g/m^3$)							
					Power Plant Effect/Total Concentration[b]				
Pollutant	**Averaging Period**	**State Standard**	**National Standard**	**San Francisco Background**	**1999 Baseline**	**1999 Analytical Maximum**	**2005 Cumulative Analytical Maximum[d]**	**Difference between 1999 Analytical Maximum and Baseline**	**Difference between 2005 Cumulative Analytical Maximum and Baseline**
Carbon Monoxide	1 hour	23,000	40,000	6,133	157.9/6,291	157.9/6,291	157.9/6,291	0	0
	8 hours	10,000	10,000	4,217	56.1/4,273	56.1/4,273	56.1/4,273	0	0
Nitrogen Dioxide	1 hour[c]	470	NA	157	173.4/330.4	173.4/330	153.8/311	0	-18.6
	annual	NA	100	42	0.6/42.6	1/43	0.3/42	0.4	-0.3
Sulfur Dioxide	1 hour	655	NA	70	142.2/212.2	142.2/212	142.2/212	0	0
	24 hours	105	365	18	34.1/52.1	34.1/52	34.1/52	0	0
	annual	NA	80	<0.1	0.05/<0.1	0.06/<0.1	0.2/<0.15	0.01	0.15
Particulate Matter (PM-10)	24 hours	50	150	**57**	1.2/**58.2**	1.7/**58.7**	2.0/**59**	0.5	0.8
	annual	30	50	26	0.06/26.06	0.09/26	0.08/26	0.03	0.02
Particulate Matter (PM-2.5)	24 hours	NA	65	ND	1.2/1.2	1.7/1.7	2.0/2	0.5	0.8
	annual	NA	15	ND	0.06/ND	0.09/ND	0.08/ND	0.03	0.02

a Maximum concentration occurs approximately 0.6 miles west of the plant. Background concentrations (except for annual averages) represent the average of the 2nd highest values recorded each year from 1994 to 1996 at the Arkansas Street monitoring station in San Francisco.

b In these columns, the number on the left shows the contributions of the power plants; the number on the right is the total contribution, including the San Francisco background.

c Maximum NO2 concentrations from the power plant were calculated using the Ozone Limiting Method (Cole and Summerhays, 1979) based on a worst-case background ozone concentration of 133 micrograms per cubic meter.

d The 2005 Cumulative Analytical Maximum assumes new owners will have to comply with a modified BAAQMD Regulation 9, Rule 11 emission rate schedule similar to the existing schedule.

NA: Not applicable
ND: Not determined; PM-2.5 ambient monitoring has only recently begun in the Bay Area.

Values shown in bold type exceed a corresponding ambient air quality standard.

concentrations for the highest day in the year. Since the estimated increase is well below the 5 microgram per cubic meter significance threshold, the impact is less than significant.

Respiratory Effects from PM-10/PM-2.5 Emissions

An analysis was carried out to estimate the contribution of PM-10 emissions from the entire plant under the 1999 A-Max scenario and to determine if the PM-10 concentrations would cause respiratory related effects in the area. The assumptions used in this analysis are based on studies cited earlier in this section regarding changes in particulate matter concentrations and respiratory related health effects. The significance threshold is defined in Significance Criterion 4 earlier in this section. The modeled maximum annual average total contribution from the plant under the 1999 A-Max scenario was reported in Table 4.5-29 to be less than 0.1 $\mu g/m^3$. This contribution is well below the 10 microgram per cubic meter threshold cited earlier in Significance Criterion 4. Thus, the maximum contribution of the plant emissions to annual average PM-10 levels under the 1999 A-Max scenario is less than significant.

For acute exposure to PM-10 and potential respiratory effects, the maximum total plant contribution to the 24-hour average concentration of PM-10 under the 1999 A-Max scenario was calculated. The maximum plant contribution was determined by establishing a pattern of daily contributions of PM-10 concentrations for an entire year. This was carried out by first simulating the daily operations at the plant for a year by using the SERASYM™ model, applying the worst case short-term meteorology to the estimated emissions for each day in the dispersion model, and extracting the maximum daily PM-10 concentration calculated for the year. A frequency distribution was developed showing the number of days that the modeled concentration contributions from the Potrero Power Plant would fall into specific categories. The distribution, shown in Table 4.5-30 summarizes the results of the SERASYM™ model for an entire year. The distribution shows that the maximum 24-hour concentration contribution is estimated to be 1.7 $\mu g/m^3$ for the 1999 A-Max scenario. The table also shows that, most of the estimated short-term concentration contributions on other days of the year are between 1.0 and 1.5 $\mu g/m^3$. These concentration contributions are in addition to the background levels of PM-10. The estimated maximum contribution from the entire plant emissions for the 1999 A-Max scenario (1.7 $\mu g/m^3$) is well below the 20 $\mu g/m^3$ threshold defined under Significance Criterion 4. This contribution would have a less than significant effect.

Contra Costa Power Plant

Maximum modeled concentrations for the Contra Costa Power Plant under the 1999 Baseline scenario conditions and under the 1999 Analytical Maximum scenario (the project) are shown in Table 4.5-31. The table shows that the maximum annual average concentration of nitrogen dioxide is estimated to increase by about 13 $\mu g/m^3$ above the baseline due to the project (1999 Analytical Maximum). Since the total annual average concentration, including the background, is less than the federal standard, the annual average nitrogen dioxide impact would be less than significant. The estimated increase of PM-10 annual average concentrations for the 1999 A-Max scenario over the 1999 Baseline scenario is 1.3 $\mu g/m^3$. This increase plus the background is less than the state annual average standard. Therefore, the impacts on annual average ambient air

TABLE 4.5-30
DISTRIBUTION OF MODELED 24-HR PM-10 MAXIMUM CONTRIBUTIONS FROM POTRERO POWER PLANT FOR AN ENTIRE YEAR[a,b,c]

