8.6 Public Health

This section presents the methodology and results of the human health risk assessment (HHRA) performed to assess the potential impacts and public exposure associated with airborne emissions from the routine operation of the proposed Chevron Richmond Refinery Power Plant Replacement Project (PPRP, or the Project). Section 8.6.1 presents a summary description of the proposed Project. Section 8.6.2 describes the affected environment, Section 8.6.3 lists the applicable laws, ordinances, regulations, and standards (LORS); and Section 8.6.4 provides an analysis of construction and operational impacts of the power plant and associated facilities. Section 8.6.5 discusses compliance with LORS applicable to the Project. Section 8.6.6 identifies the mitigation measures. Section 8.6.7 discusses the cumulative impacts, and Section 8.6.8 presents the references cited in preparing this section.

8.6.1 Introduction

Chevron ("the Applicant") 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 ("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 and serves as 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 (Cogen 3000) consisting of one combustion turbine generator (CTG), a refinery fuel gas-fired heat recovery steam generator with duct burner (HRSG), 13.8-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 ("H_2-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, recycled water, water, wastewater, steam, and electricity to existing pipe racks, 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 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.

8.6.2 Affected Environment

The proposed Renewal Project site is located in the western portion of the city of Richmond, California 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 rise to a height of approximately 400 to 600 feet approximately 4 to 5 miles from the site, and gradually rise 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.

Surrounding land uses include industrial, residential, recreational, and commercial classifications. The surrounding land uses are described in further detail in Section 8.4, Land Use. Based on the EDR "Offsite Receptor Report" (EDR, 2007), approximately 220,000 residents live within a six-mile radius of the proposed Renewal Project. Sensitive receptors, which are defined as groups of individuals that may be more susceptible to health risks due to chemical exposure (such as schools, daycare facilities, convalescent centers, or hospitals) are also located within six miles of the proposed Project. The sensitive receptors located within a 6-mile radius of the Project Site are presented in Appendix 8.6-A. The nearest sensitive receptor is a day care center located approximately one and one quarter miles south/southeast of the property boundary.

8.6.3 Laws, Ordinances, Regulations, and Standards

An overview of the regulatory process for public health issues is presented in this section. The relevant LORS that affect public health and are applicable to the Project are identified in Table 8.6-1. Table 8.6-2 summarizes the primary agencies responsible for public health, the general category of the public health concern regulated by each of the agencies, and the conformity of the Project to each of the LORS applicable to public health. Points of contact with the primary agencies responsible for public health are identified in Table 8.6-2.

8.6.4 Environmental Analysis

8.6.4.1 Toxic Air Contaminant (TAC) Exposure Assessment

Human health risks potentially associated with TAC emissions from the operation of the proposed Project were evaluated. The HHRA was performed following the latest guidance outlined in the Air Toxics Hot Spots Program Risk Assessment Guidelines (Office of Environmental Health Hazard Assessment [OEHHA], 2003), the U.S. Environmental

TABLE 8.6-1
Applicable Federal, State, and Local Laws, Ordinances, Regulations, and Standards

LORS	Purpose	Regulating Agency	Applicability/Compliance Strategy
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 National Ambient Air Quality Standards (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. 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 volume (ppbv) for subject sources.
40 CFR Part 68 (Risk Management Plan) and Health and Safety Code Sections 25531 to 25541	Regulate public exposure to regulated substances	USEPA Region IX	Prepare Risk Management Plan (RMP) and offsite consequence analysis if required.
Health and Safety Code Sections 44360 to 44366 (Air Toxics ”Hot Spots” Information and Assessment Act—AB 2588)	Requires preparation and biennial updating of facility emission inventory of hazardous substances; risk assessments.	BAAQMD with oversight from CARB/OEHHA	An estimate of toxic air contaminant (TAC) emissions and associated risk will be evaluated as part of this section.
Health and Safety Code 25249.5 et seq. (Safe Drinking Water and Toxic Enforcement Act of 1986—Proposition 65)	Provides notification of Proposition 65 chemicals.	OEHHA	Comply with all signage and notification requirements, if required.
BAAQMD Regulation 2, Rule 2 (Permits – New Source Review [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	A source shall be exempt from MACT requirements if the combined potential to emit from all related sources in a proposes modification is less than 10 tons per year of any HAP and less than 25 tons per year of any combination of HAPs. (BAAQMD 2-2-114)

