6.11 PUBLIC HEALTH

There are multiple topics that potentially relate to public health concerns from operation of the VV2 Project. These topics include the potential for health impacts due to the emissions of air pollutants; health risks from the emissions of air contaminants and airborne pathogens; exposure to hazards from the handling of wastes, chemicals and other materials; exposure to electromagnetic fields (EMF) from the transmission of the power; and safety concerns for workers. Most of these topics are addressed in other sections in this AFC document. For instance, impacts on air quality attainment of California Ambient Air Quality Standards (CAAQS) or National Ambient Air Quality Standards (NAAQS) due to criteria pollutant emissions are addressed in Section 6.3. Risks potentially associated with accidental releases of used/stored hazardous materials at the proposed facility such as the aqueous ammonia used for control of air pollution, are discussed Section 6.7, Hazardous Materials. A discussion of EMF is provided in Section 6.14, Transmission Line Safety and Nuisance. Small quantities of hazardous waste may be generated during the operational phase of the project, but since waste management plans will be in place, the potential for public exposure is considered minimal (see Section 6.16, Waste Management). Releases from the project in wastewater streams to the public sewer system are discussed in Section 6.17, Water Resources. Programs to achieve a safe workplace for employees of the VV2 Project are described in Section 6.18, Worker Safety.

The remaining topic, health risks from the emissions of air contaminants, is discussed in this section of the AFC. This section presents the methodology and results of a human health risk assessment performed to evaluate potential impacts and public exposure associated with airborne emissions from operation of the VV2 Project.

Chemical substances in ambient air that potentially pose risks to human health include byproducts from the combustion of natural gas in the combustion turbines, diesel fuel from the emergency diesel fire-water pump, and particulates in the drift from the cooling tower. For public health, the term *chemical substances* refer to chemical substances in ambient air that are regulated by either the United States Environmental Protection Agency (EPA) and/or the State of California. The California Office of Environmental Health Hazard Assessment (OEHHA) and the California Air Resources Board (ARB) use the term Toxic Air Contaminant (TAC), which currently includes over 244 chemical substances. The EPA uses the term Hazardous Air Pollutants (HAP), and has currently identified 188 substances as HAPs, all of which are presently included in California's list of TACs.

6.11.1 LORS Compliance

The relevant LORS that affect public health and are applicable to this project are identified in Table 6.11-1. The applicability to the project of each of the LORS related to public health is also presented in this table, as well as references to the locations where each of these issues is addressed.

Table 6.11-1
Summary of LORS Applicable to Public Health

LORS*	Applicability	Where Discussed in AFC
Federal:		
U.S. Clean Air Act, Section 112, 40 Code of Federal Regulations (CFR) Parts 61 and 63	National Emissions Standards for Hazardous Air Pollutants (NESHAP) require the control of specific substances (Part 61) or HAP emissions for certain sources (Part 63). These NESHAP prescribe standards and practices which are considered Maximum Available Control Technology (MACT) for these sources.	Section 6.11.1.1
State:		
Health and Safety Code (H&SC) Sections 39650 *et seq*.	Mandates the establishment of safe exposure limits for toxic air contaminants (TACs) and identification of control technologies.	Sections 6.11.1.2 and 6.11.3.4
H&SC Section 39666	Delegates the enforceability of California Airborne Toxic Control Measures (ATCM) to local air quality district.	Section 6.11.1.2
H&SC Section 41700	Prohibits odors and emissions from causing injury, detriment, nuisance, or annoyance to any considerable number of people.	Section 6.11.1.2
H&SC Sections 44360 to 44366 (Air Toxics “Hot Spots” Information and Assessment Act -- AB2588)	Regulates public exposure to toxic air contaminants from existing and new sources.	Sections 6.11.1.2 and 6.11.3.4

Table 6.11-1
Summary of LORS Applicable to Public Health

LORS*	Applicability	Where Discussed in AFC
H&SC Sections 25249.5 *et seq.* (Safe Drinking Water and Toxic Enforcement Act of 1986 -- Proposition 65)	Requires notification related to public exposure to chemicals known to cause cancer or reproductive toxicity.	Section 6.11.1.2
Title 17, California Code of Regulations (CCR), Section 93115	Requires Tier 2, 3 and 4 particulate matter standards and operational limitations on engines driving emergency standby electrical power generators and fire-water pumps.	Sections 6.11.1.2 and 6.11.3.2
Titles 17 and 26, CCR Section 93103, Subchapter 7.5, Chapter 1, Part III	Regulates hexavalent chromium and chromate substances in cooling towers through notification, concentration limits, and testing record retention.	Sections 6.11.1.2 and 6.11.4.2
Title 22, CCR Section 60306	Regulates the use of reclaimed water in cooling towers and requires the use of biocides to control the growth of bacteria and other pathogens.	Sections 6.11.1.2 and 6.11.4.2
Cooling Technology Institute (CTI) Guidelines: “Best Practices for Control of Legionella.”	Establishes industry recommendations and guidelines for the best practice and management for control of bacteria and to minimize the risk from Legionella.	Sections 6.11.1.2 and 6.11.4.2
CEC Staff Cooling Water Management Program Guidelines For Wet and Hybrid Cooling Towers at Power Plants (CEC, 2004)	Provides example of adequate contents of a biocide application and monitoring program designed to control microorganisms, to the maximum extent feasible, within cooling towers using open recirculating water systems.	Sections 6.11.1.2 and 6.11.4.2
Local (Mojave Desert Air Quality Management District (MDAQMD)):		
MDAQMD Rule 402 (Nuisance)	Implements H&SC Section 41700 (see above)	Sections 6.11.1.3 and 6.11.4.2

Table 6.11-1
Summary of LORS Applicable to Public Health

LORS*	Applicability	Where Discussed in AFC
MDAQMD Regulation X – Notification of MACT Standards	Notifies sources of the requirement and local enforceability for Federal standards and practices which prescribe MACT standards for the control of HAP emissions	Sections 6.11.1.3 and 6.11.3.2
MDAQMD Regulation X – Notification of ATCMs	Notifies sources of the requirement and local enforceability for California ATCM and practices for the control of HAP emissions.	Sections 6.11.1.3 and 6.11.3.2
MDAQMD Rule 1000 (Emission Standards for Specific Air Contaminants)	Implements the Federal NESHAP promulgated under 40 CFR Part 61 (see above)	Section 6.11.1.3
MDAQMD Rule 1320 (New Source Review for Air Toxics)	New Source Review for Air Toxics implements the Federal NESHAP under 40 CFR Part 63 and also the California Air Toxic Control Measures (see above).	Sections 6.11.1.3 and 6.11.3.2
MDAQMD CEQA and Federal Conformity Guidelines	Provides significance thresholds under CEQA for exposure of sensitive receptors to cancer and non-cancer public health risk impacts.	Sections 6.11.1.3 and 6.11.4.2
* The LORS in this table relate only to public health concerns due to the emissions of HAP and other air contaminants. See other AFC sections for LORS related to other public health topics such as air quality, EMF, hazards, waste streams, etc.		

