8.1 Air Quality

This section discusses issues pertaining to air quality as applicable to the Chevron Richmond Refinery Power Plant Replacement Project (PPRP, or the Project). It contains the following sections:

- Section 8.1.1 presents a summary description of the PPRP.
- Section 8.1.2 presents the air quality setting, including geography, topography, climate, and meteorology.
- Section 8.1.3 provides an overview of the ambient air quality standards.
- Section 8.1.4 discusses existing air quality in the vicinity of the Project and describes each of the criteria pollutants.
- Section 8.1.5 identifies the laws, ordinances, regulations, and standards (LORS) that can affect the Project and Project conformance, as well as the air quality regulatory agencies relevant to the Project.
- Section 8.1.6 presents the environmental analysis of emissions from the construction and operation of the Project, as well as the procedures used in assessing facility emissions and air quality impacts, and the results of the health risk assessment.
- Section 8.1.7 discusses compliance with LORS applicable to the Project.
- Section 8.1.8 discusses mitigation for Project air quality impacts.
- Section 8.1.9 presents the cumulative impacts assessment.
- Section 8.1.10 provides a list of references used in preparing this section.
- The data used to determine the construction impacts are presented in Appendix 8.1-A; the facility emissions and operating assumptions are presented in Appendix 8.1-B; and the data for the air quality impact assessment (AQIA), including the dispersion modeling input parameters, are presented in Appendix 8.1-C.

Potential public health risks posed by emissions of toxic air contaminants, including ammonia, are also addressed in more detail in Section 8.6, Public Health.

8.1.1 Introduction

Chevron is proposing the PPRP to add an additional 60 megawatts (MW) net generation to its existing refinery electrical generation located within Chevron's Richmond Refinery in the City of Richmond (see Figure 1.2-1) in Contra Costa County, California. The proposed PPRP will be integrated into Chevron's plans to meet its growing refinery electrical load, and produce steam to replace an existing boiler plant that is approaching its end of life. The PPRP is a subset of the larger Richmond Refinery Renewal Project that is concurrently undergoing California Environmental Quality Act (CEQA) review by the City of Richmond. The California Energy Commission (CEC) has jurisdiction for only the PPRP portion of the Renewal Project which is the subject of this application.

The PPRP will consist of the following components:

- A nominal 43-MW net, natural gas- or liquid petroleum gas (butane)-fired cogeneration train consisting of one combustion turbine generator (CTG), a refinery fuel gas-fired heat recovery steam generator, 13.8-kilovolt (kV) switchgear and ancillary equipment.
- Shutdown of the existing No. 1 power plant refinery steam boilers currently providing steam to the Refinery.
- A 17-MW net extraction, condensing steam turbine generator (STG), an associated cooling tower, and 12-kV switchgear installed as part of the new hydrogen production facility (the remainder of the hydrogen plant is under CEQA review as part of the Renewal Project). The new hydrogen plant will be a net generator of steam for both the STG and the Refinery steam system.
- Reconductoring of approximately 4,000 feet of existing onsite double-circuit overhead 115-kV transmission line to upgrade its ampacity. The reconductoring will reuse existing transmission line structures.
- Adjacent onsite service connections for fuel, reclaimed water, water, wastewater, steam, and electricity to existing piperacks, with the exception of the reconductoring noted above.

The Cogen 3000 portion of the PPRP will occupy approximately 0.5 acre within an existing 5.2-acre cogeneration facility, and the STG and associated equipment (H_2-STG) will occupy approximately 0.5 acre within a new 7.9-acre hydrogen plant that will be built as part of the Richmond Refinery Renewal Project. The PPRP will be located well within the heart of the existing 2,900-acre Richmond Refinery. Temporary construction laydown and parking for the PPRP will be provided in various existing laydown areas within the Refinery that are currently used for ongoing maintenance and project laydown. A complete description of the PPRP is provided in Section 2.0.

8.1.2 Air Quality Setting

8.1.2.1 Geography and Topography

The proposed Renewal Project site is located in the western portion of the city of Richmond, at 841 Chevron Way. The new equipment associated with the PPRP will be located within the boundaries of the existing Chevron Refinery property. The Project site is relatively flat; at an elevation of approximately 15 feet (5 meters) above sea level. The hills which border the western property boundary rise to an elevation of approximately 450 feet. The hills east of the Project site are approximately 4 to 5 miles from the site and rise to a height of approximately 400 to 600 feet, gradually rising to approximately 1,500 feet southeast of the facility. The Coastal Mountain range lies approximately 5 miles to the west of the facility across the San Pablo Bay in Marin County and includes Mount Tamalpais, which has a peak height of approximately 2,600 feet above sea level.

8.1.2.2 Climate and Meteorology

The climate of the greater San Francisco Bay Area, including Richmond, is a Mediterranean-type climate characterized by warm, dry summers and mild, wet winters. The warmest days

of the year, however, normally occur during the month of September, with an average maximum mean temperature of 74 degrees Fahrenheit (°F) while daytime winter temperatures average about 60°F (WRCC, 2007). A climate summary, including average annual rainfall, for the nearby city of Richmond, is included in Appendix 8.1-C.

The climate is influenced largely by a high-pressure system often present over the eastern Pacific Ocean. In winter, the Pacific high-pressure system shifts southward, allowing storms to pass through the region. The mean annual rainfall in Richmond, for the period between 1950 and 2005, is approximately 23 inches (WRCC, 2007). A majority of the rainfall in the Richmond area falls between November and March as frontal storms move from the northwest to southeast. Over 80 percent of the average rainfall occurs during these months (WRCC, 2007).

The prevailing winds in the region are from the southwest; however, due to the heavy influence of topographic features in the Project area, winds in Richmond are predominately from the south-southeast. The wind is typically the strongest in the afternoons. During the summer and fall months, high pressure offshore coupled with low pressure in the Central Valley causes marine air to flow eastward through the Carquinez Strait. Afternoon wind speeds of 15 to 20 miles per hour (mph) are common throughout the strait region. Annual average wind speeds are approximately 8 mph in Martinez, and approximately 9 to 10 mph further east. The air flowing in from the coast to the Central Valley, called the sea breeze, begins developing at or near ground level along the coast in late morning or early afternoon. As the day progresses, the sea breeze layer deepens and increases in velocity while spreading inland. (BAAQMD, 1999)

Inversions affect air quality conditions significantly because they influence the vertical depth in the atmosphere available for diluting air contaminants released near the ground (i.e., the "mixing depth" of the atmosphere). Temperature inversions are common in summer and fall seasons when the conditions for sea breezes are most frequent. Radiation inversions are common during the winter months when the heat quickly radiates from the earth's surface causing the air in contact with it to rapidly cool. Mixing depths under both of these conditions can be as shallow as 50 to 100 meters. (BAAQMD, 1999)

The Bay Area Air Quality Management District (BAAQMD) maintains a meteorological station at the Chevron Refinery. Therefore, the BAAQMD's meteorological data files for 1999 through 2003 were used in the dispersion modeling analysis to represent typical winds at the PPRP site. The annual and quarterly wind rose plots for the Chevron Refinery monitoring station are presented in Appendix 8.1-C.

8.1.3 Overview of Air Quality Standards

The U.S. Environmental Protection Agency (USEPA) has established national ambient air quality standards (NAAQS) for the following seven pollutants, termed "criteria pollutants": ozone (O_3), nitrogen dioxide (NO_2), carbon monoxide (CO), sulfur dioxide (SO_2), particulate matter with aerodynamic diameter less than or equal to 10 microns (PM_{10}), particulate matter with aerodynamic diameter less than or equal to 2.5 microns ($PM_{2.5}$), and airborne lead (Pb). The federal Clean Air Act (CAA) requires the USEPA to designate areas (counties) as attainment or non-attainment with respect to each criteria pollutant, depending on whether the areas meet the NAAQS. An area that is designated non-attainment means the

area is not meeting the NAAQS and is subject to planning requirements to attain the standard.

In addition to the seven pollutants listed above, the California Air Resources Board (CARB) has also established state standards for visibility-reducing particles, sulfates, hydrogen sulfide, and vinyl chloride. Similar to the USEPA, CARB designates counties in California as attainment or non-attainment with respect to the California ambient air quality standards (CAAQS). The state standards were designed to protect the most sensitive members of the population, such as children, the elderly, and people who suffer from lung or heart diseases.

Both state and federal air quality standards were based on two variables: maximum concentration and an averaging time over which the concentration would be measured. Maximum concentrations were based on levels that may have an adverse effect to human health. The averaging times were based on whether the damage caused by the pollutant would occur during exposures to a high concentration for a short time (e.g., 1 hour), or to a relatively lower average concentration over a longer period (8 hours, 24 hours, or 1 month). For some pollutants, there is more than one air quality standard, reflecting both short-term and long-term effects. Table 8.1-1 presents the NAAQS and CAAQS.

TABLE 8.1-1
Ambient Air Quality Standards

Pollutant	Averaging Time	California	National
Ozone	1 hour	0.09 ppm (180 µg/m^3)	0.12 ppm[a]
	8 hours	0.07 ppm (137 µg/m^3)	0.08 ppm[b] (157 µg/m^3)
CO	8 hours	9.0 ppm (10 mg/m^3)	9 ppm (10 mg/m^3)
	1 hour	20 ppm (23 mg/m^3)	35 ppm (40 mg/m^3)
NO_2	Annual arithmetic mean	—	0.053 ppm (100 µg/m^3)
	1 hour	0.25 ppm (470 µg/m^3) [c]	—
SO_2	Annual arithmetic mean	—	0.03 ppm (80 µg/m^3)
	24 hours	0.04 ppm (105 µg/m^3)	0.14 ppm (365 µg/m^3)
	3 hours	—	0.5 ppm [d] (1300 µg/m^3) (Secondary standard)
	1 hour	0.25 ppm (655 µg/m^3)	—
PM_{10}	24 hours	50 µg/m^3	150 µg/m^3
	Annual arithmetic mean	20 µg/m^3	—
$PM_{2.5}$	Annual arithmetic mean	12 µg/m^3	15 µg/m^3 [e]
	24 hours	—	35 µg/m^3 [f]
Sulfates	24 hours	25 µg/m^3	—
Lead	30 day average	1.5 µg/m^3	—
	Calendar quarter	—	1.5 µg/m^3
Hydrogen sulfide	1 hour	0.03 ppm (42 µg/m^3)	—

TABLE 8.1-1
Ambient Air Quality Standards

Pollutant	Averaging Time	California	National
Vinyl chloride	24 hours	0.010 ppm (26 µg/m^3)	—
Visibility-reducing particles	8 hours (10 a.m. to 6 p.m. PST)	In sufficient amount to produce an extinction coefficient of 0.23 per kilometer due to particles when the relative humidity is less than 70 percent.	—

Notes:

[a] As of June 15, 2005 the federal 1-hour ozone standard is no longer used, except in Early Action Compact (EAC) areas.

[b] 3-year average of 4th-highest daily maximum 8-hour concentrations.

[c] The nitrogen dioxide ambient air quality standard was amended on February 22, 2007, to lower the 1-hr standard to 0.18 ppm and establish a new annual standard of 0.030 ppm. These changes become effective after regulatory changes are submitted and approved by the Office of Administrative Law, which is expected later in 2007.

[d] This is a national secondary standard, which is designed to protect public welfare.

[e] 3-year average of the weighted annual mean concentrations.

[f] 3-year average of 98th percentile of 24-hour concentrations.

µg/m^3 = micrograms per cubic meter
mg/m^3 = milligrams per cubic meter
ppm = parts per million

8.1.4 Existing Air Quality

The federal CAA requires USEPA to classify areas in the country as attainment or non-attainment, with respect to each criteria pollutant, depending on whether they meet the national standards. In addition, CARB makes area designations within California for state ambient air quality standards (AAQS). The attainment status for both the NAAQS and CAAQS are listed in Table 8.1-2.