TABLE 8.6-1
Applicable Federal, State, and Local Laws, Ordinances, Regulations, and Standards

LORS	Purpose	Regulating Agency	Applicability/Compliance Strategy
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 Authority to Construct (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 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 5000 ppm.
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/liter.

TABLE 8.6-2
Summary of Agency Contacts for Public Health

Agency	Authority	Regulatory 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
OEHHA	Assess public exposure to toxic air contaminants from existing sources	Cynthia Oshita or Susan Long Office of Environmental Health and Hazard Assessment 1001 I Street Sacramento, CA (916) 445-6900
BAAQMD	Permit issuance, enforcement	Brian Bateman Bay Area Air Quality Management District 939 Ellis Street San Francisco, CA 94109 (415) 771-6000
Contra Costa County	Environmental Health Division	Richard Lee/Assistant Director 50 Douglas Drive Martinez, CA 94553 925-646-5225, ext. 200
Richmond Fire Department	Hazardous response	Michael Banks, Fire Chief Richmond City Hall 1401 Marina Way South, Richmond, CA 94804 510-307-8031

Protection Agency's (USEPA's) Guideline on Air Quality Models (USEPA, 2005), the California Air Resources Board's (CARB) Recommended Interim Risk Management Policy for Inhalation-based Residential Cancer Risk (CARB, 2003), and the Bay Area Air Quality Management District's (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 HHRA analysis.

The HHRA process requires four general steps to estimate health impacts: (1) identify and quantify project-generated emissions; (2) evaluate pollutant transport (air dispersion modeling) to estimate ground-level TAC concentrations at each receptor location; (3) assess human exposure, and (4) use a risk characterization model to estimate the potential health risk at each receptor location. The following sections describe in detail the methods used in this HHRA.

8.6.4.1.1 TAC Emission Calculations

Emissions associated with the Project will consist primarily of combustion by-products produced by the natural gas-fired combustion turbine, and particulate emissions from the STG cooling tower. The Project is also expected to emit small quantities of TACs, including ammonia. The TACs are compounds that have been identified as pollutants that may pose a significant health hazard by the CARB.

Non-criteria 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 Chevron as part of the BAAQMD permit application (Chevron, 2006).

The health risk analysis was conducted assuming that the combustion turbines would be operated 8,760 hours per year at the maximum heat input rating. This would be a conservative estimate of emissions, as the planned operating rates will likely be less than this amount due to scheduled/unscheduled maintenance activities and the fact that refinery steam demand fluctuates.

The combustion turbine emissions are presented in Table 8.6-3. Detailed emission calculations for the non-criteria pollutants are provided in Appendix 8.1-B.

TABLE 8.6-3
Non-criteria Pollutant Emissions Cogen Unit

Pollutant	Emission Factor (pounds per million standard cubic feet [lb/MMscf])[a]	Emissions	
		lb/hr	tpy
Acetaldehyde	1.53E-05	1.29E-02	0.056
Ammonia @ 10 ppm slip[b]	4.49E-03	3.77	16.5
Arsenic	8.50E-07	7.14E-04	0.003
Benzene	6.47E-05	5.43E-02	0.24
Benzo(a)pyrene	8.96E-08	7.53E-05	0.0003
Benzo(b)fluoranthene	4.04E-08	3.39E-05	0.0001
Benzo(k)fluoranthene	2.41E-08	2.02E-05	0.0001
Cadmium	9.88E-07	8.30E-04	0.004
Copper	4.21E-06	3.54E-03	0.02
Formaldehyde	1.11E-04	9.32E-02	0.41
Indeno(1,2,3-cd)pyrene	1.03E-07	8.65E-05	0.0004
Lead	4.89E-06	4.11E-03	0.02
Manganese	6.81E-06	5.72E-03	0.03
Mercury	1.80E-07	1.51E-04	0.0007
Naphthalene	3.13E-07	2.63E-04	0.0012