6.11.1.1 Federal

National Emission Standards for Hazardous Air Pollutants (NESHAP), 40 CFR Parts 61 and 63. EPA regulations related to hazardous air pollutants will have limited applicability to the VV2 Project because it will not be a major source of HAP emissions. Even so, the VV2 Project will meet the MACT emission standard specified in 40 CFR 63 Subpart YYYY for stationary gas turbines through existing control requirements, including exclusive firing on natural gas and installation of an oxidation catalyst, which will be enforceable through permitted operating conditions. The Asbestos NESHAP, 40

CFR 61 Subpart M requires notification when the demolition occurs at the facility, even though no asbestos will be used in its construction.

These Federal NESHAP regulations have been incorporated by reference in MDAQMD Regulation X.

6.11.1.2 State

H&SC Sections 39650 *et seq.* These sections of the California Health & Safety code establish a broad statewide program of public protection against exposure to toxic air contaminants determined to be carcinogenic, teratogenic, mutagenic, or otherwise toxic or injurious to humans, including control technology requirements and cumulative impact analysis. The VV2 Project will meet all applicable measures to control and minimize air toxics emissions and, as evidenced by this health risk assessment, will not compromise the public health.

H&SC Section 39666. The California H&SC delegates the enforceability of California ATCM to local air quality district. The VV2 Project will comply with all applicable California ATCM through locally enforceable permit conditions.

H&SC Section 41700. The H&SC prohibits the discharge of air pollutants that cause injury, detriment, nuisance, or annoyance to the public. This requirement is implemented through MDAQMD Rule 402.

H&SC Sections 44360-44366 – Air Toxic "Hot Spots" Information and Assessment. Under California Health and Safety Code 44360-44366, the VV2 Project will file the required air toxics emissions information. This filing requirement applies after the start of operation. Assessments provided in this Public Health section indicate that the VV2 Project will have insignificant impacts from TAC/HAP emissions. The administering agency for the Air Toxics "Hot Spots" program is the MDAQMD.

H&SC Sections 25249.5 *et seq.* (Safe Drinking Water and Toxic Enforcement Act of 1986 -- Proposition 65). The VV2 Project will emit chemicals covered by Proposition 65 and will be responsible for any required notification to the public of potential exposure to chemicals known to cause cancer or reproductive toxicity.

CCR Title 17, Section 93115. California requires all new stationary engines driving emergency standby electrical power generators and fire-water pumps to meet Tier particulate matter standards through add-on controls or operational limitations. The VV2

Project will comply with these control requirements on the planned fire-water pump and back-up electric power generator.

CCR Titles 17 and 26, Section 93103, Subchapter 7.5, Chapter 1, Part III. These requirements regulate hexavalent chromium and chromate substances in cooling towers. These requirements will be met as part of the VV2 Project operations and maintenance program, which will not use any biocide or other substance in the cooling water system that contains hexavalent chromium or chromate substances.

CCR Title 22, Section 60306. This CCR section regulates the use of reclaimed water in cooling towers. The VV2 Project will develop and implement a cooling tower management plan that will address all requirements for the use of biocides to control the growth of bacteria and other pathogens in reclaimed water systems.

Cooling Technology Institute (CTI) Guidelines: "Best Practices for Control of Legionella.". These guidelines will be reviewed to ensure all necessary controls and operational considerations are established when developing the VV2 Project cooing tower maintenance plan to ensure industry recommendations and guidelines for the best practice and management for control of bacteria are followed to minimize the risk from Legionella.

CEC Staff Cooling Water Management Program Guidelines for Wet and Hybrid Cooling Towers at Power Plants (CEC, 2004). The VV2 Project will develop and implement a Cooling Tower maintenance plan in accordance with the CEC Cooling Water Management Program Guidelines (May, 2004). The Program will be documented and submitted to the CEC for review and approval prior to commencement of cooling tower operation. The plan will contain a description of the biocide(s) selected and the reasons for their selection, a description of how the biocide is to be administered (continuous or intermittent feed, level of residual concentrations, etc.), detailed description of the microbial testing protocol that includes Legionella monitoring, response to microbial control following an upset, shutdown, startup, and maintenance procedures, and a description of documents relating to maintaining the microbiological control program.

6.11.1.3 Local

MDAQMD has several rules and regulations that implement Federal and State programs dealing with air toxic emissions, as described below:

Rule 402 – Nuisance. Under this local implementation of H&SC Section 41700 (see above), the MDAQMD does not permit the discharge from any source quantities of air contaminants or other material which cause injury, detriment, nuisance or annoyance to any considerable number of persons or to the public. The provisions of this rule will be met through existing control and operational limits on the project.

Regulation X – Emission Standards for Specific Air Contaminants. This MDAQMD regulation contains a notification that MDAQMD will enforce the Federal MACT standards and California ATCM requirements.

Rule 1000 - National Emission Standards for Hazardous Air Pollutants (NESHAP). This MDAQMD rule adopts the Federal NESHAP requirements promulgated under 40 CFR Part 61 by reference.

Rule 1320 – Toxic Air Contaminants New Source Review. This rule requires that a Health Risk Assessment (HRA) be performed if the TAC emissions will increase. A detailed HRA is necessary if TAC emissions exceed MDAQMD de minimus (minimum threshold) levels. Toxics Best Available Control Technology (T-BACT) must be installed if the HRA shows a cancer risk greater than one-in-a-million. At no time shall the cancer risk exceed ten-in-a-million. The VV2 Project will be equipped with T-BACT and will not cause a cancer risk greater than one-in-a-million.

CEQA and Federal Conformity Guidelines. Under CEQA, the MDAQMD is an expert commenting agency on air quality and related matters within its jurisdiction or impacting on its jurisdiction. The MDAQMD CEQA Guidelines set public health risk significance thresholds for project operations under CEQA and limits exposure of sensitive receptors to substantial pollutant concentrations, including those resulting in a cancer risk greater than or equal to 1 in a million and/or a Hazard Index (HI) (non-cancerous) greater than or equal to 0.1. Significance thresholds are not necessarily applicable to all projects.

6.11.1.4 Agency Contacts

The primary agency responsible for public health in the vicinity of the VV2 Project is the MDAQMD. While ARB and OEHHA provide oversight of the MDAQMD program and review of HRAs, they generally do not deal directly with applicants. Agencies and agency contacts relevant to public health issues analyzed in this section are provided in Table 6.11-2. Agency contacts for air quality are provided in Section 6.3 and contacts for hazardous materials handling are provided in Section 6.7.

Table 6.11-2
Administering Agency and Contact Information

Agency	Contact	Permits/Issue
MDAQMD 14306 Park Ave Victorville, CA 92392	Richard Wales (760) 245-1661, ext 6726	Implementation of AB2588, ATCMs, and review of health risk assessments

6.11.1.5 Required Permits and Permit Schedule

No permits are specifically required to address the requirements for public health. Instead, the permits required for air quality (see Section 6.3.1) will restrict the HAP/TAC emissions as well as the criteria pollutants. The project will be required to receive a Determination of Compliance (DOC) issued by the MDAQMD. The application for a DOC will be submitted concurrent with submission of the AFC. The DOC will include requirements related to the control of TAC/HAP emissions from this facility.