TABLE 8.1-2
State and Federal Air Quality Designations for the Project Area (As of May 9, 2007)

Pollutant	State Designation	Federal Designation
O_3	Non-attainment	Non-attainment
CO	Attainment	Attainment
NO_2	Attainment	Attainment
SO_2	Attainment	Attainment
PM_{10}	Non-attainment	Unclassified
$PM_{2.5}$	Non-attainment	Attainment
Lead, H_2S, and Sulfates	Attainment/Unclassified	Attainment/Unclassified

Source: BAAQMD, 2007a

The reported ambient air quality data were obtained from data published by BAAQMD (BAAQMD, 2007b), CARB (CARB, 2007), and USEPA (USEPA, 2007). The closest and most representative monitoring stations to the proposed Project site are Richmond and San Pablo, but because these stations do not monitor for $PM_{2.5}$, the nearest monitoring station with $PM_{2.5}$ (Concord) was used. Tables 8.1-3 through Table 8.1-8 present the monitoring data collected from the Richmond (SO_2), San Pablo (O_3, PM_{10}, CO, and NO_2), and Concord ($PM_{2.5}$) stations.

8.1.4.1 Ozone

Ozone is a photochemical oxidant that is formed when volatile organic compounds (VOCs) and NO_x react in the presence of ultraviolet sunlight. The principal sources of NO_x and VOC, often termed ozone precursors, are combustion processes (including motor vehicle engines) and evaporation of solvents, paints, and fuels. Motor vehicles are the single largest source of ozone precursor emissions in the Bay Area. Exposure to ozone can cause eye irritation, aggravate respiratory diseases and damage lung tissue, as well as damage vegetation and reduce visibility (BAAQMD, 1999). The Bay Area Air Basin is designated as a non-attainment area for ozone by both USEPA and CARB.

Table 8.1-3 shows the annual maximum hourly ozone levels recorded at the San Pablo monitoring station during the period 2004 through 2006, as well as the number of days in which the state and federal standards were exceeded. Data from the station shows that over the 3-year period, ozone concentrations have generally been below both state and federal standards with the exception of one day in 2004.

TABLE 8.1-3
Ozone Levels at the San Pablo Monitoring Station, 2004 through 2006

	2004	2005	2006
Highest 1-hour Average (ppm)	0.11	0.066	0.061
Highest 1-hour Average (µg/m^3)	216.0	129.6	119.8
Highest 8-hour Average (ppm)	0.070	0.057	0.050
Highest 8-hour Average (µg/m^3)	137.4	111.9	98.2
Number of Days Exceeding			
State Standard (180 µg/m^3, 1-hour)	1	0	0
State Standard (137 µg/m^3, 8-hour)	1	0	0
Federal Standard (157 µg/m^3, 8-hour)	0	0	0
Federal Standard (225.8 µg/m^3, 1-hour)	0	0	0

Source: BAAQMD, 2007b; CARB, 2007

8.1.4.2 Nitrogen Dioxide

NO_2 is a byproduct of combustion sources such as motor vehicle exhaust or stationary combustion sources. The principle form of nitrogen oxide produced by combustion is nitric oxide (NO), but NO reacts quickly to form NO_2, creating a mixture of NO and NO_2 commonly called NO_x. The Bay Area Air Basin is designated attainment status for NO_2 by both USEPA and CARB. As previously noted, CARB and Office of Environmental Health

Hazard Assessment (OEHHA) staff recently proposed lowering the state's 1-hour NO_2 standard and establishing an annual NO_2 standard. These changes have been submitted to the Office of Administrative Law and approval of the new standards is expected in 2007.

Table 8.1-4 shows the maximum 1-hour and annual-average NO_2 levels recorded at the San Pablo monitoring station between 2004 and 2006. Ambient NO_2 concentrations measured at this monitoring station did not violate either the proposed state 1-hour standard or the annual NAAQS.

TABLE 8.1-4
Nitrogen Dioxide Levels at the San Pablo Monitoring Station, 2004 through 2006

	2004	2005	2006
Highest 1-hour Average (ppm)	0.060	0.054	0.055
Highest 1-hour Average (µg/m^3)	112.9	101.6	103.5
Annual Average (ppm)	0.013	0.012	0.013
Annual Average (µg/m^3)	24.5	22.6	24.5
Number of Days Exceeding			
State Standard (470 µg/m^3, 1-hour)	0	0	0
Federal Standard (100 µg/m^3, annual)	0	0	0

Source: BAAQMD, 2007b; CARB, 2007

8.1.4.3 Carbon Monoxide

CO is a colorless, odorless gas formed by incomplete combustion of fossil fuels. Motor vehicles are by far the single largest source of CO in the Bay Area (BAAQMD, 1999). The Bay Area Air Basin is designated attainment status for the state CO standards by CARB.

Table 8.1-5 shows the California and federal air quality standards for CO, and the maximum 1- and 8-hour average levels recorded at the San Pablo monitoring station during the period 2004 through 2006.

TABLE 8.1-5
Carbon Monoxide Levels at the San Pablo Station, 2004 though 2006

	2004	2005	2006
Highest 8-hour average (ppm)	1.8	1.3	1.4
Highest 8-hour average (mg/m^3)	2.1	1.5	1.6
Highest 1-hour average (ppm)	3.2	2.8	2.5
Highest 1-hour average (mg/m^3)	3.7	3.2	2.9
Number of Days Exceeding			
State/Federal Standard (10 mg/m^3 / 10 mg/m^3, 8-hr)	0	0	0
State/Federal Standard (23 mg/m^3 / 40 mg/m^3, 1-hr)	0	0	0

Source: BAAQMD, 2007b; CARB, 2007; USEPA, 2007

8.1.4.4 Sulfur Dioxide

Sulfur dioxide is a colorless, pungent gas formed primarily by the combustion of sulfur-containing fossil fuels. The Bay Area Air Basin is designated attainment status for SO_2 by both USEPA and CARB.

Table 8.1-6 presents the maximum SO_2 levels recorded at the Richmond Station. During the period shown, the annual average SO_2 concentrations have been well under the federal standard. The state 24-hour average standard has not been exceeded at this location in the 3-year period, 2004 through 2006.

TABLE 8.1-6
Sulfur Dioxide Levels at the Richmond Station, 2004 through 2006

	2004	2005	2006
Highest 1-hour average (ppm)	0.039	0.02	0.026
Highest 1-hour average (µg/m^3)	102.1	52.4	68.1
Highest 3-hour average (ppm)	0.019	0.011	0.014
Highest 3-hour average (µg/m^3)	49.7	28.8	36.6
Highest 24-hour average (ppm)	0.005	0.006	0.006
Highest 24-hour average (µg/m^3)	13.1	15.7	15.7
Annual Average, All Hours (ppm)	0.0016	0.0011	0.002
Annual Average, All Hours (µg/m^3)	4.2	2.9	5.2
Number of Days Exceeding			
State Standard (655 µg/m^3, 1-hour)	0	0	0
State Standard (105 µg/m^3, 24-hour)	0	0	0
Federal Standard (1300 µg/m^3, 3-hour)	0	0	0
Federal Standard (365 µg/m^3, 24-hours)	0	0	0

Source: BAAQMD, 2007b; CARB, 2007; USEPA, 2007

8.1.4.5 Fine Particulates (PM_{10} and $PM_{2.5}$)

Fine particulate matter (PM_{10} and $PM_{2.5}$) includes a wide range of solid or liquid particles, including smoke, dust, aerosols, and metallic oxides. There are many sources of fine particulate emissions, including combustion, industrial processes, grading and construction, and motor vehicles (BAAQMD, 1999). The Bay Area Air Basin is designated attainment for both PM_{10} and $PM_{2.5}$ by USEPA, but non-attainment for both the state PM_{10} and $PM_{2.5}$ standards by CARB.

Table 8.1-7 shows the maximum 24-hour and annual concentration of PM_{10} recorded at the San Pablo monitoring station during 2004 through 2006.

TABLE 8.1-7
PM_{10} Levels at the San Pablo Station, 2004 through 2006

	2004	2005	2006
Highest 24-hour average (µg/m^3)	64	42	58
Annual Arithmetic Mean (µg/m^3) (State Standard = 20 µg/m^3)	21.2	19	21
Number of Days Exceeding			
State Standard (50 µg/m^3, 24-hour)	1	0	NA
Federal Standard (150 µg/m^3, 24-hour)	0	0	0

NA – Not Available: Data for 2006 was only available from USEPA at the time of report preparation.
Source: BAAQMD, 2007b; USEPA, 2007

The reported $PM_{2.5}$ data were obtained from the Concord monitoring station for 2004 through 2006. Table 8.1-8 presents the 3-year average 24-hour $PM_{2.5}$ concentration and annual arithmetic mean concentrations.

TABLE 8.1-8
$PM_{2.5}$ Levels at the Concord Station, 2004 through 2006

	2004	2005	2006
Maximum 24-hour Average Concentration (µg/m^3) [a]	74	49	62
Annual Arithmetic Mean (µg/m^3)	11	9	10
Number of Days Exceeding			
State Standard (12 µg/m^3, Annual)	0	0	0
Federal Standard (65 µg/m^3, 24-Hour [b])	1	0	0
Federal Standard (15 µg/m^3, Annual)	0	0	0

Notes:

[a] For $PM_{2.5}$, the 24-hour standard is attained when 98 percent of the daily concentrations, averaged over three years, are equal to or less than the standard (CARB, 2007).

[b] The Federal 24-hour standard was modified by the USEPA from 65 to 35 µg/m^3 on December 17, 2006. Therefore, exceedances for the 24-hour federal standard were compared to the previous 65 µg/m^3 standard through 2006.

Source: BAAQMD, 2007b; USEPA, 2007

8.1.5 Laws, Ordinances, Regulations, and Standards

The CAA, implemented by the USEPA, requires major new and modified stationary sources of air pollution to obtain a construction permit prior to commencing construction through a program known as the Federal New Source Review (NSR) program. The requirements of the NSR program are dependent on whether the air quality in the area where the new source (or modified source) is being located attains the NAAQS. The program that applies in areas that are in attainment of the NAAQS is the Prevention of Significant Deterioration (PSD). The program that applies to areas where the air does not meet the NAAQS (termed non-attainment areas) is the non-attainment NSR.

USEPA implements the NSR program through regional offices. Arizona, California, Hawaii, Nevada, and specific Pacific trust territories are administrated out of the USEPA Region IX

office located in San Francisco. USEPA typically delegates its NSR, Title V, and Title IV authority to local air quality agencies that have sufficient regulatory structure to implement these programs consistent with requirements of the CAA and implementing regulations. BAAQMD has been delegated several of these programs. However, USEPA currently retains authority for administering the PSD program in BAAQMD.

CARB was established by the state legislature in 1967 with the purpose of attaining and maintaining healthy air quality, conducting research into causes and solutions to air pollution, and addressing the impacts that motor vehicles have on air quality. To this end, CARB implements the following programs:

- Establish and enforce motor vehicle emission standards, including fuel standards.
- Monitor, evaluate, and set health-based air quality standards.
- Conduct research to solve air pollution problems.
- Establish toxic air contaminant (TAC) control measures.
- Oversee and assist local air quality districts.

Air pollution control districts were established shortly after the CARB, based on meteorological and topographical factors. The districts were established to enforce air pollution regulations for the purpose of attaining and maintaining all state and federal AAQS. The districts regulate air emissions by issuing air permits to stationary sources of air pollution in compliance with approved regulatory programs. Each district promulgates rules and regulations specific to air quality issues within its jurisdiction. The air emissions sources regulated by each district vary. The types of air pollution sources that might be regulated include manufacturers, power plants, refineries, gasoline service stations, and auto body shops.

Each level of government has adopted specific regulations that limit emissions from stationary combustion sources, several of which are applicable to the PPRP. The agencies having permitting authority for the proposed Project are shown in Table 8.1-9.

TABLE 8.1-9
Air Quality Agencies

Agency	Authority	Contact
USEPA Region IX	Regulatory oversight	Gerardo Rios USEPA Region IX 75 Hawthorne Street San Francisco, CA 94105 (415) 947-3974
CARB	Regulatory oversight	Michael Tollstrup Project Assessment Branch California Air Resources Board 2020 L Street Sacramento, CA 95814 (916) 322-6026
BAAQMD	Permit issuance, enforcement	Brian Bateman Bay Area Air Quality Management District 939 Ellis Street San Francisco, CA 94109 (415) 771-6000

The applicable LORS and compliance with these requirements are discussed in more detail in the following sections. An application for an Authority to Construct (ATC) was also filed with BAAQMD in June 2005.