TABLE 8.6-3
Non-criteria Pollutant Emissions Cogen Unit

Pollutant	Emission Factor (pounds per million standard cubic feet [lb/MMscf])[a]	Emissions	
		lb/hr	tpy
Nickel	9.42E-06	7.91E-03	0.03
Phenol	5.63E-06	4.73E-03	0.02
Selenium	1.96E-08	1.65E-05	0.0001
Toluene	1.07E-04	8.99E-02	0.39
Xylenes	3.73E-05	3.13E-02	0.14
Zinc	2.08E-05	1.75E-02	0.08
Total TAC Emissions			**17.9**
Highest Individual HAP (formaldehyde)			**0.4**

Note:

[a] Emission factors based on the "Air Toxic Emission Factors for Combustion Sources Using Petroleum Based Fuels, Final Report, Volume II" (EERC, 1998)

[b] The ammonia emission factor may be adjusted as a result of the BAAQMD's review of the air permit application.

lb/MMscf = pounds per million standard cubic feet ; lb/hr = pounds per hour; tpy = tons per year

The health risk analysis was conducted assuming the cooling tower will be operated 8,760 hours per year, at the maximum circulation rate. This would be a conservative estimate of emissions, as the planned operating rates will likely be less than this amount due to scheduled/unscheduled maintenance activities and the fact that refinery steam demand fluctuates.

The cooling tower emissions are presented in Table 8.6-4. Detailed emission calculations for the non-criteria pollutants are provided in Appendix 8.1-B.

TABLE 8.6-4
Non-criteria Pollutant Emissions For STG Cooling Tower

Pollutant	Max. Concentration for Cooling Tower Discharge (lb/hr/gpm)	Average Concentration for Cooling Tower Discharge (lb/hr/gpm)	Emissions*	
			lb/hr	tpy
Bromine & Compounds	1.5E-01	1.25E-01	5.4E-05	2.0E-04
Chlorine	6.74E-02	5.62E-02	2.4E-05	8.9E-05
Chloroform	5.06	4.2	1.8E-03	6.6E-03
Total Cooling Tower HAP emissions				**7.6E-03**

Note:

* Emission factors based on BAAQMD permit application (Chevron, 2006)

8.6.4.1.2 Dispersion Modeling

Air dispersion modeling was performed to evaluate pollutant transport and predict ground level concentrations. The dispersion modeling was conducted within HARP using the USEPA Industrial Source Complex Short-Term (ISCST3) model (EPA, 1995). ISCST3 model options include the 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. Five years of on-site meteorological data collected by the BAAQMD from 1999 to 2003 was used in the dispersion modeling. The surface meteorological data was preprocessed by the BAAQMD for ISCST3 using a mixing height of 600 meters. Other dispersion modeling options were based on the BAAQMD's *Permit Model Guidance* (BAAQMD, 2005a):

- 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

Two receptor grids were used to analyze the potential impacts. An initial coarse grid with 100 meter spacing extending to 10 kilometers from the center of the facility was used to identify the location of the maximum predicted impacts. A second, refined grid with 30-meter spacing extending to 2 kilometers was centered on the point of maximum impact (PMI) and the maximum exposed individual resident (MEIR). The potential impacts at the sensitive receptors were evaluated based on the nearest 100 or 30 meter grid location.

Receptor and source base elevations were determined using the 7.5-minute U.S. Geological Survey (USGS) Digital Elevation Model (DEM) data (i.e., 30-meter spacing between grid nodes). All coordinates were referenced to the Universal Transverse Mercator (UTM) North American Datum 1927 (NAD27), zone 10.

Detailed source parameters for the Cogen 3000 and H_2-STG are presented in Appendix 8.1-C.