Range ($\mu g/m^3$)	1999 Baseline Frequency		1999 A-Max Frequency		2005 A-Max Frequency	
	Days	Percent	Days	Percent	Days	Percent
0-0.5	88	24	0	0	79	22
0.5-1.0	270	74	47	13	34	9
1.0-1.5	6	2	315	86.5	220	60
1.5-2.0	0	0	2	0.5	31	9
>2.0	0	0	0	0	0	0
Max Value	1.2 $\mu g/m^3$		1.7 $\mu g/m^3$		2.0 $\mu g/m^3$	

a A full year of plant operations (from SERASYM™) was input to locate maximum off-site 24-hour effect. The maximum ratio, which represents the worst case 24-hour methodology, was then applied to the full year of plant operations (by unit). The total of all units is shown in the table. ISC3 was used for the dispersion modeling.
b This table shows the maximum contribution of the plant to 24-hour PM-10 levels. Background PM-10 concentrations are not included in this table.
c For short-term exposure, the contribution from the plant would be significant if the maximum 24-hour average exceeds 20 $\mu g/m^3$, or if the number of days exceeding 20 $\mu g/m^3$ increases compared to the baseline.

concentrations of PM-10 are less than significant. The table shows that the maximum annual average sulfur dioxide impact is less than 1 $\mu g/m^3$ and that the total concentration is well below the ambient air standard. The increase would therefore be less than significant.

For evaluating 1-hour NO_2 and CO impacts, it was assumed that, over such a short time interval, the maximum operating rates for all units at the plant could be operating at the same maximum rate for both the 1999 baseline and for 1999 A-Max. Therefore the maximum 1-hour ambient air concentrations would not change. For the 8-hour CO and 24-hour SO_2 impacts, is was assumed that the plant would operate at maximum capacity under both scenarios and would not change.

This assumption can be made, because the ambient air concentrations for these pollutants are well below the standards, and any changes in these emissions would not cause a standard exceedance. Therefore, it was assumed that the maximum operating rates for units that generate NO_2, CO, and SO_2 would not change from the 1999 Baseline, and the impacts would be less than significant.

For the estimated maximum 24-hour concentration of PM-10, Table 4.5-31 shows that the maximum concentration is expected to increase as a result of the project by less than one microgram per cubic meter. Thus, the impact would be less than significant.

TABLE 4.5-31
CONTRA COSTA POWER PLANT CONCENTRATION ESTIMATES

		Concentrations in Micrograms per Cubic Meter ($\mu g/m^3$)							
					Power Plant Effect/Total Concentration[b]				
Pollutant	**Averaging Period**	**State Standard**	**National Standard**	**Delta Region Background**	**1999 Baseline**	**1999 Analytical Maximum**	**2005 Cumulative Analytical Maximum[d]**	**Difference between 1999 Analytical Maximum and Baseline**	**Difference between 2005 Cumulative Analytical Maximum and Baseline**
Carbon Monoxide	1 hour	23,000	40,000	6,517	81.1/6,598	81.1/6,598	81.1/6,804	0	0
	8 hours	10,000	10,000	3,297	56.7/3,354	56.7/3,354	56.7/3,498	0	0
Nitrogen Dioxide	1 hour[c]	470	NA	132	135.4/267	135.4/267	17.7/150	0	-117.7
	annual	NA	100	31	11.8/43	24.6/56	3.7/35	12.8	-8.1
Sulfur Dioxide	1 hour	655	NA	87	0.6/88	0.6/88	0.6/88	0	0
	24 hours	105	365	24	0.2/24	0.2/24	0.2/24	0	0
	annual	NA	80	3	0.2/3.2	0.3/3.3	0.3/3.3	0.1	0.1
Particulate Matter (PM-10)	24 hours	50	150	**60**	2.9/**62.9**	2.9/**62.9**	2.9/**62.9**	0	0
	annual	30	50	22	1.3/23.3	2.6/24.6	2.3/24.3	1.3	1
Particulate Matter (PM-2.5)	24 hours	NA	65	ND	2.9/2.9	2.9/2.9	2.9/2.9	0	0
	annual	NA	15	ND	1.3/ND	2.6/ND	2.3/ND	1.3	1

a Maximum contributions have been combined from the two units. No offsite location would reach these levels. Background concentrations (except for annual averages) represent the average of the 2nd highest values recorded each year from 1994 to 1996 at the Bethel Island monitoring station.
b In these columns, the number on the left shows the contributions of the power plants; the number on the right is the total contribution, including the Delta Region background.
c Maximum NO2 concentrations from the power plant were calculated using the Ozone Limiting Method (Cole and Summerhays, 1979) based on a worst-case background ozone concentration of 133 micrograms per cubic meter.
d The 2005 Cumulative Analytical Maximum assumes new owners will have to comply with a modified BAAQMD Regulation 9, Rule 11 emission rate schedule similar to the existing schedule.

NA: Not applicable
ND: Not determined; PM-2.5 ambient monitoring has only recently begun in the Bay Area.

Values shown in bold type exceed a corresponding ambient air quality standard.

Respiratory Effects from PM-10/PM-2.5 Emissions

With regard to the potential short-term impacts on respiratory effects, the estimated maximum 24-hour average contribution from the plant (with or without divestiture) is estimated to be less than 3 $\mu g/m^3$ (Table 4.5-31), which is well below the 20 $\mu g/m^3$ concentration threshold that may cause increased respiratory problems.

For chronic exposure to PM-10, the estimated maximum annual average contribution from the plant was shown in Table 4.5-31 to be less than 3 $\mu g/m^3$, which is below the significance threshold of 10 $\mu g/m^3$.

Pittsburg Power Plant

Maximum modeled concentrations for the Pittsburg plant under 1999 Baseline conditions and under the 1999 Analytical Maximum scenario (the project) are shown in Table 4.5-32. Similar to the other plants, the maximum annual average concentration of nitrogen dioxide for the 1999 Analytical Maximum scenario is predicted to increase over the 1999 baseline conditions. The maximum estimated increase (26 $\mu g/m^3$), plus the annual average background, is less than

the national ambient air standard of 100 $\mu g/m^3$. Therefore, annual average impacts of nitrogen dioxide are less than significant. For sulfur dioxide, the annual average increase is less than 0.2 micrograms per cubic meter, and for PM-10, the annual average increase is 1.1 $\mu g/m^3$. Since these increases plus the background levels are less than the ambient air standards, the impacts are less than significant.