6.11.2 Affected Environment

The proposed VV2 Project will be located in the southwest portion of the Mojave Desert Air Basin (MDAB) along the western rim of the Mojave River north of the Southern California Logistics Airport. Emissions from operation of the facility will be locally regulated by the MDAQMD. The MDAB currently has relatively few industrial sources locally, but is impacted by the transport of emissions from southern and central California.

Terrain immediately located around the project is generally flat but then slopes down to the Mojave River to the east. Continuing east directly across the river and approximately 2 miles from the project site, the topography rises quickly to elevations of just over 4,000 feet (1,220 meters). This is the closest elevated terrain relative to the project site. In accordance with public health requirements stated in the CEC Power Plant Certification Rules (CEC, 2006), Figure 6.11-1 (located at the end of this Section) presents a map showing all terrain areas exceeding the elevation of the stack (145 feet) within a 10-mile radius of the proposed power plant. As has been allowed by the CEC Staff in other AFCs, this figure is presented at a map scale which more easily shows the elevated terrain within this area.

Population density in the area immediately around the VV2 Project power plant site is sparse and dispersed. Figure 6.11-2 presents a map showing the distribution of population (population density) within a 6-mile radius of the VV2 Project site, which is considered inclusive of the area of potential exposure to air toxic substances. To evaluate public health within this area, individual exposure points were identified where residences, workers, or a sensitive population may be located. Sensitive receptors are defined as groups of individuals that may be more susceptible to health risks due to TAC exposure. Schools, day care facilities, convalescent homes, and hospitals are of particular concern. Only one sensitive receptor, the Oro Grande Elementary School, is located with 3 miles of the power plant, and three others are located between 3- and 6-miles (see Figure 6.11-2). Other individual receptors include residences located to the north of the VV2 Project site, and to the east in the town of Oro Grande.

6.11.3 Environmental Impacts (Health Risk Assessment)

Potential environmental impacts associated with the project that are addressed in this section are limited to human exposure to chemical substances of concern emitted into the air and associated with operation of the Project. The methods used to assess potential human health risks are consistent with those prepared by The Air Toxics Hot Spots Program Guidance Manual for Preparation of Health Risk Assessments (OEHHA, 2003) (Guidance Manual) which describes algorithms, exposure methods, and cancer and noncancer health values needed to perform a health risk assessment (HRA) under AB2588. This Guidance Manual is generally considered the best available reference for conducting human health risk assessment in California. Additional references include the Health Assessment Document for Diesel Engine Exhaust (EPA, 2002).

A list of all toxic substances emitted by the project under normal operating conditions, which may cause an adverse public health impact as a result of acute, chronic, or sub-chronic exposure and to which members of the public may be exposed, are presented in Table 6.11-3. In accordance with CEC Guidelines, the list includes all pollutants emitted by the Project that are listed pursuant to H&SC Section 25249.8. The human health risks potentially associated with these substances were evaluated in an HRA. No air toxics are expected to be emitted from the solar field, oil/water separator or emergency fire-water pump fuel tank.

Table 6.11-3
Chemical Substances Potentially Emitted To The Air
From The VV2 Hybrid Power Plant

1,3-Butadiene	Polycyclic aromatic hydrocarbons (PAHs)
Acetaldehyde	Benzo(a)anthracene
Acrolein	Benzo(a)pyrene [B(a)P]
Ammonia	Benzo(b)fluoranthene
Arsenic	Benzo(k)fluoranthene
Barium	Chrysene
Benzene	Dibenz(a,h)anthracene
Beryllium	Indeno(1,2,3-cd)pyrene
Chloroform	Perchloroethylene (tetrachloroethene)
Copper	Phenol
Cyanide compounds	Propylene
Diesel Particulate Matter	Propylene Oxide
Diethyl phthalate	Selenium
p-Dichlorobenzene	Toluene
Ethylbenzene	Trichloroethylene
Formaldehyde	Vanadium
Hexane	Xylenes
Naphthalene	Zinc

6.11.3.1 Risk Definitions and Significance

Cancer Risk. Cancer risk is the probability or chance of contracting cancer over a human life span, which is 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, the lower the cancer risk (i.e., a linear, no-threshold model). In assessing public health impacts, cancer risk is the expected incremental increase in cancer cases based on an equally exposed population of individuals, typically expressed as cases per million individuals.

State and local regulations have developed cancer risk levels above which a project is considered to have a potential significant impact on public health. California's AB2588 Air Toxic Hot Spots Program and California's Proposition 65, for example, have developed a significance level for incremental cancer risk of 10 in one million as the public notification level for air toxic emissions from existing sources, and sources over 100 in one million must establish and implement risk reduction strategies. The MDAQMD has also established cancer risk significance thresholds for permitting new stationary sources. MDAQMD Rule 1320 allows for an incremental risk of between 1-in-a-million (1×10^{-6}) and 10-in-a-million (1×10^{-5}), provided toxics best available control technology (T-BACT) is employed. The VV2 combustion turbines will be fired exclusively on natural gas-fired and will also employ an oxidation catalyst, and therefore meets T-BACT requirements.

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 that there is a dose of the chemical of concern below which there would be no impact on human health. The air concentration corresponding to this dose is called the reference exposure level (REL). Non-cancer health risks are measured in terms of a hazard index (HI), which is the calculated exposure of each contaminant divided by its REL. Hazard indices for those pollutants affecting the same target organ are typically summed, with the resulting totals expressed as hazard indices for each organ system.

Similar to cancer risk, non-cancer impacts also have determined significance thresholds based on the estimated HI for the project. The MDAQMD Rule 1320 considers an incremental HI of less than 1.0 to be an insignificant health risk. For this VV2 Project health risk assessment, all hazard indices were summed regardless of target organ. This method leads to a conservative (upper bound) assessment. RELs used in the hazard index calculations were those published in the CAPCOA AB2588 Risk Assessment Guidelines (CAPCOA, 1993), as updated in September 2003 by the California OEHHA in the *Consolidated Table of OEHHA/ARB Approved Risk Assessment Health Values* (OEHHA, 2003).

Chronic toxicity is defined as adverse health effects from prolonged chemical exposure, caused by chemicals accumulating in the body. Because chemical accumulation to toxic levels typically occurs slowly, symptoms of chronic effects usually do not appear until long after exposure commences. The lowest no-effect chronic exposure level for a non-cancer air toxic is the chronic REL. Below this threshold, the body is capable of eliminating or detoxifying the chemical rapidly enough to prevent its accumulation. The chronic hazard index was calculated using the hazard indices calculated with model-predicted annual concentrations.

Acute toxicity is defined as adverse health effects caused by a short-term chemical exposure of no more than 24 hours. For most chemicals, the multi-pathway exposure required to produce acute effects is higher than levels required to cause chronic effects because the duration of exposure is shorter. Because acute toxicity is predominantly manifested in the upper respiratory system at threshold exposures, all hazard indices are typically summed to calculate the total acute hazard index. Model-predicted one-hour average concentrations are divided by acute RELs to obtain a hazard index for health effects caused by relatively high, short-term exposure to air toxics.