8.6.4.1.3 Risk Characterization

The results of the dispersion modeling analysis represent an intermediate product in the HHRA process. The HARP model was subsequently used to determine cancer, chronic, and acute health risks.

Cancer risks were evaluated based on the annual TAC ground-level concentrations, inhalation cancer potency, oral slope factor, frequency and duration of exposure at the receptor, and breathing rate of the exposed persons. Cancer risks were estimated using a conservative assumption of 70-year continuous exposure duration for residential receptors and a 40-year, 5-day week, 8-hours-per-day exposure duration for commercial/industrial receptors. In addition, for predicted cancer risks where the inhalation pathway is the dominant pathway of cancer risks, the Derived (Adjusted) Method in HARP was used for

the cancer risk evaluation, based on the *Recommended Interim Risk Management Policy for Inhalation-Based Residential Cancer Risk* (CARB, 2003).

Chronic toxicity is defined as adverse health effects from prolonged chemical exposure, caused by chemicals accumulating in the body. Acute toxicity is defined as adverse health effects caused by a brief chemical exposure of no more than 24 hours. To assess chronic and acute non-cancer exposures, annual and 1-hour TAC ground-level concentrations are compared with the Reference Exposure Levels (RELs) developed by OEHHA to obtain a chronic or acute hazard index. The REL is a concentration in ambient air at or below which no adverse health effects are anticipated.

OEHHA/CARB Cancer and Non-Cancer RELs

This HHRA included potential health impacts from home grown produce, dermal absorption, soil ingestion, and mother's milk, as required by OEHHA guidelines (OEHHA, 2003). The inhalation cancer potency, oral slope factor values, and RELs used to characterize health risks associated with the modeled impacts were obtained from the *Consolidated Table of OEHHA/ARB Approved Risk Assessment Health Values* (OEHHA and CARB, 2005), and are shown in Table 8.6-5.

Significance Criteria

Cancer Risk. Residential cancer risk is the probability or chance of contracting cancer over a human life span (assumed to be 70 years). Carcinogens are not assumed to have a threshold below which there would be no human health impact. In other words, any exposure to a carcinogen is assumed to have some probability of causing cancer; the lower the exposure (time or mass), the lower the cancer risk (i.e., a linear, no-threshold model). Under various state and local regulations, an incremental increased cancer risk greater than 10 in 1 million due to a project is considered to be a significant impact on public health. For example, the 10-in-1-million risk level is used by the Air Toxics Hot Spots (AB 2588) program and California's Proposition 65 as the public notification level for air toxic emissions from existing sources.

Non-Cancer Risk. Non-cancer health effects can be either chronic or acute. In determining potential non-cancer health risks (chronic and acute) from air toxics, it is assumed there is a dose of the TAC below which there would be no impact on human health. The air concentration corresponding to this dose is called the Reference Exposure Level. Non-cancer health risks are measured in terms of a hazard quotient, which is the calculated exposure of each contaminant divided by its REL. Hazard quotients for pollutants affecting the same target organ are typically summed with the resulting totals expressed as hazard indexes for each organ system. A hazard index of less than 1.0 is considered to be an insignificant health risk. For this health risk assessment, all hazard quotients were summed regardless of target organ.

8.6.4.1.4 Summary of TAC Exposure Assessment Results

A summary of the PMI UTM locations for increased cancer risk, chronic health index, and acute health index have been included in Table 8.6-6 along with the predicted health risk impacts. An evaluation of the chemicals and sources contributing to the maximum predicted risks are also presented in this section. In addition, the HARP report files were also prepared and submitted on CD (see Appendix 8.6-B for a description of HARP files included on the CD).