Table 4.5-32 shows that the 1999 Analytical Maximum contribution of PM-10/PM-2.5 is estimated to be 15.9 $\mu g/m^3$ versus 12.3 $\mu g/m^3$ for the 1999 Baseline. The maximum short-term concentrations reported in Table 4.5-32 show that the estimated 24-hour levels for PM-10 and PM-2.5 are predicted to increase by 3.6 $\mu g/m^3$ over the 1999 Baseline conditions. For both the 1999 baseline and the 1999 Analytical Maximum scenarios, over 99% of the maximum levels are contributed by emissions from Units 1 through 4 at the plant. The difference between the maximum contributions (3.6 $\mu g/m^3$), and is less than the significance threshold of 5 $\mu g/m^3$.

For maximum one-hour levels of CO, NO_2, and SO_2, the estimated contributions under the A-Max scenario do not change from 1999 baseline conditions. Thus the impacts are less than significant.

The modeling results in Table 4.5-32 show that the maximum one hour average concentration of nitrogen dioxide may exceed the state standard under both the 1999 baseline conditions and under the 1999 Analytical Maximum scenario. The estimated maximum concentrations for both scenarios incorporate extremely conservative background conditions. For the worst case modeling analysis, it is assumed that the highest background levels for nitrogen dioxide and ozone occur simultaneously at the same location. The background levels for these pollutants directly affect the magnitude of the estimated one-hour nitrogen dioxide total concentration. Since it is highly unlikely that the maximum background levels occur simultaneously, it can be

TABLE 4.5-32
PITTSBURG POWER PLANT CONCENTRATION ESTIMATES[a]

		Concentrations in Micrograms per Cubic Meter ($\mu g/m^3$)							
					Power Plant Effect/Total Concentration[b]				
Pollutant	**Averaging Period**	**State Standard**	**National Standard**	**Delta Region Background**	**1999 Baseline**	**1999 Analytical Maximum**	**2005 Cumulative Analytical Maximum[d]**	**Difference between 1999 Analytical Maximum and Baseline**	**Difference between 2005 Cumulative Analytical Maximum and Baseline**
Carbon Monoxide	1 hour	23,000	40,000	6,517	551.6/7,068	551.6/7,068	288.2/6,805	0	-263
	8 hours	10,000	10,000	3,297	432.2/3,729	432.2/3,729	226/3,523	0	-206
Nitrogen Dioxide	1 hour[c]	470	NA	132	350.8/**483**	350.8/**483**	262/394	0	-89
	annual	NA	100	31	20.0/51	46.1/77	9.3/40.3	26.1	-10.7
Sulfur Dioxide	1 hour	655	NA	87	3.9/90.9	3.9/90.9	2.1/89.1	0	-1.8
	24 hours	105	365	24	1.6/25.6	1.6/25.6	0.8/24.8	0	-0.8
	annual	NA	80	3	0.14/3.1	0.3/3.3	0.13/3.1	0	-.01
Particulate Matter (PM-10)	24 hours	50	150	**60**	12.3/**72.3**	15.9/**75.9**	7.4/**67.4**	3.6	-4.9
	annual	30	50	22	1.1/23.1	2.2/24.2	1.0/23	1.1	-0.1
Particulate Matter (PM-2.5)	24 hours	NA	65	ND	12.3/12.3	15.9/15.9	7.4/7.4	3.6	-4.9
	annual	NA	15	ND	1.1/1.1	2.2/2.2	1.0/1.0	1	-0.1

a The maximum receptor is approximately 0.3 miles east of the plant. Background concentrations (except for annual averages) represent the average of the 2nd highest values recorded each year from 1994 to 1996 at the Bethel Island monitoring station.
b In these columns, the number on the left shows the contributions of the power plants; the number on the right is the total contribution, including the Delta Region background.
c Maximum NO2 concentrations from the power plant were calculated using the Ozone Limiting Method (Cole and Summerhays, 1979) based on a worst-case background ozone concentration of 133 micrograms per cubic meter.
d The 2005 Cumulative Analytical Maximum assumes new owners will have to comply with a modified BAAQMD Regulation 9, Rule 11 emission rate schedule similar to the existing schedule.

NA: Not applicable
ND: Not determined; PM-2.5 ambient monitoring has only recently begun in the Bay Area.

Values shown in bold type exceed a corresponding ambient air quality standard.

assumed that the state one-hour standard will not be exceeded. It should be noted that the maximum 1-hour concentration is predicted to be the same, with or without the project.

Respiratory Effects from PM-10/PM-2.5 Emissions The maximum contributions to 24-hour PM-10/PM-2.5 levels for both the 1999 Baseline and the 1999 Analytical Maximum scenarios were estimated to determine whether the total contributions from the plant emissions would cause significant respiratory effects. Dispersion model runs for the two scenarios were carried out to estimate the maximum offsite concentrations. Table 4.5-32 shows that the 1999 Baseline contribution (12.3 $\mu g/m^3$) and the 1999 A-Max scenario (15.9 $\mu g/m^{3)}$ are less than the threshold of 20 $\mu g/m^3$ that may cause increased respiratory effects. The maximum contributions were determined by modeling PM-10 emissions for the maximum daily operating scenario, which was

extracted from a SERASYM™ run of plant operations for an entire year. Daily power plant operations are expected to vary as modeled in this analysis, and worst case daily meteorology is used for every day of the year to see how plant operations would affect the most sensitive receptors. The maximum 24-hour contribution under the 1999 A-Max scenario (15.9 $\mu g/m^3$) is less than the threshold of 20 $\mu g/m^3$.

Table 4.5-33 shows a frequency distribution of the number of days that the modeled concentrations would fall into specific concentration intervals. The most frequent occurrences for 24-hour concentrations are between 10 and 15 $\mu g/m^3$ under the 1999 A-Max scenario.