Diesel Particulate Risk. In 1990, the State of California administratively listed under Proposition 65 the particulates formed in the exhaust of diesel powered equipment as a chemical known to the State to cause cancer. For estimating risks due to diesel particulate matter exhaust, the risk assessment methodology used was consistent with that employed by the ARB in the document entitled Risk Reduction Plan to Reduce Particulate Matter Emissions from Diesel-Fueled Engines and Vehicles (ARB, 2000).

OEHHA has estimated that 130 to 2,400 excess cancer cases would be expected to occur in a population of 1 million people breathing an average concentration of diesel exhaust particles of 1 $\mu g/m^3$ over a 70-year lifetime. These excess cancer cases are beyond what would be expected to occur if there were no diesel exhaust particles in the air. An independent review by the ARB Scientific Review Panel (SRP) derived a best-estimate of the cancer unit risk factor as 300 excess cancer cases per million people breathing 1 $\mu g/m^3$ of diesel particles over a lifetime (OEHHA, 2000).

California Environmental Quality Act Significance Criteria for Health Impacts. California has not established State-wide significance thresholds for cancer and non-cancer health risk impacts under CEQA. However, most air districts in California have adopted local significance thresholds for health risks in their policy guidance to project proponents. The MDAQMD California Environmental Quality Act (CEQA) and Federal Conformity Guidelines, dated July 2006, define significance thresholds for cancer health impacts as equal to or greater than 1 (case) in a million at the Maximum Exposed Individual (MEI) for cancer risk. The MDAQMD guidelines also define significance thresholds for the non-cancer health effects as a project-wide MEI hazard index equal to or greater than 0.1. The MDAQMD Guidelines notes that these thresholds are not applicable to all projects. By comparison, the SCAQMD CEQA guidelines define significance thresholds for cancer health impacts as equal to or greater than 10 in a million for the MEI cancer risk and a MEI hazard index significance thresholds equal to or greater than 1.0 for non-cancer impacts.

6.11.3.2 Health Risk Assessment Approach

The HRA contains three quantitative determinations: emission estimation, air dispersion analysis, and health risk characterization. Source emissions of toxic air contaminants from the project were estimated based on EPA emission factors and quantification methods for facility operations. Exposure calculations were performed using air dispersion modeling analysis to predict ground-level air concentrations, by source. Results of the air modeling exposure predictions were then applied to the emission estimates and, along with the respective cancer health risk factors and chronic and acute noncancer reference exposure levels for each toxic substance, were used to perform a health risk characterization that quantified individual health risks associated with predicted levels of exposure.

The VV2 Project HRA was performed using the Hotspots Analysis Reporting Program (HARP) software package (Version 1.3, October 2006) developed by the ARB for conducting health risk assessments in California under the Air Toxics Hot Spots Program. The HARP modeling system is a comprehensive health risk assessment tool that contains air emissions, dispersion and risk analysis modules.

The VV2 Project HRA was a multi-pathway risk analysis. Air contaminant inhalation and plant ingestion are the dominant pathways for public exposure to chemical substances released by the VV2 power plant. In addition, because combustion by-products produced in the natural gas fired turbines and duct burners, as well as secondary emissions of metals in cooling tower drift potentially emitted by the VV2 Project cooling tower, are considered multi-pathway air toxics, soil ingestion, dermal absorption, and mother's milk ingestion were also assessed. The inhalation pathway is expected to represent the majority of the predicted risk.

Health Risk Factors. Chemical substance were evaluated in this analysis using health values that have been approved by the OEHHA and the ARB for use in facility health risk assessments conducted for the AB2588 Air Toxics Hot Spots Program (OEHHA, 2003). The chemical substances of concern that are addressed in this HRA are listed in Table 6.11-4, along with their respective published OEHHA health effect values. The table lists the OEHHA adopted inhalation and oral cancer slope factors, noncancer acute Reference Exposure Levels (RELs), and inhalation and oral noncancer chronic RELs. The cancer potency factors and reference exposure levels (RELs) used are consistent with the current values as determined by OEHHA.

Table 6.11-4
Risk Assessment Health Values For Substances of Potential Concern

Compound	Cancer Risk		Non-cancer Effects	
	Inhalation Cancer Potency $(mg/kg\text{-}day)^{-1}$	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	1.0E-02	--	9.0E+00	--
Acrolein	--	--	6.0E-02	1.9E-01
Ammonia	--	--	2.0E+02	3.2E+03
Antimony	--	--	2.0E-01	--
Arsenic	1.2E+01	1.5 E+00	3.0E-02	1.9E-01
Benzene	1.0E-01		6.0E+01	1.3E+03
Beryllium	8.4E+00		7.0E-03	
1,3-Butadiene	6.0E-01		2.0E+01	--
Cadmium*	1.5E+01		2.0E-02	--
Chlorobenzene	--	--	1.0E+03	--
Chloroform	5.3E-06	1.9E-02	3.0E+02	1.5E+02
Copper	--	--	2.4E+00	1.0E+02
Ethylbenzene	--	--	2.0E+03	--
Diesel Exhaust PM	1.1E+00	--	5.0E+00	--
p-Dichlorobenzene	1.1E-05	4.0E-02	8.0E+02	--
Formaldehyde	2.1E-02		3.0E+00	9.4E+01
Hexane	--	--	7.0E+03	--
Hydrochloric acid	--	--	9.0E+00	2.1E+03
Lead	4.2E-02	8.5E-03	--	--
Manganese	--	--	9.0E-01	--
Mercury	--	--	9.0E-02	1.8E+00
Naphthalene	1.2E-01	3.4E-05	9.0E+00	--
Nickel	9.1E-01		5.0E-02	6.0E+00
PAHs	3.9E+00	1.2E+01	--	--
PAHs				

Table 6.11-4
Risk Assessment Health Values For Substances of Potential Concern

Compound	Cancer Risk		Non-cancer Effects	
	Inhalation Cancer Potency (mg/kg-day)$^{-1}$	Oral Slope Factor (μg/m^3)-1	Chronic Inhalation Reference Exposure Level (μg/m^3)	Acute Inhalation Reference Exposure Level (μg/m^3)
Benzo(a)anthracene	3.9E-01	1.2E+00		
Benzo(a)pyrene [B(a)P]	3.9E+00	1.2E+01		
Benzo(b)fluoranthene	3.9E-01	1.2E+00		
Benzo(k)fluoranthene	3.9E-01	1.2E+00		
Chrysene	3.9E-02	1.2E-01		
Dibenz(a,h)anthracene	4.1E+00	4.1E+00		
Indeno(1,2,3-cd) pyrene	3.9E-01	1.2E+00	3.5E+01	2.0E+04
Perchloroethylene	5.9E-06	2.1E-02	3.5E+01	2.0E+04
Phenol	--	--	2.0E+02	5.8E+03
Propylene	--	--	3.0E+03	--
Propylene oxide	1.3E-02		3.0E+01	3.1E+0
Selenium	--	--	2.0E+01	--
Toluene	--	--	3.0E+02	3.7E+04
Trichloroethylene	2.0E-06	7.0E-03	6.0E+0	--
Xylene	--	--	7.0E+02	2.2E+04
Zinc	--	--	3.5E+01	--
Source: OEHHA, 2003 and as amended for Napthalene, 2005.				