TABLE 8.6-5
Risk Assessment Health Values for Substances of Potential Concern

	Cancer Risk		Non-cancer Effects	
Compound	**Inhalation Cancer Potency (mg/kg-day)**	**Oral Slope Factor $(\mu g/m^3)^{-1}$**	**Chronic Inhalation Reference Exposure Level ($\mu g/m^3$)**	**Acute Inhalation Reference Exposure Level ($\mu g/m^3$)**
Acetaldehyde	1.0 E-2	--	9.00E+00	--
Ammonia	--	--	2.0E+02	3.2E+03
Arsenic	1.2 E+1	1.5 E0	3.0 E-2	1.9 E-1
Benzene	1.0E-01		6.0E+01	1.3E+03
Benzo(a)pyrene	3.9 E+0	1.2 E+1	--	--
Benzo(b)fluoranthene	3.9 E-1	1.2 E+0	--	--
Benzo(k)fluoranthene	3.9 E-1	1.2 E+0	--	--
Cadmium	1.5 E+1	--	2.0 E-2	--
Copper	--	--	2.4 E+0	1.0 E+2
Formaldehyde	2.1 E-2	--	3.0 E+0	9.4 E+1
Indeno(1,2,3-cd) pyrene	3.9 E-1	1.2 E+0	--	--
Lead	4.2 E-2	8.5 E-3	--	--
Manganese	--	--	2.0 E-1	--
Mercury	--	--	9.0 E-2	1.8 E+0
Naphthalene	1.2 E-1	--	9.0 E+0	--
Nickel	9.1 E-1	--	5.0 E-2	6.0 E+0
Phenol	--	--	2.0 E+2	5.8 E+3
Selenium	--	--	2.0 E+1	--
Toluene	--	--	3.0 E+2	3.7 E+4
Xylenes	--	--	7.0 E+1	--
Zinc	--	--	3.5 E+1	--
Bromine & Compounds	--	--	1.7 E+0	--
Chlorine	--	--	2.0 E-1	2.1 E+2
Chloroform	1.9 E-2	--	3.0 E+2	1.5 E+2

Note:

mg/kg-day = milligrams per kilogram per day
$\mu g/m^3$ = micrograms per cubic meter
Source: OEHHA/CARB, 2005

TABLE 8.6-6
HHRA Summary – PPRP

Risk	Receptor Number	Value	UTM (NAD 27)	File Name
70-yr Cancer Der. MEIR	31,548	0.189 per million	553756, 4197622	Rep_Can_70yr_DerOEH_Rec31548_AllSrc_AllCh_BySrc_ByChem_Site.txt
70-yr Cancer Der. Adj. MEIR	31,548	0.178 per million	553756, 4197622	Rep_Can_70yr_DerAdj_Rec31548_AllSrc_AllCh_BySrc_ByChem_Site.txt
Cancer MEIW	1,180	0.394 per million	552556, 4199102	Rep_Can_WRK_Avg_Rec1180_AllSrc_AllCh_BySrc_ByChem_Site.txt
Resident Chronic HI	31,548	0.00125	553756, 4197622	Rep_Chr_Res_DerOEH_Rec31548_AllSrc_AllCh_BySrc_ByChem_Site.txt
Worker Chronic HI	1,180	0.00869	552556, 4199102	Rep_Chr_Wrk_PtEst_Rec1180_AllSrc_AllCh_BySrc_ByChem_Site.txt
Resident Acute HI	31,345	0.00149	553786, 4197652	Rep_Acu_Rec31345_AllSrc_AllCh_BySrc_ByChem_Site.txt
Work Acute HI	3,360	0.0114	552601, 4199228	Rep_Acu_Rec3360_AllSrc_AllCh_BySrc_ByChem_Site.txt
70-yr Cancer Der. PMI	3,344	1.32 per million	552588, 4199070	REP_PMI.txt
70-yr Cancer Der. Adj. PMI	1,180	1.24 per million	552556, 4199102	
Chronic HI PMI	1,180	0.00869	552556, 4199102	
Acute HI PMI	3,360	0.0114	552601, 4199228	

Notes:

Adj. = adjusted

Der. = derived

HI = Hazard Index

MEIR = maximum exposed individual resident

MEIW = maximally-exposed individual worker

NAD = North American Datum

PMI = point of maximum impact

UTM = Universal Transverse Mercator

The cancer risk at the PMI is approximately 1.2 in a million (70-year derived adjusted cancer value). The PMI is located along the western boundary of the facility. The derived adjusted cancer MEIR is predicted to be 0.178 in a million. The receptor location for the MEIR is about 400 meters (m) south of the facility's southwest boundary. The maximally-exposed individual worker (MEIW) is predicted to be 0.394 in a million, located on the western border of the facility boundary. Both the MEIR and MEIW for the proposed Project are below the BAAQMD's Regulation 2, Rule 5 significance threshold of one in one million.