Federal and state agencies and BAAQMD have specific regulations applicable to stationary combustion sources. These applicable regulations are presented in this section. Section 8.1.7 presents a detailed discussion of the Project's conformance with the applicable regulations. An ATC permit has been filed with the BAAQMD for the entire Renewal Project.

8.1.5.1 Federal

USEPA promulgates and enforces federal air quality laws, with Region IX administering the federal air programs in California. The federal CAA provides the legal authority to regulate air pollution from stationary sources. The applicable federal regulations are summarized in Table 8.1-10 (on page 8.1-12), along with the agency responsible for administration of the regulation.

8.1.5.2 State

CARB's primary responsibilities are to develop, adopt, implement, and enforce the state's motor vehicle pollution control program; to administer and coordinate the state's air pollution research program; to adopt and update, as necessary, the state's AAQS; to review the operations of the local air pollution control districts; and to review and coordinate preparation of the State Implementation Plan for achievement of the federal AAQS.

The California Health and Safety Code, Section 41700 prohibits the discharge from a facility of air pollutants that cause injury, detriment, nuisance, or annoyance to the public, or which endanger the comfort, repose, health, or safety of the public, or that damage business or property.

The state has promulgated numerous laws and regulations at the state level (i.e., Toxic Air Contaminants and Air Toxic Hot Spots) which are effectuated at the local level by the air districts. A discussion of these state and local LORS is presented in Tables 8.1-11 (see page 8.1-14) and 8.1-12 (see page 8.1-15), respectively.

In August 2006, the California legislature passed Assembly Bill (AB) 32, the California Global Warming Solutions Act of 2006. AB 32 requires California resource agencies to establish a comprehensive program of regulatory and market mechanisms to achieve reductions in greenhouse gas (GHG) emissions (CARB, 2006). The Richmond Refinery, including the PPRP, will be subject to AB 32, and will be required to comply with all final rules, regulations, emissions limitations, emission reduction measures or market-based compliance mechanisms adopted under AB 32. However, there are currently no applicable facility-specific GHG emission limits or caps. Therefore, GHG emissions have been estimated for the PPRP for information purposes at this time.

TABLE 8.1-10
Applicable Federal Laws, Ordinances, Regulations, and Standards for Protection of Air Quality

LORS	Purpose	Regulating Agency	Applicability/Compliance Strategy
Title 40 CFR Part 50	Establishes AAQS for criteria pollutants.	USEPA Region IX	The Applicant will conduct a dispersion modeling analysis to determine if the Project will exceed the state or federal AAQS.
Title 40 CFR Parts 51 and 52, NSR/PSD (BAAQMD Reg 2, Rule 2)	Requires NSR facility permitting for construction or modification of specified stationary sources. NSR applies to pollutants for which ambient concentration levels are higher than NAAQS. PSD review applies to pollutants for which the area is in attainment with the NAAQS.	USEPA Region IX	The PSD requirements apply on a pollutant-specific basis to any project that is a new major stationary source or a major modification to an existing major stationary source. BAAQMD classifies an unlisted source (which is not in the specified 28 source categories) that emits or has the potential to emit 250 tons per year (tpy) of any pollutant regulated by the Act as a major stationary source. For listed sources, the threshold is 100 tpy. NO_x or SO_x emissions from a modified major source are subject to PSD if the cumulative emission increases for either pollutant exceeds 40 tpy. In addition, a modification at a non-major source is subject to PSD if the modification itself would be considered a major source.
Title 40 CFR, Part 60	Establishes national standards of performance for new or modified facilities in specific source categories.	BAAQMD, with USEPA Region IX oversight	Proposed 40 CFR Part 60 Subpart KKKK – NO_x Emission Limits for New Stationary Combustion Turbines, was proposed on February 18, 2005, and is expected to be promulgated shortly. It would apply to all new combustion turbines that commence construction, modification, or reconstruction after February 18, 2005. The proposed rule would require natural-gas-fired turbines greater than or equal to 30 MW to meet a NO_x emission limit of 50 nanograms per Joule (ng/J) (0.39 pounds per megawatt-hour [lb/MW-hr]), and an SO_2 limit of 73 ng/J (0.58 lb/MW-hr). Alternatively, a fuel sulfur limit of 500 parts per million by weight (ppmw) could be met. Stationary combustion turbines regulated under this subpart would be exempt from the requirements of Subpart GG.
Title 40 CFR, Part 63	Establishes national emission standards to limit emissions of hazardous air pollutants (HAPs, or air pollutants identified by USEPA as causing or contributing to the adverse health effects of air pollution but for which NAAQS have not been established) from facilities in specific categories.	BAAQMD, with USEPA Region IX oversight	Title 40, Code of Federal Regulations, Part 63—National Emission Standards for Hazardous Air Pollutants for Source Categories, establishes emission standards to limit emissions of hazardous air pollutants from specific source categories for Major HAP sources. Sources subject to Part 63 requirements must either use the maximum achievable control technology (MACT), be exempted under Part 63, or comply with published emission limitations. The applicable MACT standard to the Project is Subpart YYYY, which sets a formaldehyde emission limit or an operational limit of 91 parts per billion by volume (ppbv) for subject sources.

TABLE 8.1-10
Applicable Federal Laws, Ordinances, Regulations, and Standards for Protection of Air Quality

LORS	Purpose	Regulating Agency	Applicability/Compliance Strategy
Title 40 CFR Part 64 (CAM Rule)	Establishes onsite monitoring requirements for emission control systems.	BAAQMD, with USEPA Region IX oversight	Title 40, Code of Federal Regulations, Part 64—Compliance Assurance Monitoring (CAM), requires facilities to monitor the operation and maintenance of emissions control systems and report any control system malfunctions to the appropriate regulatory agency. If an emission control system is not working properly, the CAM rule also requires a facility to take action to correct the control system malfunction. The CAM rule applies to emissions units with uncontrolled potential to emit levels greater than applicable major source thresholds. Emission control systems governed by Title V operating permits requiring continuous compliance determination methods are generally compliant with the CAM rule. Exemptions from CAM are presented in 40 CFR 64.2(b).
Title 40 CRF part 70 (BAAQMD Reg 2, Rule 6)	CAA Title V Operating Permit Program	BAAQMD, with USEPA Region IX oversight	Title 40, Code of Federal Regulations, Part 70—Operating Permits Program, requires the issuance of operating permits that identify all applicable federal performance, operating, monitoring, recordkeeping, and reporting requirements. These requirements are implemented at the local level through BAAQMD Regulation 2, Rule 6. The Title V permit is tied to the BAAQMD NSR regulations.
Title 40 CRF part 72 (BAAQMD Reg 2 Rule 7)	CAA Acid Rain Program	BAAQMD, with USEPA Region IX oversight	Title 40, Code of Federal Regulations, Part 72—Acid Rain Program, establishes emission standards for SO_2 and NO_x emissions from electric generating units through the use of market incentives, requires sources to monitor and report acid gas emissions, and requires the acquisition of SO_2 allowances sufficient to offset SO_2 emissions on an annual basis. This program is implemented through BAAQMD's Regulation 2, Rule 7. However, units which commence construction after November 15, 1990, and supply equal to or less than one-third of its potential electrical output capacity or equal to or less than 219,000 MWe-hours actual electric output on an annual basis to any utility power distribution for sale (on a gross basis), are exempt from this regulation.

TABLE 8.1-11
Applicable State Laws, Ordinances, Regulations, and Standards for the Protection of Air Quality

LORS	Purpose	Regulating Agency	Applicability/Compliance Strategy
California Code of Regulations, Section 41700	Prohibits emissions in quantities that adversely affect public health, other businesses, or property.	BAAQMD with CARB oversight	The CEC conditions of exemption and the air quality management district (AQMD) ATC processes are developed to ensure no adverse public health affects or public nuisances result from operation of the Project.
California Code of Regulations Sections 93300-93347 (Toxic "Hot Spots" Act)	Requires preparation and biennial updating of facility emission inventory of hazardous substances; risk assessments.	BAAQMD with CARB oversight	An estimate of TAC emissions and associated risk will be evaluated as part of this subsection and Section 8.6, Public Health.

8.1.5.3 Local

When the state's air pollution statutes were reorganized in the mid-1960s, local districts were required to be established in each county of the state. There are three different types of districts: county, regional, and unified. In addition, special AQMDs, with more comprehensive authority over non-vehicular sources as well as transportation and other regional planning responsibilities, have been established by the Legislature for several regions in California, including the BAAQMD. AQMDs have principal responsibility for developing plans for meeting the NAAQS and CAAQS; for developing control measures for non-vehicular sources of air pollution necessary to achieve and maintain both state and federal air quality standards; for implementing permit programs established for the construction, modification, and operation of sources of air pollution; and for enforcing air pollution statutes and regulations governing non-vehicular sources.

The BAAQMD plans define the proposed strategies, including stationary source control measures and NSR rules, whose implementation will attain the state AAQS. The relevant stationary source control measures and NSR requirements are presented in Table 8.1-12.

8.1.6 Environmental Analysis

An analysis of the Project's ambient air quality impact was conducted to demonstrate compliance with the local, state, and federal air quality requirements for criteria pollutants (e.g., NO_2, CO, SO_2, PM_{10} and $PM_{2.5}$), and noncriteria pollutants (e.g., ammonia) during operations. The following subsections describe the Project, the Project phases for which emissions have been evaluated (including construction), the ambient impact analyses results, and the evaluation of facility compliance with the applicable local, state, and federal air quality regulations.

TABLE 8.1-12
Applicable Local Laws, Ordinances, Regulation, Standards, and Permits for Protection of Air Quality

LORS	Purpose	Regulating Agency	Applicability/Compliance Strategy
BAAQMD Reg 1, Section 301 (Public Nuisance)	Prohibits the emissions of air contaminants or other material which create a public nuisance.	BAAQMD	The CEC conditions of exemption and the BAAQMD ATC process is designed to ensure that the operation of the Project will not cause a public nuisance.
BAAQMD Regulation 2, Rule 2 (Permits – NSR)	Purpose of this Rule is to provide for the review of new and modified sources and provide mechanisms, including the use of Best Available Control Technology (BACT), Best Available Control Technology for Toxics (TBACT), and emission offsets, by which authorities to construct such sources may be granted.	BAAQMD	As part of the NSR permit approval process, an air quality dispersion analysis must be conducted, using a mass emissions-based analysis contained in the rule or an approved dispersion model, to evaluate impacts of increased criteria pollutant emissions from any new or modified facility on ambient air quality. The PSD requirements apply on a pollutant-specific basis to any project that is a new major stationary source or a major modification to an existing major stationary source. BAAQMD classifies an unlisted source (which is not in the specified 28 source categories) that emits or has the potential to emit 250 tpy of any pollutant regulated by the Act as a major stationary source. For listed sources, the threshold is 100 tpy. NO_x or SO_x emissions from a modified major source are subject to PSD if the cumulative emission increases for either pollutant exceeds 40 tpy of NO_x, SO_x, or VOC emissions. (Note: for this application, it is assumed VOCs are equivalent to POCs.) In addition, a modification at a non-major source is subject to PSD if the modification itself would be considered a major source. BACT shall be applied to all new and modified sources with a potential to emit 10 pounds or more of any of the following: POC, NPOC, NO_x, SO_2, PM_{10} or CO. (BAAQMD 2-2-301) A source shall be exempt from MACT requirements if the combined potential to emit from all related sources in a proposed modification is less than 10 tpy of any HAP and less than 25 tpy of any combination of HAPs. (BAAQMD 2-2-114) Offsets for NO_x are required at a 1.0 to 1.0 ratio if a modification to the permit causes a cumulative increase of 10 to 35 tpy. Offsets for PM_{10} and SO_x are required at a 1.0 to 1.0 ratio if a modification to the permit causes a cumulative increase of 1.0 tpy. (BAAQMD 2-2-302 and 2-2-303) A visibility, soils, and vegetation analysis is required if the proposed project is subject to PSD requirements and is within 10 kilometers of a Class I Area. (BAAQMD 2-2-417).