TABLE 4.5-33
DISTRIBUTION OF MODELED 24-HR PM-10 MAXIMUM CONTRIBUTIONS FROM PITTSBURG POWER PLANT FOR AN ENTIRE YEAR[a,b,c]

Range ($\mu g/m^3$)	1999 Baseline Frequency		1999 A-Max Frequency		2005 A-Max Frequency	
	Days	Percent	Days	Percent	Days	Percent
0-5	200	55	0	0	88	24
5-10	149	41	14	4	276	76
10-15	15	4	222	61	0	0
15-20	0	0	128	35	0	0
>20	0	0	0	0	0	0
Max Value	12.3 $\mu g/m^3$		15.9 $\mu g/m^3$		7.36 $\mu g/m^3$	

a A full year of plant operations (from SERASYM™) was input to locate maximum off-site 24-hour effect. The maximum ratio, which represents the worst case 24-hour methodology, was then applied to the full year of plant operations (by unit). The total of all units is shown in the table. ISC3 was used for the dispersion modeling.
b This table shows the maximum contribution of the plant to 24-hour PM-10 levels. Background PM-10 concentrations are not included in this table.
c For short-term exposure, the contribution from the plant would be significant if the maximum 24-hour average exceeds 20 $\mu g/m^3$, or if the number of days exceeding 20 $\mu g/m^3$ increases compared to the baseline.

The maximum annual average contribution to PM-10/PM-2.5 levels from the plant under the 1999 A-Max scenario is estimated to be 2.2 $\mu g/m^3$, which is below the significance threshold of 10 $\mu g/m^3$ (Significance Criterion 4).

Year 2005 Cumulative

The contributions to ambient air concentrations for the year 2005 are based on the emissions estimated under the 2005 A-Max scenarios defined earlier in Tables 4.5-23 through 4.5-28. The estimated concentrations for the three fossil-fueled plants under these scenarios are shown in Tables 4.5-29, 31, and 32. Nitrogen dioxide concentrations are expected to be less than the 1999 Analytical Maximum scenarios if Regulation 9, Rule 11 applies., but the impacts would be higher if the rule does not apply to the new owner. Sulfur dioxide concentrations are not expected to change significantly and at some plants will decrease. The impacts would therefore be less than significant. PM-10 annual concentrations would not change over the 1999 Baseline and would decrease slightly at the Pittsburg plant because of the shut down of two units. Thus, the impacts are less than significant. For short-term impacts, there would be no change in maximum concentrations, because the maximum short-term operating rates would not change.

With regard to respiratory effects under the 2005 cumulative scenarios for the three plants, Tables 4.5-29, 4.5-31, and 4.5-32 show that the short-term and annual average concentrations of PM-10/PM-2.5 change only slightly from the 1999 A-Max or 1999 Baseline scenarios. The tables show that the maximum contributions from the plants of PM-10/PM-2.5 are much less than the significance thresholds of 10 $\mu g/m^3$ (maximum annual average contribution) and 20 $\mu g/m^3$ (maximum 24-hour average contribution).

Cumulative (2015) Bay Area Analysis

The City and County of San Francisco uses 2015 as an analysis year for evaluating the long-term environmental impacts of cumulative development. The air quality analysis of the recently-published *Draft Mission Bay Subsequent EIR* (Mission Bay SEIR) includes 2015 carbon monoxide concentration estimates for local intersections affected by cumulative increases in traffic (City and County of San Francisco, 1998). The Mission Bay SEIR predicts worst-case carbon monoxide concentrations in 2015 of 11.0 ppm, one-hour average, and 6.3 ppm, eight-hour average, at the study intersection nearest the Potrero Power Plant (i.e., Third and 16th Streets). These estimates include the effect of the increase in traffic due to cumulative development, including development at Mission Bay. The Mission Bay SEIR concludes that the cumulative effect would be less than significant because the concentrations would be below the applicable ambient air quality standards of 20 ppm, one-hour average, and 9.0 ppm, eight-hour average.

The project (i.e., divestiture of the power plants) would generate little or no additional motor vehicle traffic, and thus, would not result in traffic-related carbon monoxide concentration changes at Third and 16th Streets greater than those estimated for the Mission Bay SEIR. Stationary source emissions associated with the Potrero Power Plant located in San Francisco would be affected. To evaluate this effect, this report includes worst-case estimates of carbon monoxide concentrations in the vicinity of that power plant (see Table 4.5-29). If the maximum

carbon monoxide concentration impact shown in the Table 4.5-29 were added to the estimates developed for the intersection of 3rd and 16th Streets, the sum would be approximately 11.14 ppm, one-hour average, and approximately 6.35 ppm, eight-hour average. Since these values would be well below their respective ambient standards, the project (and cumulative growth) would not result in a significant cumulative effect on local carbon monoxide concentrations.

Geysers Power Plant

Tables 4.5-27 and 4.5-28 show that emissions of criteria air pollutants are not expected to change at the Lake County units, but that emissions would increase at the Sonoma County units. On a local basis, the only criteria air pollutants of concern would be PM-10 and hydrogen sulfide. Based on Table 4.5-28, the increase in PM-10 emissions is estimated to be approximately 36 percent. Such an increase would not result in standard exceedances given the low background concentrations in the project vicinity. To support this conclusion, it is noted that Table 4.5-19 shows that the highest monitored 24-hour PM-10 concentrations in the vicinity over the past five years are approximately 60 percent of the state standard and the highest annual average PM-10 concentrations are approximately 40% of the standard. Further, even if one were to assume that all of the monitored PM-10 were from the Sonoma County units, which is a grossly conservative assumption, a 36 percent increase in PM-10 concentrations would not result in exceedances of either the 24-hour or annual average state PM-10 standards. Thus, the estimated increase in PM-10 would not be significant. The same logic can be used to conclude that the PM-10 impacts associated with the cumulative 2005 A-Max scenario would also be less than significant. The potential effects associated with the estimated increase in hydrogen sulfide emissions are discussed under Impact 4.5-3.

Mitigation Measures Proposed as Part of Project

None.

Mitigation Measures Identified in This Report

None required.