The maximum chronic hazard index increment is predicted to be approximately 0.0087 and is located on the western border of the facility fenceline.

The maximum acute hazard index is predicted to be approximately 0.01 and is located along the facility's western boundary. The chronic and acute index increments predicted for the proposed Project are all below the BAAQMD's Regulation 2, Rule 5 significance threshold of 1.0.

The contributions from the Cogen 3000 and H_2-STG cooling tower to the maximum health risk impacts from the proposed Project are shown in Table 8.6-7. Combustion emissions from the turbines contributed a majority of the cancer, chronic, and acute risks at both the maximum residential and worker receptors.

TABLE 8.6-7
Contribution of Sources to the Health Risks at the Maximum Exposed Receptors

	Cancer		HIC		HIA	
Source	**Resident**	**Worker**	**Resident**	**Worker**	**Resident**	**Worker**
Turbines	0.19 per million	0.39 per million	0.00124	0.00867	0.00147	0.0114
Cooling Tower	<0.001 per million	<0.001 per million	<0.0001	<0.0001	<0.0001	0.000135

Note:
HIA = acute hazard index; HIC =chronic hazard index

Table 8.6-8 presents the top contributors of the TACs to the maximum health risk values for the Project operation. Arsenic is the highest contributor to cancer risks and acute health risks. Nickel is the highest contributor to the predicted chronic risk value.

Modeling showed that the MEIR excess lifetime cancer risk was 0.19 in a million, and the MEIW excess lifetime cancer risk was 0.39 in a million. Excess lifetime cancer risks less than (10 in 1 million) are unlikely to represent public health impacts that require additional facility emission controls.

For residential receptors, arsenic has the highest potential to contribute to the cancer impact; however, the contribution is less than 0.2 in 1 million. The dominant exposure pathway for arsenic is oral exposure. Other substances each contribute less than 0.1 in 1 million at the MEIR.

8.6.4.2 Construction Impacts

The construction phases of the Hydrogen Plant Replacement Project and the Power Plant Replacement Project are expected to take place over a period of approximately 28 to

30 months. Diesel PM_{10} (particulate matter of 10 microns) emissions from construction equipment exhaust would potentially cause short-term human health impacts during construction. However, the BAAQMD *CEQA Guidelines* (BAAQMD, 1999) emphasize implementation of effective control measures rather than detailed quantification of construction emissions. Therefore, the Applicant will incorporate diesel PM_{10} control measures as outlined in the Draft Environmental Impact Report (DEIR) for the Renewal Project (ESA, 2007). As a result of the implementation of diesel PM_{10} control measures, no significant public health effects are expected during the construction phase.

TABLE 8.6-8
Contributions of the TACs to the Maximum Predicted Impact at the MEIR, MEIW, PMI Locations