TABLE 8.1-12
Applicable Local Laws, Ordinances, Regulation, Standards, and Permits for Protection of Air Quality

LORS	Purpose	Regulating Agency	Applicability/Compliance Strategy
BAAQMD Regulation 2, Rule 3 (Permits – ATC and Permit to Operate [PTO] for Power Plants)	The purpose of this rule is to outline the special permitting provisions for the construction of power plants within the District.	BAAQMD	In conjunction with the submittal of the SPPE Application to the CEC, the Applicant will work with the BAAQMD to provide the information needed for the issuance of an ATC. As stated in this rule, the review will be conducted as outlined in Reg 2, Rule 2.
BAAQMD Regulation 2, Rule 5 (Permits – Toxics NSR)	The purpose of this rule is to provide for the review of new and modified sources of TAC emissions in order to evaluate potential public exposure and health risk, to mitigate potentially significant health risks resulting from these exposures, and to provide net health risk benefits by improving the level of control when existing sources are modified or replaced.	BAAQMD	TBACT shall be applied to any new or modified source of TACs where the source risk is a cancer risk greater than 1.0 in a million (10^{-6}), and/or a chronic hazard index greater than 0.20. An ATC or PTO will be denied if the cancer risk exceeds 10 in a million, or the chronic hazard index exceeds 1.0, or the acute hazard index exceeds 1.0.
BAAQMD Regulation 2, Rule 6 (Permits – Title V)	The purpose of this rule is to implement the operating permit requirements of Title V of the CAA as amended in 1990.	BAAQMD	An application must be submitted to BAAQMD that presents all information necessary to evaluate the subject facility and determine the applicability of all regulatory requirements.
BAAQMD Regulation 2, Rule 7 (Permits – Acid Rain)	The purpose of this rule is to incorporate by reference the provisions of 40 CFR Part 72 for purposes of implementing an acid rain program that meets the requirements of Title IV of the CAA.	BAAQMD	If a facility is subject to 40CFR Part 72, an application must be presented to BAAQMD with all relevant sources at the facility, a compliance plan for each unit, applicable standards, and estimated commencement date of operation.
BAAQMD Regulation 6 (Particulate Matter and Visible Emissions)	Purpose of this Regulation is to limit the quantity of particulate matter in the atmosphere through the establishment of limitations on emission rates, concentration, visible emissions, and opacity.	BAAQMD	Exhaust emissions shall not be darker than No. 1 when compared to the Ringleman Chart for any period(s) aggregating 3 minutes in any hour, exceed the opacity standard of not greater than 20 percent for a period or periods aggregating 3 minutes in any hour, or exceed the 0.15 grains per dry standard cubic feet of exhaust gas volume.
BAAQMD Regulation 7 (Odorous Substances)	The purpose of this regulation is to place general limitations on odorous substances and specific emission limitations on certain odorous compounds.	BAAQMD	Emissions of odorous substances shall not remain odorous after dilution with odor-free air at a rate of 1,000 volumes of odor-free air per volume of source sample. The maximum emissions of ammonia shall not exceed 5,000 ppm.
BAAQMD Regulation 9, Rule 1	Establishes emission limits for sulfur dioxide from all sources and limits ground-level concentrations of SO_2	BAAQMD	Dispersion modeling will be conducted to determine if off-property SO_2 ground level concentrations are less than 0.5 ppm for 3 consecutive minutes, 0.25 ppm averaged over 60 consecutive minutes, or 0.05 ppm averaged over 24 hours. Sulfur contents in the fuel will be less than 0.5% and gas stream concentrations will be less than 300 ppm (dry).

TABLE 8.1-12
Applicable Local Laws, Ordinances, Regulation, Standards, and Permits for Protection of Air Quality

LORS	Purpose	Regulating Agency	Applicability/Compliance Strategy
BAAQMD Regulation 9, Rule 3	The purpose of this rule is to limit the emissions of NO_x from new or modified heat transfer operations.	BAAQMD	For new or modified heat transfer operation designed for a maximum heat input of 264 gigajoules (GJ) (250 MMBtu) per hour or more, NO_x shall not exceed 125 ppm when gaseous fuel is burned or 225 ppm when liquid fuel is burned.
BAAQMD Regulation 9, Rule 9	Purpose of this rule is to limit emissions of NO_x from stationary gas turbines.	BAAQMD	For turbines with a heat input rating greater than 500 million British thermal units per hour (MMBtu/hr) (40+ MW), NO_x emission levels shall not exceed 0.72 lb/MW-hr or 25 ppmv.
BAAQMD Regulation 10 (40 CFR Part 60)	Establishes national standards of performance for new or modified facilities in specific source categories.	BAAQMD	Subpart GG (Standards of Performance for Stationary Gas Turbines) applies to gas turbines with a heat input at peak load equal to or greater than 10.7 gigajoules per hour (GJ/hr), or 10 million MMBtu/hr, at the lower heating value. The New Source Performance Standards (NSPS) limits the sulfur content of fuel to 0.8 percent. USEPA promulgated new standards for new, modified, or reconstructed stationary combustion turbines constructed/modified after February 18, 2005. The proposed rule would require natural-gas-fired turbines greater than or equal to 30 MW to meet a NO_x emission limit of 50 ng/J (0.39 lb/MW-hr), and an SO_2 limit of 73 ng/J (0.58 lb/MW-hr). Alternatively, a fuel sulfur limit of 500 ppmw could be met. Stationary combustion turbines regulated under this subpart would be exempt from the requirements of Subpart GG.
BAAQMD Regulation 11, Rule 10	The purpose of this rule is to reduce emissions of hexavalent chromium from cooling towers by eliminating chromium-based circulating water treatment programs.	BAAQMD	Hexavalent chromium levels in the circulating water must be less than 0.15 milligrams per liter (mg/L).

8.1.6.1 Methodology for Estimating Facility Impacts

The new cogeneration equipment will consist of a GE Frame 6B gas-fired CTG, rated at 43 MW net output (nominal at site design conditions), and a heat recovery steam generator (HRSG) equipped with duct burners with a maximum combined cogeneration (turbine and duct burner) heat input rating of 840 MMBtu/hr higher heating value (HHV). The cooling tower associated with the STG will have a maximum recirculation rate of 36,000 gallons per minute (gpm), which includes a higher recirculation rate than is needed for process cooling for the STG.

The operating profile for the Cogen 3000 has not been finalized. Therefore, for this SPPE application, the maximum hourly and annual emissions from the Cogen 3000 were conservatively estimated using the combined maximum heat input rating for the turbine and duct burner. The hourly and annual emission rates for the STG cooling tower were estimated assuming the maximum design water circulation rate for the complete hydrogen plant cooling load (STG portion is approximately 44 percent of this rate) and the maximum total dissolved solids (TDS) concentration permissible in the water supply.

The emissions of NO_x and CO during the commissioning, turbine startup, and shutdown phases may be higher than the steady-state operation because the emission control systems will not be operating at their design efficiencies during these events. However, the commissioning emissions would only occur during the initial installation of the equipment, and because the PPRP and hydrogen plant will be operated on a continuous basis, the Cogen 3000 and STG cooling tower would only be shut down a minimal number of times for scheduled and unscheduled maintenance. Based on the expectation that the Cogen 3000 and STG cooling tower will operate on a continuous basis, emissions from startup were estimated for this analysis but were not included in the comparison to the NAAQS and CAAQS.

8.1.6.1.1 Emission Estimates

Natural gas combustion results in the formation of NO_x, SO_2, VOCs, PM_{10}, $PM_{2.5}$, and CO. (Note: for this application it is assumed VOCs are equivalent to the BAAQMD's POCs.) Because natural gas is a clean-burning fuel, there will be minimal formation of combustion PM_{10} and SO_2. The CTG will be equipped with steam-injected combustors that minimize the formation of NO_x. To further reduce NO_x emissions, selective catalytic reduction (SCR) will be used, and oxidation control systems will be used to reduce CO and VOC emissions. In addition to criteria pollutants, noncriteria pollutants will also be emitted by the PPRP, including ammonia, which will be used as a reactant by the SCR systems to control NO_x emissions.

Emissions of the criteria and noncriteria pollutants have been characterized and quantified in this application.

Emission Profile

There will be three discrete phases of the Project, which are addressed in this air quality assessment. The first phase is the construction of the new facility, the second phase is the new facility commissioning, and the final phase is the new facility operation.

Construction Phase. Short-term emissions would be generated from construction equipment exhaust, motor vehicle exhaust, re-entrained road dust, and fugitive dust emissions from soil disturbance. As described in Section 8.1.1, the PPRP is a subset of the larger Renewal

Project, specifically the PPRP is a subset of the Hydrogen Plant and the Power Plant Replacement Projects.

Based on engineering estimates, the construction of the Hydrogen Plant Replacement and the Power Plant Replacement Projects would occur over a period of approximately 28 to 30 months. For the purpose of estimating short-term construction impacts, it was assumed the magnitude, duration, and construction activities associated with the entire Hydrogen Plant Replacement Project (i.e., the H_2 facility, the STG, and the H_2-STG cooling tower) would be greater than the magnitude, duration, and activities associated with construction of the Cogen 3000, the STG, and the H2-STG cooling tower alone. Therefore, it is expected that the construction emissions from the entire Hydrogen Plant Replacement Project would be greater than the construction emissions from the Cogen 3000, the STG, and the H2-STG cooling tower portions of the Hydrogen Plant Replacement Project. The maximum short-term daily construction emissions are conservatively represented by the construction emissions related to the entire Hydrogen Plant Replacement Project and are presented in Table 8.1-13. The methodology used to estimate the construction emissions is provided in Appendix 8.1-A.

TABLE 8.1-13
Maximum Daily Construction Emissions

Construction Emission Source	Emissions (lb/day)					
	VOC [a]	CO	NO_x	SO_x	PM_{10}	$PM_{2.5}$
Fugitive Dust [b]	-	-	-	-	40	8
Construction Equipment Exhaust [b]	14	109	96	0.08	4	3
Onroad Emissions – Workers [c]	2	52	6	0.05	44	5
Onroad Emissions – Trucks [c]	1	10	23	0.03	6	1
Maximum Total (lb/day)	**17**	**171**	**125**	**0.16**	**94**	**17**

Notes:

[a] Emission factors in URBEMIS and EMFAC are listed as reactive organic gases (ROG). For this analysis it is assumed ROGs are equivalent to VOCs

[b] Fugitive dust and construction equipment exhaust emissions were estimated using URBEMIS2002 v. 8.7.0 emission factors. It was assumed that a maximum of 4 acres per day would be graded and that construction equipment would operate 4 hours per day, except for cranes, which would operate 2 hours per day.

[c] Onroad exhaust emissions were estimated using EMFAC2007 v. 2.3 emission factors. It was assumed that workers would travel 5 miles per trip, delivery and dump trucks would travel 10 miles per trip, and water trucks would travel 5 miles per trip. Onroad emissions included emissions from re-entrained road dust. Re-entrained road dust emissions were estimated using AP-42, Ch. 13.2.1 (USEPA, 2006).

lb/day = pounds per day

The short-term construction emissions were not compared to thresholds because the BAAQMD has not published quantitative thresholds of significance for construction emissions. The BAAQMD *CEQA Guidelines* (BAAQMD, 1999) emphasize implementation of effective control measures rather than detailed quantification of construction emissions. According to the BAAQMD *CEQA Guidelines*, implementation of all the basic control measures would reduce fugitive PM_{10} emissions during construction to less than significant levels (BAAQMD, 1999). The BAAQMD's basic control measures will be implemented as part of the Project construction (ESA, 2007). However, these control measures would not address exhaust

emissions generated during construction. According to the BAAQMD *CEQA Guidelines*, construction equipment exhaust emissions (CO, NO_x, and VOC) are included in the emissions inventory that is the basis for the regional air quality plans and are not expected to impede attainment or maintenance of the ozone standards in the Bay Area (BAAQMD, 1999). Therefore, construction emissions from the PPRP would be less than significant.