Level of Significance After Mitigation: Less than Significant

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Impact 4.5-3: The project may lead to an increase in health risks from toxic air contaminants in the vicinities of the power plants. (Less than Significant)

Potrero Power Plant

The predicted maximum health risk from emissions of carcinogenic substances for Baseline conditions was reported earlier in this section. The maximum reported risk under existing conditions (0.17 in a million) was the result of burning natural gas to power Unit 3 and burning distillate in the combustion turbines (CTs). Since the same fuel types will be burned under 1999 baseline conditions, the risks from exposure to carcinogenic substances will change in proportion

to the amount of annual fuel use changes in future years. Both the 1999 A-Max and 2005 Cumulative A-Max show the potential for the plant to increase operations, and those levels are quantified in Chapter 3 and Appendix G of this EIR. Table 4.5-34 summarizes the estimated health risks for the three fossil-fueled plants under existing, 1999 Baseline, 1999 A-Max, and 2005 Cumulative A-Max conditions.

Under the 1999 Baseline conditions, emissions of carcinogenic substances are not expected to change significantly, and the estimated maximum risk would remain at 0.17 in a million. Under divestiture, assuming that the plant operates at its Analytical Maximum capacity, annual fuel use is expected to increase, thus increasing emissions of carcinogenic substances slightly. The estimated risk from additional fuel usage under the 1999 A-Max scenario is expected to increase by 0.06 in a million over 1999 baseline conditions. The total risk in 1999 A-Max is therefore estimated to be 0.23 in a million. Since the total estimated risk is well below the significance threshold of 10 in a million, the health risk from exposure to carcinogenic substances under divestiture would be less than significant. The predicted maximum hazard index for chronic exposure to non-carcinogens is estimated to be less than 0.03, and the estimated acute hazard index would remain the same as for the baseline (less than 0.2 in a million). For chronic and acute exposure to non-carcinogens, the hazard indices would therefore remain well below the significance threshold of 1.0 and would be less than significant.

Contra Costa Power Plant

Table 4.5-34 shows that the maximum incremental health risk from emissions of carcinogenic substances from the plant was estimated to be about 0.03 in a million. Under 1999 Baseline conditions, the estimated risk would be 0.04 in a million. Under divestiture, assuming that the plant operates under its Analytical capacity, the health risk would increase slightly, because of the expected increase in annual fuel use. Both the 1999 A-Max and 2005 Cumulative A-Max show the potential for the plant to increase operations, and those levels are quantified in Chapter 3 and Appendix G of this EIR. The emissions changes would cause the estimated maximum risk to be about 0.05 in a million, which is well below the significance threshold of 10 in a million. Most of the risk is due to exposure to gasoline vapors during the handling of fuel for vehicles, which is not expected to change under divestiture. Thus, the impact is less than significant.

For exposure to non-carcinogenic substances under existing and 1999 Baseline conditions, the hazard indices for chronic and acute exposure were estimated to be 0.01and 0.02, respectively. Because emissions would increase under divestiture, the hazard indices for both chronic and acute exposure would increase slightly to levels less than 0.02, and the hazard index for acute exposure would remain at 0.02. The impacts are less than significant since they are below the significance threshold of 1.0.

Pittsburg Power Plant

Table 4.5-34 shows that the maximum incremental health risk from emissions of carcinogenic substances from the Pittsburg plant under existing conditions is estimated to be 0.1 in a million. Under 1999 baseline conditions, the estimated risk would be 0.13 in a million. Both the 1999

TABLE 4.5-34
SUMMARY OF HEALTH RISKS FOR PG&E FOSSIL FUELED POWER PLANTS

Plant	Existing Conditions[a]			1999 Baseline[b]			1999 A-Max[b]			2005 Cumulative A-Max[b]		
	Cancer Risks[d] (in a million)	Hazard Index[c] Chronic	Hazard Index[c] Acute	Cancer Risks (in a million)	Hazard Index[c] chronic	Hazard Index[c] acute	Cancer Risks[d] (in a million)	Hazard Index[c] chronic	Hazard Index[c] acute	Cancer Risks[d] (in a million)	Hazard Index[c] chronic	Hazard Index[c] Acute
Potrero	0.17	0.02	0.2	0.17	0.02	0.2	0.23	0.03	0.2	0.28	0.035	0.2
Contra Costa	0.03	0.01	0.02	0.04	0.01	0.02	0.05	0.02	0.02	0.04	0.02	0.02
Pittsburg	0.1	0.01	0.01	0.13	0.02	0.01	0.17	0.03	0.01	0.14	0.02	0.01

a Cancer risks and Hazard Indices are based on the results reported in Pacific Gas and Electric Company Air Toxics Hot Spots Risk Assessments (1993), adjusted to existing emissions.
b Risks are adjusted to projected 1999 and 2005 emissions.
c Hazard index is the ratio of the maximum exposure level and the reference dose of each toxic substance. The reference dose is the level with no observed health effect. A hazard index less than 1.0 indicates no health effect.
d The significance threshold for incremental cancer risk is 10 in a million, based on BAAQMD Guidelines.

SOURCE: Environmental Science Associates

A-Max and 2005 Cumulative A-Max show the potential for the plant to increase operations, and those levels are quantified in Chapter 3 and Appendix G of this EIR. Under the 1999 A-Max scenario, the health risk would increase slightly to 0.17 in a million, which is well below the significance threshold of 10 in a million.

For exposure to non-carcinogenic substances under existing conditions, both the chronic and acute hazard indices at the maximum receptor are estimated to be 0.01. Under 1999 baseline conditions, the hazard indices for chronic and acute exposure were estimated to be 0.02 and 0.01, respectively. Because annual emissions would increase under divestiture, the chronic hazard index would increase slightly to 0.03. The hazard index for acute exposure would remain at 0.01. The impacts are less than significant since they are below the significance threshold of 1.0.