TACs	Cancer Risks	Chronic Risks	Acute Risks
Acetaldehyde	1.27 E-9	4.88 E-5	NA
Ammonia @ 10 ppm slip	NA	6.45 E-4	3.8 E-3
Arsenic	8.3 E-7	1.59 E-3	8.82 E-3
Benzene	5.37 E-8	3.10 E-5	8.74 E-5
Benzo(a)pyrene	1.02 E-7	NA	NA
Benzo(b)fluoranthene	4.61 E-9	NA	NA
Benzo(k)fluoranthene	2.75 E-9	NA	NA
Cadmium	1.23 E-7	1.82 E-3	NA
Copper	NA	5.04 E-5	1.14 E-4
Formaldehyde	1.94 E-8	1.06 E-3	3.20 E-3
Indeno(1,2,3-cd)pyrene	1.17 E-8	NA	NA
Lead	1.37 E-8	NA	NA
Manganese	NA	9.78 E-4	NA
Mercury	NA	2.28 E-4	2.71 E-4
Naphthalene	3.12 E-10	9.99 E-7	NA
Nickel	7.12 E-8	5.41 E-3	4.25 E-3
Phenol	NA	8.09 E-7	2.63 E-6
Selenium	NA	2.81 E-8	NA
Toluene	NA	1.02 E-5	7.84 E-6
Xylenes	NA	1.53 E-6	4.59 E-6
Zinc	NA	1.71 E-5	NA
Bromine & Compounds	NA	4.39 E-6	NA
Chlorine	NA	1.68 E-5	4.26 E-6
Chloroform	1.36 E-9	8.40 E-7	1.47 E-4

Note:
NA = Not Applicable

8.6.4.3 Hazardous Materials

Hazardous materials will be used and stored at the facility. The quantities of hazardous materials proposed to be stored onsite and a description of their uses are presented in Section 8.11, Hazardous Materials and Waste. Use of hazardous materials at the proposed facility will be in accordance with standard practices for their storage and management. Normal use of hazardous materials, therefore, will not pose significant impacts to public health. While mitigation measures will be in place to prevent releases, accidental releases that migrate offsite could result in potential impacts to the public.

The California Health and Safety Code Sections 25531 to 25541 and Title 40 CFR Part 68 under the Clean Air Act establish emergency response planning requirements for some of the hazardous materials to be used and stored at the facility. The hazardous materials regulated under these LORS are termed "regulated substances." These regulations require preparation of a Risk Management Plan (RMP), which is a comprehensive program to identify hazards and predict the areas that may be affected by a release of a regulated substance. The only regulated substance to be used at the facility is anhydrous ammonia, which is produced and used at the facility. No new sources of ammonia are required for the proposed Project and the Refinery will update the existing RMP when applicable to include the use of ammonia in the Cogen 3000 project.

8.6.4.4 Operation Odors

Small amounts of ammonia used to control nitrogen oxides (NO_x) emissions may escape up the exhaust stack but would not produce operational odors. The expected exhaust gas ammonia concentration, known as ammonia "slip," will be less than 10 parts per million (ppm). After mixing with the atmosphere, the concentration at ground level will be far below the BAAQMD Regulation 7 limit of 5,000 ppm. Therefore, potential ammonia emissions are not expected to create objectionable odors.

8.6.5 Compliance With LORS

Table 8.6-9 presents a compliance evaluation for the applicable LORS and permits.

8.6.6 Mitigation Measures

8.6.6.1 Criteria Pollutants

Emissions of criteria pollutants will adhere to National Ambient Air Quality Standards (NAAQS) or California Ambient Air Quality Standards (CAAQS) as discussed in Section 8.1, Air Quality. The proposed facility also will include emission control technologies necessary to meet the required emission standards specified for criteria pollutants under BAAQMD rules. Offsets or net reductions in air emissions will ensure that the Project will not result in an increase in total emissions in the air basin. Air dispersion modeling results (presented in Section 8.1, Air Quality) show that Project emissions will not cause or contribute to the violation of ambient air quality standards (either NAAQS or CAAQS) for those pollutants for which the area is designated as in attainment. These standards are intended to protect the general public with a wide margin of safety. Therefore, the Project is not anticipated to have a significant impact on public health from emissions of criteria pollutants. For those criteria pollutants (and their precursor pollutants) where the

ambient air quality standards are not in attainment, mitigation will be provided to reduce the impacts to less than significant levels (see Section 8.1).