Commissioning Phase. During the commissioning phase, the turbine and duct burner will be initially operated at various load rates without the benefit of the emission control systems to ensure proper operation of the equipment. The commissioning phase for this Project is expected to be approximately 21 days of unit operation. During this period, the Applicant will ensure that emissions are reduced to the extent feasible by limiting equipment operation consistent with the equipment manufacturers recommended intervals. Table 8.1-14 presents an estimate of the maximum hourly emissions during commissioning for NOx and CO. Emission rates for other criteria pollutants are expected to be equal to or lower than normal operating rates due to reduced loads during commissioning. Similarly, the commissioning of the H_2-STG cooling tower will not result in emissions greater than normal operating rates.

TABLE 8.1-14
Turbine and Duct Burner Commissioning Emission Rate

	NOx	CO	VOC	SO_2	PM_{10}
Maximum Hourly, lb/hr	588.5	47.8	*	*	*
Maximum Daily, lb/day	3,581	334.3	*	*	*
Maximum Annual, ton/yr	37.6	3.51	*	*	*

Note:
* Not emitted in amounts greater than normal operating rates.
Reference: Information prepared for the BAAQMD permitting process.

Operational Phase. Operational emission estimates were prepared for the two expected operating modes. The first operating mode is the startup and shutdown mode and the second is the steady-state operating mode. Emission estimates for these two operating modes are based on vendor data and engineering estimates.

Startup and Shutdown Emissions. During a startup and shutdown, the emission control systems (steam-injected combustors, SCR, and oxidation catalyst) are not operating at design efficiencies, resulting in higher emission rates for NO_x and CO emissions. As stated previously, the Cogen 3000 equipment is expected to operate as a baseload unit, with shutdowns only for scheduled and unscheduled maintenance activities. Shutdown emission rates are not expected to be greater than normal operating rates. Therefore, the number of startups and shutdowns will not significantly contribute to the daily and annual emission estimates. Table 8.1-15 presents the Cogen 3000 startup emissions on a pounds per hour basis.

TABLE 8.1-15
Cogen 3000 Startup Emission Rates*

	NO_x	CO	VOC	SO_2	PM_{10}
Startup (lb/hr)	143.2	33.5	*	*	*

Note:
* Not emitted in amounts greater than normal operating rates.
Reference: Information prepared for the BAAQMD permitting process.

Steady-state Operating Emissions. Table 8.1-16 presents the maximum fuel usage expected for the CTG. The maximum fuel usage was estimated based on the combined maximum turbine and duct burner firing rate. The daily and annual fuel usage was based on the maximum hourly fuel usage rate multiplied by 24 and 8,760 hours, respectively.

TABLE 8.1-16
Maximum Cogen 3000 Fuel Use

Period	Cogen 3000 Maximum Fuel Use (MMBtu HHV)*
Per Hour	840
Per Day	20,160
Per Year	7,358,400

Note:

* Hourly, daily and annual fuel use are based on the assumption that the Cogen 3000 unit would be operated at the maximum heat input rating for each hour times 24 hours per day, 365 days per year.

The Cogen 3000 operational emission rates for steady-state operations have been estimated based on the combined maximum heat input rating and conservative estimates of annual operation. Emission estimates are provided in Appendix 8.1-B. The emission rates for the Cogen 3000 unit are shown in Table 8.1-17.

TABLE 8.1-17
Maximum Pollutant Emission Rates for the Cogen 3000 Unit [a]

Pollutant	ppmvd @ 15% O_2	Emission Rate (lb/hr)[b]
NO_x	2.5	7.7
CO	4.0	7.5
VOC	2.0	2.2
PM_{10} [c]	NA[d]	6.3
SO_2 [e]	<1	0.38
Ammonia	10.0	3.8

Notes:

[a] Maximum values exclude startups and shutdowns.

[b] Assumes a maximum heat input value of 840 MMBtu/hr (HHV) for the CTG and duct burner.

[c] 100 percent of particulate matter emissions assumed to be emitted as PM_{10} and $PM_{2.5}$; $PM_{10}/PM_{2.5}$ emissions include both front and back half as those terms are used in USEPA Method 5.

[d] Not available.

[e] Assessed using 0.164 grains of sulfur per 100 cubic feet of natural gas.

See Appendix 8.1-B, Table 8.1-B3.

ppmvd = parts per million by volume-dry

Operational emissions from the STG cooling tower have been estimated based on a recirculation rate in gallons per minute for the complete cooling tower (both STG portion and hydrogen plant portion), a maximum expected TDS concentration in the water supply,

and established emission calculation procedures. The annual emissions reflect 24 hours per day, 365 days per year of operation. It was conservatively assumed that all particulate matter less than 10 microns is also less than 2.5 microns. Emission estimates are provided in Appendix 8.1-B. The PM_{10} and $PM_{2.5}$ emission rates for the cooling towers are shown in Table 8.1-18.

TABLE 8.1-18
Maximum $PM_{10}/PM_{2.5}$ Cooling Tower Emissions

	Recirculation Rate (gpm)	Maximum TDS Concentration (mg/L)	Hourly $PM_{10}/PM_{2.5}$ (lb/hr)	Annual $PM_{10}/PM_{2.5}$ (lb/yr)
STG Cooling Tower	36,000	5000	4.5	39,460

Note: Annual emissions are based on 8,760 hours per year of operation.

lb/hr = pounds per hour
lb/yr = pounds per year

8.1.6.1.2 Facility Emissions

The facility emission estimates were based on the turbine and duct burner emission rates shown in Table 8.1-17, the cooling tower emissions in Table 8.1-18, and the maximum design capacities of the equipment. The maximum annual, daily, and hourly emissions for the Project during normal operation are shown in Table 8.1-19. Detailed emission estimates are provided in Appendix 8.1-B.

TABLE 8.1-19
Maximum Annual, Daily, and Hourly Emissions for PPRP during Normal Operation (Excludes Startup Emissions)

	NO_x	SO_2	VOC	CO	PM_{10}
Maximum Hourly Turbine and Duct Burner Emissions, lb/hr	7.7	0.4	2.2	7.5	6.3
STG Cooling Tower Emissions, lb/hr	–	–	–	–	4.5
Maximum Daily Turbine and Duct Burner Emissions, lb/day[a]	184.4	9.6	51.8	180	151.2
STG Cooling Tower Emissions, lb/day	–	–	–	–	108.0
Total Emissions (lb/day)	**184.4**	**9.6**	**51.8**	**180**	**259.2**
Turbine and Duct Burner Emissions, lb/yr[b]	67,452	3,329	18,921	65,700	55,188
STG Cooling Tower Emissions, lb/yr	–	–	–	–	39,460
Total Emissions (lb/yr)	67,452	3,329	18,921	65,700	**94,648**
Total Emissions (tpy)	**33.7**	**1.7**	**9.5**	**32.9**	**47.3**

Notes:

[a] Daily emissions includes 24-hours per day of operation at the maximum fuel firing rate of 840 MMBtu/Hr HHV.

[b] Annual emissions are based on 8,760 hours per year of operation for the CTG and STG cooling tower.

In response to State's call for greenhouse gas (GHG) reductions in Assembly Bill 32, Chevron has incorporated into the Renewal project a more efficient cogeneration technology. The Cogen plant will reduce the Refinery's GHG emissions by using a single

natural gas fuel stream to produce both electric and thermal energy to serve the Refinery, thereby avoiding the higher GHG emissions that would result from the separate production of these commodities. Furthermore, Chevron's Hydrogen Plant design recovers waste heat from the process in a heat recovery steam generator that will drive a condensing steam turbine generator, creating 17 megawatts of electrical energy for use in the hydrogen plant, in lieu of several less efficient non-condensing steam turbine drivers.

An analysis of the overall GHG emissions from the Renewal Project was also conducted as a part of the administrative draft Environmental Impact Report (EIR) (ESA, 2007). Based on the administrative draft EIR, when considering the change in CO_2 for the PPRP, the change in CO_2 emission from baseline to the expected utilization would be an increase of approximately 77,000 metric tons (ESA, 2007). However, when considering the net change in CO_2 emissions for the entire Renewal Project, the proposed Renewal Project shows a net reduction in CO_2 emissions of approximately 219,000 metric tons/year (emissions of CO_2 equivalent were not included in this analysis). At the time of this analysis, state (CARB) and/or local (BAAQMD) guidelines did not exist to assess the significance of the GHG emissions. Therefore, emissions are presented for informational purposes and no conclusions regarding significance are made at this time.

8.1.6.1.3 Toxic Air Contaminants and Noncriteria Pollutant Emissions

Emissions associated with the Project will consist primarily of combustion by-products produced by the natural-gas-fired combustion turbines, and particulate emissions from the cooling towers. However, the Project is also expected to emit small quantities of TACs and noncriteria pollutants (e.g., ammonia). The TACs are compounds that have been identified by CARB as pollutants that may pose a significant health hazard. Some of these pollutants are also regulated under the federal NSR program. These federally regulated pollutants include lead, asbestos, beryllium, mercury, fluorides, sulfuric acid mist, hydrogen sulfide, total reduced sulfur, and reduced sulfur compounds, but since they are expected to be emitted in quantities less than their federal thresholds, they are being analyzed as TACs.

Noncriteria pollutant emission factors for the analysis of emissions from the gas turbine were obtained from the Energy & Environmental Research Corporation (EERC) August 1998 publication entitled *Air Toxic Emission Factors for Combustion Sources Using Petroleum Based Fuels, Final Report, Volume II* (EERC, 1998). Emission factors for the cooling water were based on information provided by the Applicant as part of the BAAQMD permit application (Chevron, 2006).

The health risk analysis was conducted assuming that the combustion turbines and cooling towers would be operated 8,760 hours per year, at the maximum heat input rating and maximum circulation rate, respectively. This would be a conservative estimate of emissions because the planned operating rates will likely be less than operating each hour of the year at the maximum capacity of the equipment.

Appendix 8.1-B provides the detailed emission calculations for noncriteria pollutants. A summary of the potential public health impacts related to the TAC emissions from the Cogen 3000 unit and the STG cooling towers are presented in Section 8.1.6.3. A complete discussion of the TAC emissions and the potential public health impacts are presented in Section 8.6.

8.1.6.2 Air Quality Impact Analysis

An ambient air quality impact analysis was conducted to compare worst-case ground-level impacts resulting from the operation of the proposed PPRP with established state and federal AAQS and applicable BAAQMD significance criteria. The analysis was conducted in accordance with the air quality impact analysis guidelines presented in the USEPA's 40 CFR Part 51, Appendix W: *Guideline on Air Quality Models* (USEPA, 2005) and the BAAQMD's *Permit Modeling Guidance* (BAAQMD, 2005a).

The analysis includes an evaluation of the possible effects of simple, intermediate, and complex terrain, and aerodynamic effects (downwash) due to nearby building(s) and structures on plume dispersion and ground-level concentrations. A basic Gaussian plume model was used in this analysis. The model assumes that the concentrations of emissions within a plume can be characterized by a Gaussian distribution of gaseous concentrations about the plume centerline. Gaussian dispersion models are approved by the USEPA and BAAQMD for regulatory use and are based on conservative assumptions (i.e., the models tend to over predict actual impacts by assuming steady-state conditions, no pollutant loss through conservation of mass, no chemical reactions, etc.).

The following subsections present:

- Modeling methodology for evaluating the impacts on ambient air quality
- Modeling scenarios and source data used to evaluate the impacts on ambient air quality
- Modeling results compared to the ambient air quality standards

8.1.6.2.1 Modeling Methodology for Evaluating Impacts on Ambient Air Quality

This section outlines the air dispersion modeling techniques used to assess the impacts from the operation of the proposed Project. The modeling methodology follows the modeling guidance provided in the USEPA's *Guideline on Air Quality Models* (USEPA, 2005) as well as the BAAQMD's modeling guidance (BAAQMD, 2005a). The Applicant's preliminary BAAQMD permitting input files were also used as the initial setup files for the analysis, including stack height, site layout, building parameters, and facility boundary.