<u>Toxic Air Contaminant Emissions</u>. Emissions of chemical substances of potential concern that may be associated with the VV2 Project include combined-cycle combustion turbines, cooling tower, auxiliary boiler, heat transfer fluid (HTF) heater, emergency generator, and emergency diesel fire-water pump. No appreciable quantity of air toxics are expected to be emitted from operation of the solar field array, oil/water separator, or emergency fire-water pump fuel tank. Detailed calculations in support of air toxic emissions discussed below are provided in Appendix K.1.

The VV2 Project will not be a major source of Federal HAP emissions. The emissions inventory shows total Federal HAP emissions of 7.8 tons per year (tpy). The primary contributor to emissions is toluene with a HAP emission of 2.6 tpy, or 33% of total HAP emissions for the VV2 Project. Regulatory major source thresholds are 10 tpy for any single HAP and 25 tpy for total HAP emissions. The VV2 Project is therefore 74% and 69% below major source thresholds for single and total HAP emissions, respectively.

Combustion Turbines. All combustion-related TAC emissions associated with the combustion of natural gas in the turbine generators were calculated using emission factors from AP-42, Section 3.1, Stationary Gas Turbines (EPA, 2000). For polycyclic aromatic hydrocarbon (PAH) emissions, a speciation profile derived from the California Air Toxics Emission Factor (CATEF) database for stationary gas-fired turbines was applied to the AP-42 composite (unspeciated) emission factor for PAH emissions. This approach is consistent with OEHHA methodology that recommends speciation of PAH emissions when conducting a refined health risk assessment. Although the oxidation catalyst will reduce the emissions of most HAPs, the exact control efficiency is unknown. EPA found that formaldehyde emissions will be reduced by a 90% control factor due to installation a catalytic oxidation system, so this reduction was applied to the uncontrolled AP-42 emission factor for this individual HAP (EPA, 2000). Ammonia slip from the SCR control system was calculated based on an emissions limit of 5 ppmvd (at 15 percent O_2) per turbine. Emission factors and TAC emissions for both turbines and the duct burners are provided in Table 6.11-5.

For the purposes of determining the potential maximum ambient concentrations of chemical substances emitted by the combustion turbines, the turbines were assumed to operate at base load conditions with a higher heating value (HHV) and an ambient temperature of 65°F. For annual emissions, the annual average natural gas consumption rate of 1.7 MMscf per hour per turbine plus 0.54 MMscf per hour per duct burner (2.25 MMscf per hour combined) was used, assuming that the continuous operation of both gas turbine/burner units. Duct burner fuel usage was incorporated into the emission estimates assuming 8,760 hours of turbine operations and 5,000 hours of duct burner operations per year at the maximum firing rate.

Cooling Towers. Concentrations of toxics present in the cooling tower make-up water were obtained from an effluent water quality analyses from the Victor Valley Water Reclamation Authority (VVWRA), which will provide reclaimed water for the VV2 Project. Emission rates were calculated from the effluent water analysis, re-circulation rate, drift control efficiency, and maximum expected total dissolved solids (TDS) concentration. Emission rates for the cooling tower are summarized in Table 6.11-6. Hourly and annual emissions rates for sources were converted to a modeled emission rate in pounds per year (lb/year) for use in evaluating long-term risks, and pounds per hour (lb/hour) for use in short-term health impact modeling.

The emission estimates assumed the cooling tower was operated at the maximum recirculation rate for 8,760 hours per year. Cooling tower emissions were estimated based on a mass balance technique using the water supply quality, cooling tower maximum cycles of concentration(s), water recirculation rate (gallons per minute, gpm), and mist eliminator drift rate (0.0005%). Potential emissions from the cooling tower were identified based on an effluent water quality analysis of reclaimed water from the VVWRA for the years 2004-2005, which is proposed for use in the VV2 Project cooling tower.

Table 6.11-5
Toxic Air Contaminant Emissions for Combined Natural Gas-Fired Turbines/Duct Burners With Selective Catalytic Reduction And Oxidation Catalyst

Toxic Air Contaminant	AP-42 Emission Factor [1] (lb/MMscf)	Maximum Hourly Emissions (lb/hr)		Annual Emissions (lb/yr)	
		Turbine/ Duct Burner (Each)	Turbine/ Duct Burner (Total)	Turbine/ Duct Burner (Each)	Turbine/ Duct Burner (Total)
Ammonia [2]	5.00E+00	1.12E+01	2.25E+01	9.84E+04	1.97E+05
Acetaldehyde	4.08E-02	9.17E-02	1.83E-01	8.03E+02	1.61E+03
Acrolein	6.53E-03	1.47E-02	2.93E-02	1.28E+02	2.57E+02
Benzene	1.22E-02	2.75E-02	5.50E-02	2.41E+02	4.82E+02
1,3-Butadiene	4.39E-04	9.85E-04	1.97E-03	8.63E+00	1.73E+01
Ethylbenzene	3.26E-02	7.33E-02	1.47E-01	6.42E+02	1.28E+03
Formaldehyde	7.24E-01	1.63E-01	3.25E-01	1.43E+03	2.85E+03
Naphthalene	1.33E-03	2.98E-03	5.96E-03	2.61E+01	5.22E+01
PAH [3]	2.24E-03				
Benzo(a)anthracene	7.75E-05	1.74E-04	3.48E-04	1.52E+00	3.05E+00

Table 6.11-5
Toxic Air Contaminant Emissions for Combined Natural Gas-Fired Turbines/Duct Burners With Selective Catalytic Reduction And Oxidation Catalyst

Toxic Air Contaminant	AP-42 Emission Factor [1] (lb/MMscf)	Maximum Hourly Emissions (lb/hr)		Annual Emissions (lb/yr)	
		Turbine/ Duct Burner (Each)	Turbine/ Duct Burner (Total)	Turbine/ Duct Burner (Each)	Turbine/ Duct Burner (Total)
Benzo(a)pyrene	4.76E-05	1.07E-04	2.14E-04	9.38E-01	1.88E+00
Benzo(b)fluoranthene	3.87E-05	8.70E-05	1.74E-04	7.62E-01	1.52E+00
Benzo(k)fluoranthene	3.77E-05	8.47E-05	1.69E-04	7.42E-01	1.48E+00
Chrysene	8.64E-05	1.94E-04	3.88E-04	1.70E+00	3.40E+00
Dibenz(a,h)anthracene	8.06E-05	1.81E-04	3.62E-04	1.59E+00	3.17E+00
Indeno(1,2,3-cd) pyrene	8.06E-05	1.81E-04	3.62E-04	1.59E+00	3.17E+00
Benzo(a)anthracene	7.75E-05	1.74E-04	3.48E-04	1.52E+00	3.05E+00
Propylene Oxide	2.96E-02	6.65E-02	1.33E-01	5.82E+02	1.16E+03
Toluene	1.33E-01	2.98E-01	5.96E-01	2.61E+03	5.22E+03
Xylenes	6.53E-02	1.47E-01	2.93E-01	1.28E+03	2.57E+03

[1] AP-42 emission factors, Table 3.1-3 (rev 4/00) converted to pounds per million standard cubic foot (lb/MMscf) of natural gas using a heat value of 1,020 Btu/scf.