TABLE 8.6-9
Compliance Evaluation for the Applicable Laws, Ordinances, Regulations, Standards and Permits for Protection of Air Quality

LORS	Compliance Assessment
Federal	
Title 40 CFR, Part 63	The Chevron Richmond Refinery exceeds the major source thresholds for HAPs (10 tons per year for any one pollutant or 25 tons per year for all HAPs combined). Therefore, National Emissions Standards for Hazardous Air Pollutants (NESHAP) regulations apply. The Cogen 3000 emissions associated with the PPRP will be 63 parts per billion volume (ppbv) formaldehyde. Therefore, the Project complies with Subpart YYYY formaldehyde emission limit of 91 ppbv. Furthermore, the Cogen 3000 HRSG incorporates an oxidation catalyst system that would be expected to control formaldehyde emissions, resulting actual emissions below the estimated 63 ppbv.
40 CFR Part 68 (Risk Management Plan) and Health and Safety Code Sections 25531 to 25541	The Applicant will prepare required materials. A complete hazardous materials assessment is included in Section 8.11.
State	
California Code of Regulations Sections 93300-93347 (Toxic “Hot Spots” Act)	The maximum exposed individual resident and worker cancer risk 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 below the BAAQMD Authority to Construct (ATC) or Permit to Operate (PTO) thresholds for cancer risk of 10 in a million, and/or the chronic and acute hazard index of 1.0.
Health and Safety Code 25249.5 et seq. (Safe Drinking Water and Toxic Enforcement Act of 1986—Proposition 65)	The facility, during construction and operation, will comply with all Prop. 65 signage and notification requirements.
Local	
BAAQMD Regulation 2, Rule 2 (Permits – New Source Review [NSR])	The Chevron Richmond Refinery exceeds the major source thresholds for HAPs (10 ton per year for any one pollutant or 25 ton per year for all HAPs combined). Therefore, NESHAP regulations apply (BAAQMD 2-2-114).
BAAQMD Regulation 2, Rule 5 (Permits – Toxics NSR)	The maximum exposed individual resident and worker cancer risk 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 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 11, Rule 10	The Applicant will obtain water from EBMUD; therefore, hexavalent chromium levels are expected to be below the 0.15 milligrams/liter limit. Furthermore, Chevron Richmond Refinery has not used chromium-based cooling tower treatment chemicals in the last twenty years.

8.6.7 Cumulative Impacts

Section 5.2 of the DEIR for the Chevron Renewal Project (ESA, 2007) presents an analysis of the cumulative 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 it is unlikely that cumulative construction or operational impacts are expected.

8.6.8 References

Bay Area Air Quality Management District (BAAQMD). 2005a. Permit Modeling Guidance. May.

_____. 2005b. Air Toxics NSR Program Health Risk Screening Analysis (HRSA) Guidelines. June.

_____. 1999. BAAQMD CEQA Guidelines, Assessing the Air Quality Impacts of Projects and Plans. December.

California Air Resources Board (CARB). 2003. Recommended Interim Risk Management Policy for Inhalation-based Residential Cancer Risk.

Chevron Products Company (Chevron). 2006. EIR Health Risk Screening Analysis – Energy Plant and Hydrogen Plant Renewal Project. June 27.

Environmental Data Resources (EDR). 2007. EDR Offsite Receptor Report. April 27.

Energy & Environmental Research Corporation (EERC). 1998. Air Toxic Emission Factors for Combustion Sources Using Petroleum Based Fuels, Final Report, Volume II. August.

ESA Associates, Inc. (ESA). 2007. *Chevron Energy and Hydrogen Renewal Project Administrative Draft EIR* (State Clearinghouse No. 2005072117). Prepared for City of Richmond, CA. May.

Office of Environmental Health Hazard Assessment (OEHHA). 2003. Air Toxics Hotspots Program Guidance Manual for Preparation of Health Risk Assessments.

OEHHA and CARB. 2005. Consolidated Table of OEHHA/CARB Approved Risk Assessment Health Values. April 25.

USEPA. 2005. Guideline on Air Quality Models, 40 CFR, Part 51, Appendix W.

_____. 1995. User's Guide for the Industrial Source Complex (ISCST3) Dispersion Model. USEPA-454/B-95-003a.