Model Selection

The operational air quality impact analysis was performed using the Industrial Source Complex, Short-Term Model (ISCST3, Version 02035). ISCST3 was selected in consultation with CEC and BAAQMD staff during a meeting on December 12, 2006. ISCST3 is a Gaussian dispersion model capable of assessing impacts from a variety of source types in areas of simple, intermediate, and complex terrain. The model can account for area, line, and volume source types; downwash effects; and gradual plume rise as a function of downwind distance. The model is capable of estimating concentrations for averaging periods from one hour to one year. The required emission source data inputs to ISCST3 include source locations, source elevations, stack heights, stack diameters, stack exit temperatures, stack exit velocities, and pollutant emission rates. The source locations are specified for a Cartesian (x,y) coordinate system where x and y are distances east and north in meters, respectively. The Cartesian coordinate system used for these analyses is the Universal Transverse Mercator Projection (UTM), 1927 North American Datum (NAD 27).

Model Options

ISCST3 model options include use of site-specific vertical profiles of wind speed and temperature, consideration of stack and building wake effects, and time-dependent exponential decay of pollutants. USEPA-recommended default values were used for the modeling analyses. A number of these default values are required for approval and are listed below.

- Rural dispersion coefficients
- Final plume rise
- Stack tip downwash
- Buoyancy-induced dispersion
- Calm processing
- No missing data processing
- Default wind profile exponents
- Default vertical potential temperature gradients
- 10-meter anemometer height

Previous modeling of the facility for BAAQMD permitting used rural dispersion coefficients. Therefore, for consistency, this modeling analysis also utilizes rural dispersion mixing coefficients.

Meteorological Data

The CEC requires five consecutive years of meteorological data approved by CARB or the local air pollution control district to be used in the air modeling. BAAQMD has recommended the use of BAAQMD's onsite meteorological data collected at the Chevron Refinery between 1999 and 2003. The BAAQMD meteorological data files have been pre-formatted by the BAAQMD for use with the Industrial Source Complex – Short-term (ISCT3) model, including the use of a predetermined mixing height of 600 meters.

Background Data

The background data need not be collected onsite, as long as the data are representative of the air quality in the subject area (40 CFR 51, Appendix W, Section 9.2). The following three criteria were used for determining whether the background data would be representative: (1) location, (2) data quality, and (3) data currentness. These criteria are defined as follows:

- **Location:** The measured data must be representative of the areas where the maximum concentration occurs for the proposed stationary source, existing sources, and a combination of the proposed and existing sources.

- **Data quality:** Data must be collected and equipment must be operated in accordance with the requirements of 40 CFR Part 58, Appendices A and B, and PSD monitoring guidance.

- **Data Currentness:** The data are current if they have been collected within the preceding three years and are representative of existing conditions.

Based on the criteria above, background concentrations for the PPRP were taken from the Richmond (7th Street, approximately 1.75 miles northeast of Proposed Project site), San Pablo (Rumrill Boulevard, approximately 2.75 miles northeast of Proposed Project site), and

Concord[1] (approximately 20 miles east of Project site) monitoring stations. Table 8.1-20 presents the maximum concentrations of NO_x, SO_2, CO, PM_{10}, and $PM_{2.5}$, recorded for the most recent years (2004 through 2006) from the above stations.

TABLE 8.1-20
Background Air Concentrations Near the Chevron Facility [a, b] 2004 through 2006

Pollutant	Averaging Time	2004		2005		2006		Average	Maximum
		ppm	µg/m³	ppm	µg/m³	ppm	µg/m³	µg/m³	µg/m³
NO_2	1-hour	0.06	113	0.05	102	0.06	104	**106**	**113**
	Annual	0.013	24.5	0.012	22.6	0.013	24.5	**23.8**	**24.5**
SO_2	1-hour	0.039	102.1	0.020	52.4	0.026	68.1	**74.2**	**102.1**
	3-hour	0.019	49.7	0.011	28.8	0.014	36.6	**38.4**	**49.7**
	24-hour	0.005	13.1	0.006	15.7	0.006	15.7	**14.8**	**15.7**
	Annual	0.0016	4.2	0.0011	2.9	0.002	5.2	**4.1**	**5.2**
CO	1-hour[c]	3.2	3665	2.8	3207	2.5	2863	**3245**	**3665**
	8-hour[c]	1.8	2061	1.3	1489	1.4	1603	**1718**	**2061**
PM_{10}	24-hour	-	64	-	42	-	58	**55**	**64**
	Annual	-	21.2	-	19.0	-	21.0	**20.4**	**21.2**
$PM_{2.5}$	24-hour	-	74	-	49	-	62	**62**	**74**
	Annual	-	10.7	-	9.0	-	10.0	**9.9**	**10.7**

Notes:

[a] Data reported are for the San Pablo (Ozone, PM_{10}, CO and NO_2), Richmond (SO_2), and Concord ($PM_{2.5}$) monitoring stations. The annual BAAQMD ambient air quality data summaries were used as the primary reference. The USEPA AIRS database and the CARB database were used when BAAQMD data were not available.

[b] Conversion from ppm to µg/m³ at 25° Celsius and 760 torr.

[c] Ambient CO data was converted from mg/m³ to µg/m³ by multiplying by 1,000.

In evaluating the impacts of operation on ambient air quality, modeling of the ambient impacts for the Project were added to the representative background concentrations in Table 8.1-20, and the results were compared to the state and federal ambient air quality standards for SO_2, NO_2, PM_{10}, $PM_{2.5}$, and CO.

Receptor Data

Cartesian coordinate receptor grids were used to assess the ground-level pollution concentrations surrounding the Project area, identify the extent of significant impacts, and identify the maximum impact locations.

For the operational air quality impact analyses, a fine receptor grid (30-meter resolution) was used around the fenceline with an initial coarse grid of receptors with 100-meter spacing extended 10 kilometers from the fenceline. A second refined receptor grid out to a radius of 1,500 meters with 30-meter grid receptor spacing was centered on the coarse grid receptor with the maximum predicted ground level concentrations. Concentrations within the facility fenceline were not calculated.

[1] The closest and most representative monitoring stations to the proposed Project site are Richmond and San Pablo, but because these stations do not monitor for $PM_{2.5}$, the nearest monitoring station with $PM_{2.5}$ (Concord) was used.

Receptor elevations, including those around the fenceline, were determined using the 7.5-minute U.S. Geological Survey (USGS) Digital Elevation Model (DEM) data (30-meter spacing between grid nodes). All coordinates were referenced to the UTM Zone 10, NAD27. Source base elevations, which are used in part to determine the height of the plume relative to the receptors, were based on information provided by the Applicant.

Building Downwash and Good Engineering Practice Assessment

For the analysis of the potential turbine impacts during operation, the USEPA's Building Profile Input Program (BPIP) (Dated 04112) was used to calculate the projected building dimensions required for ISCST3 evaluation of impacts from building downwash. The cooling towers were represented as volume sources; therefore, an evaluation of the good engineering practice (GEP) stack height or building downwash was not applicable.

GEP as used in the modeling analyses is the maximum allowed stack height to ensure that emissions from the stack do not result in excessive concentrations of any air pollutant in the immediate vicinity of the source as a result of atmospheric downwash, eddies, or wakes that may be created by the source itself, nearby structures, or nearby terrain obstacles. In addition, the GEP modeling restriction ensures that any required regulatory control measure is not compromised by the effect of that portion of the stack that exceeds the GEP.

USEPA's guidance for determining GEP stack height (H_g) (USEPA, 1985) is based on the height of a nearby structure(s) measured from the ground-level elevation at the base of the stack (H) and the lesser dimension, height or projected width, of the nearby structure(s) (L) as follows:

$$H_g = H + 1.5L$$

The GEP modeling restriction is the greater of the calculated GEP stack height or 65 meters. Therefore, based on the onsite and offsite building dimensions as input into BPIP, the GEP height for the facility stack is the greater of 65 meters or the calculated height of 39.9 meters. A stack height of 50.6 meters (from the Applicant's preliminary BAAQMD permitting files) was used to model the Cogen 3000 unit. The difference between the modeled stack height and the expected stack height will be resolved through the permitting process.

8.1.6.2.2 Modeling Scenarios and Source Data Used to Evaluate Impacts on Ambient Air Quality

In evaluating the impacts of the proposed Project on ambient air quality, modeling of the worst case ambient impacts for the Project were added to representative background concentrations, and the results were compared to the state and federal AAQS.

Operation Impacts Analysis

The maximum short-term emission rates used for modeling the worst-case impacts were based on unit capacity and maximum heat input or circulation rate. Because the units are expected to run continuously with the exception of scheduled maintenance or unscheduled breakdown, the startup and shutdown cycles were not considered part of the "normal" operations for comparison to the AAQS. Therefore, the maximum 1-hour, 3-hour, 8-hour, and 24-hour emission rates for normal operations were based on the maximum heat input and the Cogen 3000 design capacity. For the annual worst-case impacts, the Cogen 3000 was assumed to operate 24 hours per day for 365 days per year. The STG cooling tower was assumed to operate at the maximum water recirculation rate for 8,760 hours.

A 2-tiered approach was used to determine the maximum ground-level concentrations for each pollutant and averaging period. The first tier used a receptor grid with 30-meter spacing along the facility fenceline and 100-meter spacing extending 10 kilometers outside the facility fenceline. The second tier used a receptor grid spacing of 30 meters, centered on the maximum first tier modeling location with a 1,500-meter radius. The coarse and fine receptor grids are presented in Figure 8.1-C3 of Appendix 8.1-C. Each year of meteorological data (1999–2003) was modeled separately to determine the maximum annual and short-term concentrations from the proposed Project.

For the proposed Project, the turbine and duct burner would be the only source of NO_x, SO_x, and CO. Therefore, the modeling results from the unit emission rate-based analysis were multiplied by the actual NO_x, SO_x, and CO emission rates for each operating scenario and averaging period to obtain projected maximum concentrations. These maximum concentrations were added to the background concentration and compared to the respective AAQS.

A detailed modeling analysis was conducted to predict the total PM_{10} and $PM_{2.5}$ impacts from the turbine operating scenario and the cooling tower emissions. The detailed analysis was conducted using the actual turbine emission rates combined with the cooling tower emissions for PM_{10}. The maximum concentrations were then added to the PM_{10} and $PM_{2.5}$ background concentrations and compared to the respective AAQS.

Source emission rates for the dispersion modeling are presented in Table 8.1-21. A summary of the source parameters and the UTM locations of each source are shown in Appendix 8.1-C. The results of the modeling analysis are presented in Section 8.1.6.2.3 and Appendix 8.1-C.

TABLE 8.1-21
ISCST3 Model Input for the PPRP

		Emission Rates*							
		NO_x		CO		SO_2		PM_{10}	
Averaging Period	**Source**	**lb/hr**	**g/s**	**lb/hr**	**g/s**	**lb/hr**	**g/s**	**lb/hr**	**g/s**
Annual	Cogen 3000	7.74	0.975	7.54	0.950	0.378	0.048	6.26	0.789
	STG Cooling Tower	–	–	–	–	–	–	4.5	0.567
1-, 3-, 8-, and 24-hour	Cogen 3000	7.74	0.975	7.54	0.950	0.378	0.048	6.26	0.789
	STG Cooling Tower	–	–	–	–	–	–	4.5	0.567

Note:
* See Appendices 8.1-B and 8.1-C
g/s = grams per second

8.1.6.2.3 Modeling Results Compared to the Ambient Air Quality Standards

Operation Impacts Analysis

The highest modeled concentrations were used to demonstrate compliance with the AAQS. Table 8.1-22 presents a comparison of the maximum PPRP operational impacts to the AAQS. For those pollutants and averaging periods where the background concentrations do not exceed the AAQS, the Project will not cause or contribute to the violation of a standard. For those pollutants where the background data is already in excess of the standards, the Project's impact plus background is above the standard, and would further contribute to an

existing violation of the standard absent mitigation. The Applicant will be providing such mitigation in the form of emission reduction credits (ERCs). The complete list of off-property impacts for the five years of meteorological data (1999–2003) are presented in Appendix 8.1-C, Tables 8.1-C5 and 8.1-C6. (Note: the results in Table 8.1-C6 do not include background concentrations).