[2] Based on maximum ammonia slip (5 ppmvd) from the SCR control device. Note that ammonia is not a HAP and is not included in the HAP Total

[3] Unspeciated PAH's (polycyclic aromatic hydrocarbons) based on AP-42 composite emission factor. PAH speciation profile derived from California Air Toxics Emission Factors (CATEF) database for natural gas-fired turbine engines, applied to composite (unspeciated) PAH emission in AP-42. Shown are PAH species for which there is a unit risk factor in OEHHA Consolidated Risk Table (OEHHA, 2003)

Table 6.11-6
Toxic Air Contaminant Emissions For Cooling Towers

Toxic Air Contaminant	VVWRA Emission Factor [1] (µg/L)	Maximum Hourly Emissions (lb/hr)		Annual Emissions (lb/yr)	
		Cooling Tower (Each)	Cooling Tower (Total)	Cooling Tower (Each)	Cooling Tower (Total)
Arsenic	6.98E-03	9.332E-08	9.33E-07	8.18E-04	8.175E-03
Barium	7.98E-02	1.068E-06	1.07E-05	9.35E-03	9.352E-02
Beryllium	8.03E-03	1.075E-07	1.07E-06	9.41E-04	9.415E-03
Copper	2.45E-02	3.281E-07	3.28E-06	2.87E-03	2.874E-02
Cyanide compounds	4.00E-05	5.351E-10	5.35E-09	4.69E-06	4.688E-05
Selenium	1.16E-02	1.558E-07	1.56E-06	1.36E-03	1.365E-02
Zinc	8.54E-03	1.142E-07	1.14E-06	1.00E-03	1.001E-02
Vanadium (fume or dust)	2.21E-02	2.962E-07	2.96E-06	2.60E-03	2.595E-02
p-Dichlorobenzene	8.34E-04	1.116E-08	1.12E-07	9.78E-05	9.780E-04
Chloroform	2.04E-03	2.723E-08	2.72E-07	2.39E-04	2.386E-03
Perchloroethylene	1.10E-05	1.472E-10	1.47E-09	1.29E-06	1.289E-05
Trichloroethylene	5.00E-07	6.689E-12	6.69E-11	5.86E-08	5.860E-07
Toluene	7.78E-04	1.041E-08	1.04E-07	9.12E-05	9.118E-04
Xylenes	7.60E-04	1.017E-08	1.02E-07	8.91E-05	8.907E-04
Diethyl phthalate	2.60E-05	3.478E-10	3.48E-09	3.05E-06	3.047E-05
Phenol	4. 00E-05	5.351E-10	5.35E-09	4.69E-06	4.688E-05

[1] Based on effluent water quality analysis of reclaimed water from the VVWRA for the years 2004-2005 and circulation rate of gallons per minute for 8,760 hours, 5 cycles of concentration, and 99.95% drift elimination.

Emergency Generator and Fire-Water Pump. Other VV2 combustion sources include an emergency power generator and an emergency fire-water pump. Emissions for these units were based on operating conditions that represent the maximum emissions profile (being permitted) for the VV2 Project. The emissions from the emergency generator and the emergency fire-water pump were quantified for routine testing and maintenance operation only. The VV2 Project will be required by California law (CARB, 2004) to equip the emergency power generator and fire-water pump with EPA Tier 2 engines (or better) that meet applicable standards for particulate control. Toxic air contaminant emissions were characterized as aggregate particulate emissions from diesel-fired engines (OEHHA, 2003). Total annual emissions of diesel particulate matter from the emergency generator and fire-water pump were determined to be 46.1 and 3.13 pounds, respectively.

Annual estimates were based on an operating limit of 300 hours per year. Testing of the emergency generator and fire-water pump engine will be limited to no more than 50 hours per year or as required by fire regulations to comply with California Tier 2 emission standards for new compression ignited engines. The VV2 Project HRA was based on 300 hours per year of operation, and therefore provides the analysis a margin of safety to allow for emergency engine use.

Auxiliary Boiler and HTF Heater. The VV2 Project will include an auxiliary boiler unit that will be used to provide sealing steam earlier in the start process, and a heater used to bump up the temperature of the heat transfer fluid (HTF) received from the solar field to approximately 740° F as it circulates through the receiver and returns to a series of heat exchangers in the power block where the fluid is used to generate high-pressure steam. Both the HTF heater and auxiliary boiler will fire exclusively on natural gas. Emissions for these units were based on operating conditions that represent the maximum emissions profile (being permitted) for the VV2 Project. The emissions from the boiler were based on an assumed maximum of 500 hours per year of operation, and 1,000 hour per year for operation of the HTF heater. Table 6.11-7 summarizes TACs potentially emitted from the natural gas-fired auxiliary boiler and HTF heater. For health risk modeling of PAH emissions, benzo(a)pyrene or B(a)P was used as the surrogate carcinogen for all PAH emissions, in accordance with OEHHA guidance (OEHHA, 2003). Since the surrogate for total PAH is the most or nearly-the-most potent carcinogens in the class, use of this cancer potency factor with total emissions will overestimate the risk.

Dispersion Modeling Methodology. Concentrations of toxic substances in ambient air resulting from potential TAC emissions were estimated using the MDAQMD-approved HARP software package. The methods and requirements used to conduct the air dispersion modeling analysis in HARP for estimating concentrations of toxic air pollutants are presented below.

Air Dispersion Model. The dispersion analysis performed in HARP uses the ISCST3 dispersion model developed by EPA, which estimates both short-term and long-term average ambient concentrations at receptor locations to produce exposure estimates. HARP incorporates ISCST3 version 99155. ISCST3 accounts for site-specific terrain, meteorological conditions, and emissions parameters (such as stack exit velocities and temperatures) in order to estimate ambient concentrations. Although EPA recently adopted as a guideline air quality model AERMOD, the air dispersion model used in the Section 6.3 air quality modeling analysis, the California ARB has not integrated AERMOD into HARP, the preferred tool for conducting multi-pathway health risk assessment in California. In addition, ISCST3 has been found in general to produce the same or lower long-term (annual) average air concentrations, and so is health protective in evaluating public health risks. Health risks potentially associated with the estimated concentrations of chemical substances in ambient air were characterized in terms of excess lifetime cancer risks (for substances listed by OEHHA as cancer causing), or comparison with reference exposure levels for non-cancer health effects (for substances listed by OEHHA with non-cancer causing effects).