Year 2005/Cumulative Analytical Maximum

Table 4.5-34 shows that the cancer risks for the three plants will not change significantly under the 2005 Cumulative A-Max scenario. Compared to 1999 Baseline conditions, the cancer risk at the Potrero Plant increases slightly to 0.28 in a million; for Contra Costa the risk stays the same as the 1999 baseline (0.04 in a million); and for the Pittsburg plant, the risks increase slightly over 1999 Baseline to 0.14 in a million. Maximum risks at all three plants remain well below the significance threshold of 10 in a million.

Table 4.5-34 shows that, under the 2005 Cumulative A-Max scenario, the chronic and acute hazard indices remain well below the significance threshold of 1.0 at each of the three plants. These impacts would remain less than significant.

Cumulative (2015) Bay Area Analysis

The City and County of San Francisco uses 2015 as an analysis year for evaluating the long-term environmental impacts of cumulative development. The Mission Bay SEIR notes:

Foreseeable development in San Francisco and throughout the Bay Area would contribute to cumulative toxic air contaminant emissions and their resulting risks. Both stationary and mobile sources would contribute to these toxic air contaminant emissions. Only sources that would be relatively close to one another would be likely to directly result in any substantial cumulative exposure and risk because toxic air contaminant concentrations attenuate substantially with distance. However, all toxic air contaminant sources would likely contribute to ambient conditions in the Bay Area (City and County of San Francisco, 1998).

Power plant emissions of toxic air contaminants contribute incrementally to risks in the immediate vicinity of the power plants and to overall ambient risks in the Bay Area. However, as described above, the facility-specific (as opposed to overall ambient) risks from the power plants would be less than significant. By 2015, cumulative ROG emissions from power plants would be higher than in 2005 due to cumulative increases in load demand, and formaldehyde and benzene emissions would increase in rough proportion to the increase in ROG emissions. However, in the vicinities of the power plants evaluated in this report, this cumulative increase would not result in

significant local effects given the extent to which the calculated risks would be below the applicable significance criteria.

With respect to the cumulative contribution to overall ambient risk from toxic air contaminants in the Bay Area (from all sources, including mobile and stationary), the Mission Bay SEIR notes that no authoritative regulatory body has adopted any standard to determine whether the risks posed by existing levels of toxic air contaminants should be considered acceptable and, in turn, whether possible increases in ambient risks could potentially be considered significant. The Mission Bay SEIR declines from adopting a significance criterion and, instead, assumes that the cumulative impact on ambient concentrations of toxic air contaminants would be significant since the project-specific impact would be significant. Based on the converse to that concept, the contribution of divestiture to overall cumulative ambient risk would be less than significant because the project-specific impact would be less than significant.

Geysers Power Plant

The principal health risk that could be experienced from plant operations under the 1999 A-Max scenario would be the potential for increased acute exposure to toxic hydrogen sulfide emissions. For the Lake County units, emissions of hydrogen sulfide are estimated to remain the same (see Table 4.5-27) under the 1999 A-Max scenario as compared with the 1999 Baseline, while the corresponding emissions at the Sonoma County units are estimated to increase by approximately 40 percent (see Table 4.5-28). However, this increase in hydrogen sulfide emissions would not be expected to result in a significant increase in health risk or nuisance odor complaints since the two phenomena are essentially independent of one another. This is because the peaks in hydrogen sulfide concentrations (and ensuing complaints) that have occurred in the past have been the result of uncontrolled releases of steam due to events like steam stacking rather than from the steady-state, "controlled" emissions released at the power plants. As discussed in the setting section, an automated pipe manifold system has been installed, and this system has significantly reduced the incidents of steam stacking. Since the project would not affect operation of the manifold system, the project would not have a significant effect on the local health risks or the potential for nuisance odor complaints that are associated with steam stacking and related uncontrolled releases of steam.

Mitigation Measures Proposed as Part of Project

None.

Mitigation Measures Identified in this Report

None required.

Impact 4.5-4: The project may result in the elimination of PG&E's existing voluntary FTP cleanup programs. Loss of these programs could result in nuisance effects, caused by FTP stains. (Less than Significant)

Potrero Power Plant

While PG&E does not maintain FTP programs at the Potrero power plant, the company addresses claims on an as-needed basis. As shown on Figure 4.5-2, unlike the winds at Contra Costa and Pittsburg (see Figures 4.5-3, -4), the winds at Potrero exhibit strong west-southwesterly directional predominance a substantial portion of the time, on a yearly basis. This directional preference in local wind direction should tend to cause FTP resulting from Potrero to be deposited downwind of the plant, out over San Francisco Bay. This same directional preference further makes it unlikely that the China Basin would be impacted. As there is no established, ongoing cleanup program for the Potrero plant, the potential impact would be less than significant. Furthermore, BAAQMD Reg. 1-301 provides potential relief to affected parties, as would a civil claim for nuisance damages.

Delta Power Plants (Contra Costa and Pittsburg)

PG&E's current FTP cleanup programs are not mandated by any specific rule or regulation. With the project, a new owner would not be obligated to continue these FTP cleanup programs as currently implemented by PG&E. As is discussed elsewhere in this report, a new owner may have the tendency to operate these plants more than PG&E. Such increased operations could potentially increase either the amount or frequency of FTP locally deposited, although by how much or how much more often would be difficult to determine. Increased operations may in fact actually decrease FTP releases, as they generally occur during plant start-up. While BAAQMD Reg. 1-301 provides potential relief to affected parties, as would a civil claim for nuisance damages, the loss of any program to address FTP could still represent a negative, but less-than-significant, impact.

Geysers Power Plant

Because there are no combustion sources used in the process that can generate acidic particles at the Geysers, no measurable impact from FTP is expected. Therefore, the project would have a less than significant impact.

Mitigation Measures Proposed as Part of Project

None.

Mitigation Measures Identified in this Report

Mitigation Measure 4.5-4: PG&E will provide the buyers of the Pittsburg and Contra Costa power plants with a summary of the history of FTP emissions and claims involving these plants, and information regarding PG&E's procedures for inspecting and cleaning the boilers and stacks at these two plants to minimize FTP. The buyers of the Pittsburg and Contra Costa power plants will develop procedures for minimizing FTP emissions in future operations, and institute a program for processing FTP claims that includes, at a minimum, a point of contact for claimants and procedures for expeditiously verifying and processing claims. PG&E shall not be required to disclose attorney-client work product information to enable the buyers to satisfy this condition.