TABLE 8.1-22
PPRP Operation Impacts Analysis—Maximum Modeled Impacts Compared to the Ambient Air Quality Standards

Pollutant	Averaging Time	Maximum Facility Impact ($\mu g/m^3$)	Background ($\mu g/m^3$) [a]	Total Impact ($\mu g/m^3$)	State Standard ($\mu g/m^3$)	Federal Standard ($\mu g/m^3$)
NO_2	1-hour [b]	25	113	138	338 [c]	–
	annual [b]	0.3	24.5	24.8	56 [c]	100
SO_2	1-hour	1.2	102.1	103.3	655	–
	3-hour	1.1	49.7	50.8	-	1,300
	24-hour	0.3	15.7	16.0	105	365
	annual	0.02	5.2	5.22	–	80
CO	1-hour	24	3665	3,689	23,000	40,000
	8-hour	14	2061	2,075	10,000	10,000
PM_{10}	24-hour	18	64	82	50	150
	annual	1.4	21.2	22.6	20	–
$PM_{2.5}$	24-hour	18	74	92	–	35
	annual	1.4	10.7	12.1	12	15

Notes:

[a] Background concentrations were the highest concentrations monitored during 2004 through 2006.

[b] 1-hour and annual NO_2 predictions are conservatively based on 100 percent conversion to NO_2. In reality, NO to NO_2 conversion is limited by the amount of ambient ozone that is available to complete the conversion.

[c] The NO_2 ambient air quality state standard was amended on February 22, 2007, to lower the 1-hour standard to 0.18 ppm and establish a new annual standard of 0.030 ppm. These changes will become effective after regulatory changes are submitted and approved by the Office of Administrative Law, which is expected later in 2007.

Fumigation Impacts Analysis

A meteorological condition that can produce high concentrations of ground-level pollutants in coastal environments is referred to as shoreline fumigation. The condition occurs when the air flows from a large water body toward land. At the land-sea interface, a new interval boundary layer begins to develop due to mechanical and thermal effects. When the land is much warmer than the water surface, thermal effects will dominate and a thermal internal boundary layer (TIBL) will develop. Below the TIBL, the atmosphere is typically unstably stratified, while above the TIBL, a temperature lapse rate is usually assumed. The fumigation condition occurs when a plume initially released into the stable flow above the TIBL, intersects the TIBL. As the plume enters the TIBL, the plume is mixed toward the ground which can result in higher ground level concentrations of pollutants.

Inversion breakup fumigation occurs when a plume is emitted into a stable layer of air and that layer is then mixed to the ground in a short period of time through convective heating and microscale turbulence. Under these conditions, an exhaust plume may be drawn to the ground with little diffusion, causing high ground-level pollutant concentrations, although typically for periods less than 1 hour.

The effects of fumigation on the maximum modeled impacts were evaluated using the USEPA SCREEN3 model (Version 96043). For this evaluation, only impacts from the turbine stack were evaluated. The same operating scenario identified in the operational impact analysis was considered for fumigation. The nearest shoreline to the combustion turbine is approximately 1,400 meters. Additional model inputs were derived from BAAQMD's *Permit Modeling Guidance* (BAAQMD, 2005a), and are summarized below:

- A 2.5 meters per second wind speed,
- Stability class F, and
- A 50.6-meter anemometer height (turbine stack height).

The fumigation calculations in SCREEN3 demonstrate that the plume height is below the TIBL. Therefore, shoreline fumigation impacts would not affect the worse-case impacts. The maximum inversion breakup fumigation concentration predicted by SCREEN3 occurs over 10 kilometers downwind of the combustion turbine location. This result was conservatively compared to the maximum 1-hour concentration predicted by ISCST3 (Table 8.1-23). As presented in Table 8.1-23, the fumigation concentrations are less than 9 percent of the maximum predicted impacts predicted by ISCST3. Based on this evaluation, it is concluded that fumigation will not result in the worst-case impacts.

TABLE 8.1-23
Fumigation Impacts Analysis Results

Pollutant	Scenario	SCREEN3 Fumigation Result ($\mu g/m^3$)	Maximum ISCST3 Facility Impact ($\mu g/m^3$)	Percent of ISCST3 Concentration (%)
NO_x	Maximum HHV	2.2	25	8.8
CO	Maximum HHV	2.2	24	9.2
SO_x	Maximum HHV	0.1	1.2	8.3

8.1.6.3 Health Risk Assessment

Health risks potentially associated with the TACs emissions were evaluated for the Project operation. The health risk assessment (HRA) was performed following the latest guidance outlined in the *Air Toxics Hot Spots Program Risk Assessment Guidelines* (OEHHA, 2003), USEPA's *Guideline on Air Quality Models* (USEPA, 2005), CARB's *Recommended Interim Risk Management Policy for Inhalation-based Residential Cancer Risk* (CARB, 2003), and the BAAQMD's *Air Toxics NSR Program Health Risk Screening Analysis (HRSA) Guidelines*. (BAAQMD, 2005b). The CARB Hotspots Analysis Reporting Program (HARP, version 1.3, October 2006) was used to conduct the HRA analysis.

Table 8.1-24 presents a summary of the potential health risk impacts related to the PPRP. The derived adjusted cancer risk at the point of maximum impact (PMI) is approximately 1.2 in a million. The PMI is located along the western boundary of the Chevron facility. The derived adjusted maximum exposed individual resident (MEIR) cancer value is predicted to be approximately 0.2 in a million. The receptor location for MEIR is about 460 meters south of the facility boundary. The maximum exposed individual worker (MEIW) cancer risk is predicted to be approximately 0.4 in a million, located along the western boundary of the

Chevron facility. Both the MEIR and MEIW for the proposed Project are below the BAAQMD significance threshold of one in one million.

The potential chronic and acute hazard indices are also presented in Table 8.1-24. The chronic and hazard PMI values are approximately 0.009 and 0.01, respectively. The chronic PMI is less than the 0.2 TBACT threshold values (BAAQMD Regulation 2, Rule 5) and the authority to construct/permit to operate threshold of 1.0.

A complete discussion of the TAC emissions and the potential public health impacts are presented in Section 8.6.

TABLE 8.1-24
Summary of the Potential Health Risk Impacts for the PPRP

Risk	Receptor	Value	UTM (NAD 27)
70-year Cancer Derived PMI	3344	1.3 per million	552588, 4199070
70-year Cancer Derived Adjusted PMI	1180	1.2 per million	552556, 4199102
Chronic Hazard Index PMI	1180	0.00869	552556, 4199102
Acute Hazard Index PMI	3360	0.0114	552601, 4199228
70-year Cancer Derived MEIR	31548	0.19 per million	553756, 4197622
70-year Cancer Derived Adjusted MEIR	31548	0.18 per million	553756, 4197622
Cancer MEIW	1180	0.39 per million	552556, 4199102
Resident Chronic Hazard Index	31548	0.00125	553756, 4197622
Worker Chronic Hazard Index	1180	0.00869	552556, 4199102
Resident Acute Hazard Index	31345	0.00149	553786, 4197652
Work Acute Hazard Index	3360	0.0114	552601, 4199228

8.1.6.4 Class I Area Visibility Impacts Analysis

BAAQMD Regulation 2, Rule 2 requires any project to conduct a modeling analysis for plume visibility if the net emission increase from the new or modified source exceeds the PSD significance thresholds and the location of the source, relative to the closest boundary of a specified Federal Class I area (Point Reyes National Seashore), is within the 10 kilometers.

Although the PPRP alone would exceed the PSD significant emission rate (SER) thresholds for a major modification, the overall net increase of the Renewal Project is below the PSD SER criteria for regulated pollutants. Therefore, because the overall Renewal Project is not subject to the PSD analysis requirements and the Point Reyes National Seashore is greater than 10 kilometers from the Project site, a visibility analysis was not conducted.

8.1.7 Compliance with Laws, Ordinances, Regulations, and Standards

Table 8.1-25 presents the compliance evaluation for the applicable LORS and permits for protection of air quality.

TABLE 8.1-25
Compliance Evaluation for the Applicable Laws, Ordinances, Regulations, Standards, and Permits for Protection of Air Quality

LORS	Compliance Assessment
Federal	
Title 40 CFR Part 50	The Applicant will comply with all BAAQMD permit conditions limiting emissions and operations. Dispersion modeling indicates the Project will not exceed the state or federal AAQS for the attainment pollutants.
Title 40 CFR Part 51 NSR/PSD (BAAQMD Reg 2, Rule 2)	Because the PPRP will exceed the 10 lb/day trigger for at least one of the regulated pollutants, an ATC and PTO application will be obtained from the BAAQMD prior to construction of the Project. As a result, the compliance requirements of 40 CFR, Part 51 will be met. Although the PPRP would individually exceed the PSD significant emission rate (SER) for a major modification for PM_{10}, the overall Renewal Project net increase is below the PSD SER criteria for regulated pollutants. Therefore, the PPRP is not subject to PSD analysis requirements.
Title 40 CFR, Part 60	The proposed turbine will utilize steam-injected NO_x reduction technology along with an SCR system, and will utilize pipeline-quality natural gas, and will comply with both the NO_x and SO_2 limits. The NO_x and SO_2 emissions from the turbines will be 0.17 lb/MW-hr and 0.0084 lb/MW-hr, respectively. The certified NO_x Continuous Emission Monitoring System (CEMS) will ensure compliance with the standard. Records of natural gas usage will ensure compliance with the SO_2 limit.
Title 40 CFR, Part 63	The Chevron Richmond Refinery exceeds the major source thresholds for HAPs (10 tpy for any one pollutant or 25 tpy for all HAPs combined). Therefore, National Emissions Standards for Hazardous Air Pollutants (NESHAP) regulations apply. The Cogen 3000 HRSG incorporates an oxidation catalyst and the expected formaldehyde emissions associated with the PPRP will be 63 ppbv. Therefore, the Project is expected to comply with Subpart YYYY control technology and formaldehyde emission limit requirement of 91 ppbv.
Title 40 CFR Part 64 (CAM Rule)	The Project will have emission control systems for NO_x and CO (SCR and oxidation catalyst). Emissions of NO_x and CO will be directly measured by a continuous monitoring system. Therefore, the CAM Rule provisions do not apply.
Title 40 CRF part 70 (BAAQMD Reg 2, Rule 6)	Title 40, Code of Federal Regulations, Part 70 applies to facilities that emit greater than 100 tpy on a pollutant-specific basis. The Chevron facility will be an affected facility under the Title V rules (BAAQMD Regulation 2, Rule 6). Accordingly, a parallel application to modify the existing Title V permit has been made to the BAAQMD in addition to the CEC SPPE application.
Title 40 CRF part 72 (BAAQMD Reg 2 Rule 7)	The facility will not supply equal to or less than one-third of its potential electrical output capacity or equal to or less than 219,000 MWe-hours actual electric output on an annual basis to any utility power distribution for sale (on a gross basis), therefore, the Project is exempt from CFR Part 72.

TABLE 8.1-25
Compliance Evaluation for the Applicable Laws, Ordinances, Regulations, Standards, and Permits for Protection of Air Quality

LORS	Compliance Assessment
State	
California Code of Regulations, Section 41700	The CEC conditions of exemption and the BAAQMD ATC process is designed to ensure that the operation of the Project will not cause a public nuisance.
California Code of Regulations Sections 93300-93347 (Toxic "Hot Spots" Act)	The MEIR and MEIW cancer risks are 0.18 and 0.39 in a million, respectively. The maximum chronic and acute hazard indices are 0.00869 and 0.0114, respectively. The levels are also below the BAAQMD ATC or PTO thresholds for cancer risk of 10 in a million, or the chronic and acute hazard index of 1.0.
Local	
BAAQMD Reg 1, Section 301 (Public Nuisance)	The CEC conditions of exemption and the BAAQMD ATC process is designed to ensure that the operation of the Project will not cause a public nuisance.
BAAQMD Regulation 2, Rule 2 (Permits – NSR)	An air quality dispersion analysis was conducted, using a mass emissions-based analysis contained in the rule and the ISCST3 dispersion model. The overall Renewal Project net increase is below the PSD SER criteria for regulated pollutants. Therefore, the PPRP is not subject to the PSD analysis requirements. Based on the BACT thresholds, a BACT analysis was conducted for the following: POC, NO_x, PM_{10} and CO. (BAAQMD 2-2-301) The PPRP does not exceed the major source thresholds for HAPs (10 tpy for any one pollutant or 25 tpy for all HAPs combined). Therefore, NESHAP regulations are not expected to apply. (BAAQMD 2-2-114) Offsets for PM_{10} will be provided at a 1.0 to 1.0 ratio for the PPRP application. (BAAQMD 2-2-303) Per BAAQMD 2-2-417, the PPRP is not subject to PSD requirements and is greater than 10 kilometers from the nearest Class I area (Point Reyes National Seashore), therefore, a visibility, soils, and vegetation analysis is not required.
BAAQMD Regulation 2, Rule 3 (Permits – ATC and PTO for Power Plants)	In conjunction with the submittal of the SPPE Application to the CEC, the Applicant will work with the BAAQMD to provide the information needed for the issuance of a ATC. As stated in this rule, the review will be conducted as outlined in Regulation 2, Rule 2.
BAAQMD Regulation 2, Rule 5 (Permits – Toxics NSR)	The MEIR and MEIW cancer risks are 0.18 and 0.39 in a million, respectively. The maximum chronic and acute hazard indices are 0.00869 and 0.0114, respectively. The values are less than the TBACT thresholds of 1.0 in a million (10^{-6}), and/or a chronic hazard index greater than 0.20. The levels are also below the ATC or PTO thresholds for cancer risk of 10 in a million, or the chronic and acute hazard index of 1.0.
BAAQMD Regulation 2, Rule 6 (Permits – Title V)	An application has been submitted to the BAAQMD that presents all information necessary to evaluate the subject facility and determine the applicability of all regulatory requirements.