Meteorological Data. Air dispersion analysis was conducted using three consecutive years (2002-2004) of sequential hourly meteorological data. The data parameters used to develop the ISCST3 air dispersion modeling files were based on largely on the same meteorological data obtained for processing in AERMOD, the air dispersion model used for evaluating criteria pollutant air quality impact analysis (See Section 6.3). These included wind speed, wind direction and temperature data from the MDAQMD Victorville Park Avenue meteorological tower, National Weather Service (NWS) cloud data from General Williams J. Fox Field in Lancaster, CA, and concurrent upper air data from Mercury Desert Rock Airport in Mercury, NV. Risk analysis of receptors on a 100-meter fine grid was modeled using meteorological data for each year. The model results for each year were compared and determined that impacts had up to 6.8% variability based on the year showing highest air concentrations and the year showing lowest concentration. Meteorological data for the year 2004 was determined through modeling analysis to produce worst-case (highest) annual air concentrations from the proposed VV2 Project.

Table 6.11-7
Toxic Air Contaminant Emissions For Auxiliary Boiler and Natural Gas-Fired Heat Transfer Fluid (HTF) Heater

Toxic Air Contaminant	Emission Factor [1] (lb/MMscf)	Maximum Hourly Emissions (lb/hr)		Annual Emissions (lb/yr)	
		Auxiliary Boiler	HTF Heater	Auxiliary Boiler	HTF Heater
Benzene	0.0058	1.99E-04	2.27E-04	9.95E-02	2.27E-01
Formaldehyde	0.0123	4.22E-04	4.82E-04	2.11E-01	4.82E-01
PAH's (excluding naphthalene) [2]	0.0004	1.37E-05	1.57E-05	6.86E-03	1.57E-02
Naphthalene	0.0003	1.03E-05	1.18E-05	5.15E-03	1.18E-02
Acetaldehyde	0.0031	1.06E-04	1.22E-04	5.32E-02	1.22E-01
Acrolein	0.0027	9.26E-05	1.06E-04	4.63E-02	1.06E-01
Propylene	0.53	1.82E-02	2.08E-02	9.09E+00	2.08E-01
Toluene	0.0265	9.09E-04	1.04E-03	4.55E-01	1.04E-00
Xylenes	0.0197	6.76E-04	7.73E-04	3.38E-01	7.73E-01
Ethyl benzene	0.0069	2.37E-04	2.71E-04	1.18E-01	2.71E-01
Hexane	0.0046	1.58E-04	1.80E-04	7.89E-02	1.80E-01

[1] Ventura County Air Pollution Control District, AB2588 Combustion Emission Factors, 2001.

[2] Unspeciated PAH (polycyclic aromatic hydrocarbon) emissions based on composite emission factor. Benzo(a)pyrene or B(a)P was modeled as the surrogate carcinogen for all PAH emissions, as indicated by the CAS number shown. Since the (B(a)P) surrogate for total PAH emissions is the most or nearly-the-most potent carcinogens in the class, use of this cancer potency factor with total emissions will overestimate the risk.

Modeled Source Release Parameters. Sources of air toxic emissions from operation of the VV2 Project were modeled as point sources with release parameters consistent with those used for modeling air quality impact analysis of criteria pollutants. A detailed discussion of modeled source release parameters including stack height and stack diameter, exhaust gas temperature, exit velocity, and a calculated volumetric flowrate for each equipment type is provided in Section 6.3, Air Quality.

Building Downwash. HARP incorporates the Building Profile Input Program (BPIP) version dated 04112. Building downwash was modeled for the risk assessment using building dimensions consistent with those used for modeling air quality impact analysis of criteria pollutants. BPIP was run to determine dominant structures for building downwash calculations run in ISCST3 for point sources. Direction specific building heights and widths of the dominant downwash structure(s) were included in the ISCST3 model data input file directly from BPIP results. Results of the BPIP analysis of building dimensions are included in HARP risk assessment modeling files in Appendix K.3.

Terrain. Terrain elevations were included in the dispersion modeling analysis to evaluate receptors above stack height and above final plume height for point source releases. ISCST3 incorporates complex terrain algorithms that can be enabled to predict ground-level concentrations at receptors above source plume heights (effective stack-height) or between stack and plume heights. Digital Elevation Model (DEM) files for the project area were opened in the HARP software package and elevation calculated for all sources, buildings, and receptors. Terrain below source elevation, such as the Mojave River Valley, is treated as flat terrain by the dispersion model.

Receptors. A network of receptors was developed to identify the locations of the maximum estimated off-site impact or point of maximum impact (PMI), the maximum exposed individual at an existing residential receptor (MEIR), and the maximum exposed individual at an existing occupational worker receptor (MEIW). In addition, sensitive receptors, locations where a sensitive population segment such as children, elderly, or the infirmed may be exposed, were also identified and modeled within three miles of the project site.

Grid receptors were used to determine the location of maximum health risk impacts at the PMI for all health risk impacts. An initial course 500-meter spaced receptor grid extending 10 kilometers from the VV2 Project site was modeled. This ensured that the entire domain of elevated terrain would be modeled to determine maximum impacts. Once a maximum impact area was determined, a fine 100-meter spaced receptor grid was placed around the maximum impact area and VV2 Project to more accurately refine maximum health risk impact determinations at the PMI.

Individual receptors within a 3-mile radius were included in the HARP modeling analysis to assess actual locations of potential individual exposures. Individual receptor location included residences, work places, and sensitive receptors and were identified based on orthographic aerial photographs, Yahoo Yellow Pages, and community elements contained in geographic information software packages. As described in Appendix K.2, twelve residential receptors were identified and modeled to determine the MEIR and nine work place receptors were identified and modeled to determine the MEIW.

A sensitive receptor is considered to be a location where infants and children, the elderly, and the chronically ill, and any other member of the general population who is more susceptible to the effects of the exposure than the population at large are found for extended periods. One school was identified as a sensitive receptor located within 3 miles of the project site. The school receptor was evaluated for health risk impacts based on both student and occupational exposure scenarios.

A table listing the residential, worker and sensitive receptors used for this analysis and a figure showing their locations are provided in Appendix K.2.

Population centriods were reviewed to determine if any were located within the risk assessment modeling domain. No matching census blocks were found within a 10-kilometer range of the VV2 Project site origin. As a result, the VV2 Project public HRA evaluated only individual health risk impacts and did not evaluate cancer burden.

Risk Characterization. The VV2 Project HRA evaluated cancer risk and non-cancer health hazards. The evaluation of potential non-cancer health effects from inhalation exposure to short-term and long-term airborne TAC concentrations was performed by comparing modeled concentrations at the MEIR and MEIW with RELs. An REL is a concentration in ambient air at or below which no adverse health effects are anticipated. Potential non-cancer effects were evaluated by calculating a ratio of the modeled concentration in air and the REL. This ratio is the hazard quotient. In accordance with the HARP model requirements and OEHHA AB2588 risk assessment guidelines, non-cancer health hazard assessment was conducted using the maximum 1-hour and annual toxic emission rates, along with the OEHHA health risk values, to determine predicted health risks due to potential air toxics exposure.

Carcinogenic risks (defined as a 70-year, residential exposure) and potential chronic and acute non-cancer health effects were assessed using the dispersion modeling described above and numerical values of toxicity provided by OEHHA. Cancer risk evaluated potential health impacts from inhalation, skin contact, and oral pathways as required by OEHHA guidelines. Additionally, this assessment included highly-conservative assumptions such as a 70-year exposure duration for residential receptors and a 40 year exposure duration for commercial/industrial receptors. An additional conservative assumption was the use of the OEHHA-defined 95th percentile breathing rate of 393 liters of air/kg-day.