Monitoring Action:	PG&E will provide the CPUC mitigation monitor with (a) verification that the buyers of the Contra Costa and Pittsburg Power Plants have received a historical summary of FTP emissions and claims involving the plants, and information regarding PG&E's FTP minimization procedures for these two plants, and (b) the buyer's description of its proposed FTP minimization procedures and claims processing program for the Contra Costa and Pittsburg Power Plants.
Responsibility:	CPUC
Timing:	PG&E will provide the submittal to the CPUC a minimum of 45 days prior to the transfer of title for the Contra Costa and Pittsburg Power Plants. CPUC approval of the submittal at least ten days prior to transfer of title of the Contra Costa and Pittsburg Power Plants.

Level of Significance after Mitigation: Less than Significant

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Impact 4.5-5: Depending upon whether, and how, the BAAQMD modifies Regulation 9, Rule 11, the project may be inconsistent with regional air quality plans. (Significant)

The potential for inconsistency relates to the Bay Area fossil-fueled power plants but not to the Geysers plant because the Bay Area is the subject of regional air quality plans, whereas no such plans have been required for Lake County or northern Sonoma County.

A series of air quality plans has been developed for the San Francisco Bay Area to address non-attainment of national and state ambient air quality standards. The two applicable air quality plans are the *'97 Clean Air Plan*, which was developed to address the non-attainment status relative to the state ambient ozone standard, and the *Ozone Maintenance Plan*, which was developed to address the "maintenance" status (i.e., of a former non-attainment area) for the national ambient ozone standard. The latter plan, the *Ozone Maintenance Plan*, is subject to revision due to EPA's recent announcement of a final decision to re-designate the Bay Area back to "non-attainment" for the national one-hour ozone standard.

The potential inconsistency of the project with these plans can be described qualitatively in relation to control measures adopted as part of these plans. Under the California Clean Air Act, the *'97 Clean Air Plan* is required to include control measures that will require certain types of major stationary sources to implement Best Available Retrofit Control Technology (BARCT). The boilers included in this project are among the types of sources for which BARCT is required. If the BAAQMD declines to modify Regulation 9, Rule 11, which is the rule that requires BARCT to be installed at the boilers, then the project could be characterized as being inconsistent with the *'97 Clean Air Plan*. The potential inconsistency with a specific control measure included in the *'97 Clean Air Plan* would be a significant effect of the project.

The potential inconsistency of the project with these plans can also be described quantitatively in relation to the emissions projections included in these plans. The *'97 Clean Air Plan* contains emissions estimates and projections for power plants. These emissions estimates were made with

certain assumptions concerning electricity generation and with certain assumptions about the effectiveness of BAAQMD Regulation 9, Rule 11. Neither set of assumptions (electricity generation and Regulation 9, Rule 11) may prove accurate.

Tables 4.5-35 and 4.5-36 provide a rough comparison between the power plant emissions estimates and projections included in the *'97 Clean Air Plan* and those for the baseline and Analytical Maximum. Tables 4.5-35 and 4.5-36 only include ROG, NO_x, and PM-10 emissions, to be consistent with the emissions projections included in the *'97 Clean Air Plan*. Emissions projections developed for the *'97 Clean Air Plan* correspond to Years 2000 and 2003. The method used to provide the comparison shown in Tables 4.5-35 and 4.5-36 involved interpolation of the emissions estimates shown under Impact 4.5-1 (e.g., Tables 4.5-23, 4.5-24, 4.5-25, and 4.5-26) for 1999 and 2005 for all four Bay Area power plants and adjustment of the emissions projections in the *'97 Clean Air Plan* to account for recent EPA revisions to CO and PM-10 emissions factors for natural gas combustion. Also, ROG emissions estimates in the *'97 Clean Air Plan* were adjusted to reflect the source test data used to develop the boiler ROG emissions for this EIR.

TABLE 4.5-35
COMPARISON WITH '97 CLEAN AIR PLAN POWER PLANT EMISSIONS ESTIMATES, 2000

	Emissions (tons per year)		
	Year 2000		
Pollutant	**Baseline**	**A-Max**	**'97 CAP[a]**
With Continued Application of BAAQMD Regulation 9, Rule 11:			
Reactive Organic Gases	431	785	177
Nitrogen Oxides	3,796	7,552	4,928
Particulate Matter	388	708	376
Without Continued Application of BAAQMD Regulation 9, Rule 11[b]:			
Nitrogen Oxides	3,796	9,590	NA[c]

a Emissions estimates included in the *'97 Clean Air Plan* were adjusted from tons per day to tons per year. In addition, the *'97 Clean Air Plan* estimates for ROG and PM-10 from power plants were adjusted to reflect the latest EPA emissions factors for natural gas combustion, which were used to develop the power plant emissions estimates contained in this report.

b For this case, only emissions of nitrogen oxides are shown. The other criteria pollutants shown above would be essentially the same with or without Regulation 9, Rule 11. Therefore, these emissions were not repeated for this case.

c NA = not applicable; the 1997 Clean Air Plan assumes that BAAQMD Regulation 9, Rule 11 would apply to the Bay Area power plants.

TABLE 4.5-36
COMPARISON WITH '97 CLEAN AIR PLAN POWER PLANT EMISSIONS ESTIMATES, 2003

Pollutant	Emissions (tons per year) Year 2003 Baseline	A-Max	'97 CAP[a]
With Continued Application of BAAQMD Regulation 9, Rule 11:			
Reactive Organic Gases	462	735	199
Nitrogen Oxides	2,253	4,109	2,665
Particulate Matter	404	650	411
Without Continued Application of BAAQMD Regulation 9, Rule 11[b]:			
Nitrogen Oxides	4,858	8,310	NA[c]

a Emissions estimates included in the *'97 Clean Air Plan* were adjusted from tons per day to tons per year. In addition, the *'97 Clean Air Plan* estimates for ROG and PM-10 from power plants were adjusted to reflect the latest EPA emissions factors for natural gas combustion, which were used to develop the power plant emissions estimates contained in this report.

b For this case, only emissions of nitrogen oxides are shown. The other criteria pollutants shown above would be essentially the same with or without Regulation 9, Rule 11. Therefore, these emissions were not repeated for this case.

c NA = not applicable; the 1997 Clean Air Plan assumes that BAAQMD Regulation 9, Rule 11 would apply to the Bay Area power plants.