TABLE 8.1-25
Compliance Evaluation for the Applicable Laws, Ordinances, Regulations, Standards, and Permits for Protection of Air Quality

LORS	Compliance Assessment
BAAQMD Regulation 2, Rule 7 (Permits – Acid Rain)	The facility will not supply equal to or less than one-third of its potential electrical output capacity or equal to or less than 219,000 MWe-hours actual electric output on an annual basis to any utility power distribution for sale (on a gross basis), therefore, the Project is exempt from CFR Part 72 and BAAQMD Regulation 2, Rule 7.
BAAQMD Regulation 6 (Particulate Matter and Visible Emissions)	The Cogen 3000 will emit PM at 0.006 grains per dry standard cubic feet (DSCF) of exhaust gas volume, less than the 0.15 grains per DSCF limit.
BAAQMD Regulation 7 (Odorous Substances)	Ammonia emissions from the SCR catalyst will be less than 10 ppmv. Therefore, maximum emissions will be below the 5,000 ppm limit, and odors from the PPRP are expected to be less than significant.
BAAQMD Regulation 9, Rule 1	Results of the dispersion modeling indicate off-property SO_2 ground-level concentrations will be below the 0.5 ppm level for 3 consecutive minutes, 0.25 ppm level averaged over 60 consecutive minutes, or the 0.05 ppm level averaged over 24 hours. The proposed turbine will burn pipeline-quality natural gas with less than 4 ppm sulfur. Therefore, sulfur contents in the fuel will be less than 0.5% and gas stream concentrations will be less than 300 ppm (dry).
BAAQMD Regulation 9, Rule 3	BACT levels of 2.5 ppmv for NO_x will be applied to the Project; therefore, the NO_x emission levels for the Project will not exceed the 125 ppmv level or 225 ppm level for liquid fuels.
BAAQMD Regulation 9, Rule 9	BACT levels of 2.5 ppmv for NO_x will be applied to the Project; therefore, the NO_x emission levels for the Project will not exceed the 25 ppmv level.
BAAQMD Regulation 10 (40 CFR Part 60)	The proposed turbine will utilize steam-injected NO_x reduction technology along with an SCR system and will utilize pipeline-quality natural gas, and will comply with both the NO_x and SO_2 limits. The NO_x and SO_2 emissions from the turbines will be 0.17 lb/MW-hr and 0.0084 lb/MW-hr, respectively. The certified NO_x CEMS will ensure compliance with the standard. Records of natural gas usage will ensure compliance with the SO_2 limit.
BAAQMD Regulation 11, Rule 10	The Applicant will obtain recycled water from the East Bay Municipal Utility District; therefore, hexavalent chromium levels are expected to be below the 0.15 mg/L limit. Furthermore, the Chevron Richmond Refinery has not used chromium-based water treatment chemicals for over a decade.

8.1.8 Mitigation

Mitigation will be provided for NO_x, CO, PM_{10}, and VOC/POC emission increases from the Project in the form of offsets and the installation of BACT, as required under BAAQMD regulations.

8.1.8.1 BACT Discussion

Applicable BAAQMD BACT levels are presented in Table 8.1-26. BAAQMD Rule 2-2-301 requires the Project to apply BACT for emission increases of POC, NO_x, SO_2, PM_{10}, and CO that are greater than 10 lb/day. As presented in the table, BACT is required for POC, NO_x, PM_{10}, CO, and ammonia. The calculation of facility emissions is discussed in Section 8.1.6.1.

TABLE 8.1-26
Best Available Control Technology Requirements (Ref. BAAQMD Rule 2-2-301)

Pollutant	Applicability Level	Permit Units Exceeding this Level	BACT Required?
POC*	10 lb/day/source	Turbine and Duct Burner	Yes
NO_x	10 lb/day/source	Turbine and Duct Burner	Yes
SO_2	10 lb/day/source	–	No
PM_{10}	10 lb/day/source	Turbine and Duct Burner STG Cooling Tower	Yes Yes
CO	10 lb/day/source	Turbine and Duct Burner	Yes
Ammonia	–	Turbine and Duct Burner	Yes

Note:

* For this analysis, it is assumed that VOC emissions are the same as POC emissions. Therefore, VOCs have been compared to the POC threshold.

BACT for NO_x emissions from the turbine and duct burner will be achieved by the use of low NO_x emitting combustion equipment and post-combustion controls. The Applicant has selected a turbine equipped with steam-injected NO_x combustors. The gas turbine will be designed to generate less than 25 parts per million by volume-dry (ppmvd) NO_x, corrected to 15 percent O_2, at the outlet of the engine. In addition, the turbine will be equipped with a post-combustion SCR system to further reduce NO_x emissions to 2.5 ppmvd NO_x, corrected to 15 percent O_2 on a three-hour average basis (excluding startups and shutdowns). The current BAAQMD BACT requirement for natural-gas-fired combined-cycle gas turbines is 2.5 ppmvd, corrected to 15 percent O_2 over a three-hour averaging period. Therefore, the PPRP will meet the BACT requirements for NO_x.

BACT for CO emissions from the turbine will be achieved by good combustor design and an oxidation catalyst. Good combustor design will result in low levels of combustion CO while maintaining very low NOx formation. In addition, the Project will use an oxidation catalyst system to further reduce CO emissions to 4.0 ppmvd, corrected to 15 percent O_2. The current BAAQMD CO BACT requirement for natural-gas-fired combined-cycle gas turbines is 4.0 ppmvd, corrected to 15 percent O_2 over a three-hour averaging period. Therefore, the PPRP will meet the BACT requirements for CO.

BACT for VOC emissions will be achieved by good combustor design and an oxidation catalyst. BACT for VOC emissions from combustion devices has historically been the use of good combustor design. With the use of the good combustor design and the oxidation catalyst, the VOC emissions leaving the stacks will not exceed 2 ppmvd, corrected to 15 percent O_2 for turbine operation at full load. The current BAAQMD VOC BACT requirement for natural-gas-fired combined-cycle gas turbines is 2.0 ppmvd, corrected to 15 percent O_2 over a three-hour averaging period. Therefore, the PPRP will meet the BACT requirements for VOC.

For the turbines, BACT for PM_{10} is best combustion practices and the use of gaseous fuels. The use of clean-burning gaseous fuel will result in minimal particulate emissions. Based on the preliminary BAAQMD draft permit conditions, BACT for cooling tower PM_{10} is achieved by limiting the cooling tower drift to 0.0005 percent. Therefore, the PPRP will meet the BACT requirements for PM_{10}.

8.1.8.2 Emission Reduction Credits Assessment

As described in Section 8.1.1, the PPRP is a subset of the larger Renewal Project, specifically the PPRP is a subset of the Hydrogen Plant and the Power Plant Replacement Projects. For comparison to the ERC thresholds, the net emissions for the Hydrogen Plant, the Power Plant replacement, and the overall Renewal Projects (ESA, 2006) are presented in Table 8.1-27. Based on the net emissions presented in Table 8.1-27, only PM_{10} exceeds the ERC thresholds. Therefore, according to BAAQMD Regulation 2-2-303, the Applicant will be required to provide emission offsets for PM_{10} at a ratio of 1.0 to 1.0.

TABLE 8.1-27
"Renewal Project" Net Emissions[a]

	Pollutant (tons per year)			
	NO_x	**SO_2**	**PM_{10}**	**VOC**
Hydrogen Plant Replacement	-10.4	-52.4	-12.7	-2.1
Power Plant Replacement	-13.5	1.7	14.8	0.9
Total Project Net Emissions[b]	-74.0	-21.8	12.0	10.1
BACT Threshold[c]	35.0	1.0	1.0	35.0
Exceed BACT Threshold	No	No	Yes	No

Notes:

[a] Data from Volume 1 of the *Chevron Energy and Hydrogen Renewal Project, Draft Environmental Impact Report*, (ESA, 2007).

[b] Total Project net emissions also include the net emission from the Catalytic Reformer Replacement, Hydrogen Purity Improvements, Storage Tanks, Central Control Room, and Maintenance Facilities.

[c] Reference: BAAQMD Rule 2-2-302, Rule 2-2-303

The Applicant currently holds various emission reduction certificates for emissions of criteria pollutants. The certificates for PM_{10} are presented in Table 8.1-28. The Applicant will work with the BAAQMD to assign the certificates needed to offset the 11.0 tpy. Through the use of BACT to control air pollutant emissions, the use of available ERCs as presented in Table 8.1-27, combined with the results of the air quality impact analysis, the Project will not

result in significant air quality impacts. Therefore, no additional operational mitigation is necessary beyond the offsets that will be provided in accordance with BAAQMD requirements.

TABLE 8.1-28
Applicant's Available Emission Reduction Credits

Certificate	Origination Date	Emission Reduction Credit Bank (Tons/Year)
765	March 18, 1992	0.5
904	April 24, 1992	0.3
917	July 14, 1992	31.1
223	January 7, 1993	5.4
617	September 15, 1993	1.5
900	April 1, 1996	0.3
	Total	**39.1**

8.1.9 Cumulative Air Quality Impacts

Section 5.2 of the DEIR for the Chevron Renewal Project (ESA, 2007) presents an analysis of the cumulative air quality impacts of the Renewal Project, including the PPRP, and other planned development projects. The DEIR's cumulative impact analysis considered following documents to determine the effects of projects that may not be well defined:

- Richmond General Plan
- North Richmond Specific Plan
- Contra Costa County General Plan
- Contra Costa County Transportation Authority Transportation Plan
- Bay Conservation Development Commission Plans
- Regional Planning Documents from the Associations of Bay Area Governments, Metropolitan Transportation Commission, and the Regional Water Quality Control Board
- Bay Area Air Quality Management District's 2005 Ozone Strategy Plan

Through this process, a total of 17 pending projects were identified. Of these 17 projects, nine of them included projects planned by the Chevron Richmond Refinery. The remaining eight were the following non-Chevron projects:

- East Bay Municipal Utility District's Richmond Advanced Recycling Expansion (RARE) Water Project
- Valero Benicia Refinery Improvement Project

- PG&E's Richmond Fuel Oil Pipeline Divesture Project
- ConocoPhillips Clean Fuels Expansion Project
- Praxair Contra Costa Pipeline Project
- Praxair Contra Costa Hydrogen Pipeline Project
- Praxair Natural Gas Pipeline Project
- Point Molate Reuse Project

The results of this analysis, presented in Section 5.2.5.12 of the DEIR, indicate that most of the cumulative air quality construction or operational impacts will be less than insignificant, or mitigated to levels less than significant.

8.1.10 References

Bay Area Air Quality Management District (BAAQMD). 1999. BAAQMD CEQA Guidelines, Assessing the Air Quality Impacts of Projects and Plans. December.

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