Table 4.5-37 presents the net change over the emissions estimates contained in the *'97 Clean Air Plan* as a percentage of the emissions inventory for the region. As shown in Table 4.5-37, the relative change in emissions would depend upon whether BAAQMD Regulation 9, Rule 11 would be modified to continue to apply to the power plants in the Bay Area. In 2000, the project could result in NO_x emissions increases that would be equivalent to +1.4 percent to +2.5 percent of the regional NO_x emissions inventory. By 2003, the NO_x emissions increases would be +0.9 to 3.4 percent of the NO_x emissions inventory. The lower end of the range relates to the A-Max scenario under which the BAAQMD rule is modified and the higher end of the range relates to A-Max scenario under which the Rule is not changed and no longer applies. As shown in Table 4.5-37, with or without modifications to the BAAQMD Regulation 9, Rule 11, the A-Max scenario could result in NO_x emissions that exceed assumptions for emissions from power plants in the Bay Area (used in the *'97 Clean Air Plan)* by the equivalent of more than one-percent of the regional inventory for NO_x in 2000 and in 2003 if the modifications to Regulation 9, Rule 11 are not implemented. In 2003, the increase in NO_x emissions above the *'97 Clean Air Plan* assumptions would be less than one percent of the regional inventory if modifications to Regulation 9, Rule 11 are implemented.

TABLE 4.5-37
NET DIFFERENCE IN POWER PLANT EMISSIONS RELATIVE TO '97 CLEAN AIR PLAN ESTIMATES AS PERCENT OF REGIONAL INVENTORY, 2000 AND 2003

	Net Difference Relative to '97 Clean Air Plan as Percent of Regional Emissions[a]			
	Year 2000		Year 2003	
Pollutant	**Baseline**	**A-Max**	**Baseline**	**A-Max**
With Continued Application of BAAQMD Regulation 9, Rule 11:				
Reactive Organic Gases	0.2	0.4	0.2	0.4
Nitrogen Oxides	-0.6	1.4	-0.3	0.9
Particulate Matter	<0.1	0.4	<0.1	0.3
Without Continued Application of BAAQMD Regulation 9, Rule 11[b]:				
Nitrogen Oxides	-0.6	2.5	1.3	3.4

a Percentages shows in this table are based on the regional emissions inventory contained in the *'97 Clean Air Plan* as adjusted to reflect annual emissions.

b For this case, only emissions of nitrogen oxides are shown. The other criteria pollutants shown above would be essentially the same with or without Regulation 9, Rule 11. Therefore, these emissions were not repeated for this case.

The principal reason for the difference in power plant emissions estimates is the difference in Bay Area electric power generation projections from which the emissions estimates are derived. For example, the electric power generation projections developed by using a model known as UPLAN (and used for the *'97 Clean Air Plan* power plant emissions estimates) predict electric power generation in 2000 from the steam turbines of 8,536 GWh. In contrast, the electric power generation modeling prepared for this report predicts Bay Area generation that is interpolated to be between 9,724 GWh (baseline) and 18,534 (A-Max) in 2000 (not including the combustion turbines).[10] Likewise, in 2003, the *'97 Clean Air Plan* predicts a generation rate of 8,734 GWh whereas the modeling results for this report provides the basis for a prediction of a generation rate of between 11,964 to 18,732 GWh (not including the existing combustion turbines, but including a future 480 MW power plant assumed to replace the Hunters Point Power Plant).

The physical effect of the inconsistency in power plant emissions projections would be that some of the benefit to regional air quality of control strategies implemented under the *'97 Clean Air Plan* would be offset to some degree. In other words, due to the possibility of higher-than-expected electric power generation rates and associated emissions that could occur as a result of divestiture as modeled in the 1999 A-Max scenario, the Plan could be less effective in improving

10 In addition to differences in overall Bay Area electric generation, the emissions estimates in this report differ from those in the '97 Clean Air Plan because of differences in projected annual capacity factors for specific units at the plants.

regional air quality than had been expected when the Plan was approved by BAAQMD. On the basis of the one-percent criterion, this effect would be significant with respect to regional NO_x emissions.

Mitigation Measure Proposed as Part of Project

None.

Mitigation Measures Identified in this Report

Mitigation Measure 4.5-5: To assure that the existing NO_x emission rate limits would apply to a new owner, BAAQMD Regulation 9, Rule 11 shall be modified so that substantially equivalent emission rate limits would apply to any new owner, or PG&E will have existing permits revised (for any fossil-fueled plant that is divested) to incorporate NO_x emission rate limits, which would apply to any new owner, in substantially the form and stringency in the current BAAQMD Regulation 9, Rule 11.

Monitoring Action:	PG&E provides the CPUC mitigation monitor with a copy of either the revised Regulation 9, Rule 11 or a modified permit to operate for each plant that is divested.
Responsibility:	CPUC
Timing:	At least 3 business days prior to the transfer of title.

Level of Significance After Mitigation: Significant. With the above measure, the inconsistency with the control strategy developed to improve regional air quality would be eliminated on a qualitative basis. With respect to power plant emissions estimates, Table 4.5-37, above, shows that, even with this measure, power plant NO_x emissions would still exceed the one-percent criterion in 1999 under the A-Max scenario (see Table 4-5-36 above). The net change in NO_x emissions would be reduced to less than one-percent of the inventory by 2003. Therefore, if the plants operated at the A-Max scenario, the estimated increase in power plant emissions over those included in the *'97 Clean Air Plan* would be a significant, unavoidable, but temporary effect.

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