The following HARP modeling options were used for the risk analysis to estimate cancer and non-cancer impacts at the PMI, the MEIR, and the MEIW.

- 70-year Resident Cancer Risk – Derived (Adjusted) Method
- 9-year (child resident) Cancer Risk – Derived (OEHHA) Method
- Worker Cancer Risk – Point Estimate
- Chronic Hazard Index – Derived (OEHHA) Method
- Acute Hazard Index – Acute Simple HI (Concurrent max)

The environmental pathways that were analyzed consist of all pathways recommended for a refined health risk assessment. Exposure pathways that were enabled include homegrown produce (default 15%), dermal absorption, soil ingestion, and mother's milk. For the cancer and chronic hazard index impacts at the MEIW, the HARP modeling option "modeled GLC and default exposure assumptions" was used.

<u>Exposure Assumptions</u>. The chief exposure assumption is one of continuous exposure to the TAC concentrations produced by continuous emissions at the maximum emission rates over a 70-year period at each receptor location. The actual risks are not expected to be any higher than the predicted risks and are likely to be substantially lower. The cancer risk for an inhaled air toxic is estimated by multiplying the exposure concentration by the breathing rate (L/kg-day) times the inhalation cancer potency factor $(mg/kg\text{-}day)^{-1}$. The averaging time for the cancer risk estimate is usually 70 years, which is used to represent a lifetime exposure. A discussion of uncertainty factors is presented in Section 6.11.3.3 below.

6.11.3.3 Risk Assessment Analytical Uncertainties

Sources of uncertainty in the assessment of risks to public health include emissions estimates, dispersion modeling, exposure characteristics, and extrapolation of toxicity data in animals to humans. To address this uncertainty, highly conservative assumptions were used in this risk assessment, as discussed below. In aggregate, these assumptions overestimate the actual risk estimates such that risks are unlikely to be higher, but could be considerable lower or non-existent.

Emissions. There are inherent uncertainties in the emission factor estimates used for gas turbines and duct burners obtained from EPA. However, for both the 1-hour and annual averaging periods, it was assumed that both gas turbines and duct burners operate at the maximum heat input rate. The annual averaging period emission estimates are based on a maximum operation of 8,760 hours per year. Under actual operations, the hours of operation and typical heat input rates will be lower. There will also be some reduction of the emissions due to the use of an oxidation catalyst. Therefore, the emission estimates have uncertainties, but are used in a manner that tends to over-estimate exposures resulting from those emissions.

Air Dispersion Modeling. In general, EPA-dispersion models such as ISCST3 (used in the HRA) are designed to over-predict concentrations rather than under-predict. For example, the model algorithms assume chemical emissions are not transformed in the atmosphere into other chemical compounds. For certain pollutants, conversion may occur quickly enough to reduce concentrations from the conservative model predictions.

Exposure Assessment. The most important uncertainties related to exposure include the definitions of exposed populations and their exposure characteristics. The choice of a "residential" maximally exposed individual is very conservative in the sense that no real person is likely to spend 24 hours a day, 365 days a year over a 70-year period at exactly the point of highest toxicity-weighted annual average air concentration.

The HARP model incorporates health protective assumptions for a daily breathing rate. The Derived (Adjusted) method is recommended for risk management decisions at residential receptors when the inhalation pathway is determined to be a dominant exposure route in a multipathway assessment such as for the VV2 Project. The method assumes exposure based on an 80th percentile breathing rate value (302 L/kg-day) while the remaining exposure (non-inhalation) pathways use average point estimates.

Toxicity Assessment. Another area of uncertainty is in the use of toxicity data in risk estimation. Estimates of toxicity for the health risk assessment obtained from OEHHA are conservative compilations of toxicity information. Toxicity estimates are derived either from observations in humans or from projections derived from experiments with laboratory animals. When toxicity estimates are derived from animal data, they usually involve extra safety factors to account for possibly greater sensitivity in humans, and the less-than-human-lifetime observations in animals. Overall, the toxicity assumptions and criteria used in the proposed project risk assessment are biased toward over-estimating risk. The amount of the bias is unknown, but could be substantial.

Diesel Particulate Unit Risk Factor. The diesel exhaust inhalation potency factor is a best-estimate value established by the ARB SRP based on review of more than 30 diesel exposure studies. The established potency risk factor is a 95th percentile upper confidence limit value, meaning that there is only a 5 percent chance that the value is underestimated (too low). In addition, the most significant of the studies reviewed by the SRP are occupational studies of exposure of diesel exhaust by railroad workers. The occupational results were then extrapolated to the general population, which includes more sensitive individuals than healthy railroad workers.

6.11.3.4 Risk Assessment Results

Point of Maximum Impact. Results of the risk assessment modeling using 500-meter course grid receptor spacing showed that maximum potential impacts for all health risks (i.e., cancer and non-cancer) occur in elevated terrain above Oro Grande, east of the VV2 Project facility across the Mojave River Valley. The potential maximum 70-year incremental lifetime cancer risk at the PMI was estimated using the 100-meter fine receptor grid covering the region of the maximum impact identified in the course grid. Although the predominant annual wind direction is due north, maximum annual and 1-hour impacts is determined to be in elevated terrain as a result of the stack height and plume rise associated with the release parameters of the gas turbine/duct burner exhaust system.

Cancer risk at the PMI was determined to be 0.73-in-one-million at a grid receptor located approximately 4.5 kilometers (3-miles) due east of the VV2 project in elevated terrain. Table 6.11-8 and 6.11-9 present the 70-year cancer risk at the PMI by source and pathway and by chemical and pathway, respectively. As shown in Table 6.11-8, TAC emissions from combustion turbines are the primary contributor to cancer risk impacts, accounting for approximately 94% of total cancer risk at the PMI. Risk analysis by chemical supports this conclusion, showing in Table 6.11-9 that approximately 89% of the cancer risk at the PMI is due to PAH emissions, which is only emitted from the combustion turbines. All other cancer risk exposures in HARP (i.e. 30-year, 9-year, 9-year child, and 40-year worker) would be lower, and would have a similar breakdown of contribution by source and toxic air contaminant.

Non-cancer maximum chronic health hazard impact at the PMI was determined to be 0.015. The PMI for chronic health impacts was identified at the same receptor as the

PMI for cancer risk. Both cancer risk and non-cancer chronic health impacts are based on annual air concentrations.

Table 6.11-8
Summary of Cancer Risk At The Point of Maximum Impact By Source and Pathway

Emission Source	Inhalation	Dermal	Soil Ingestion	Home-grown Vegetables	Oral Exposure	Total
Combustion Turbines	5.10E-08	1.31E-07	1.96E-08	4.79E-07	6.30E-07	6.81E-07
Cooling Towers	9.02E-11	3.17E-10	1.54E-10	2.91E-10	7.61E-10	8.52E-10
Auxiliary Boiler	2.68E-11	5.42E-10	8.12E-11	1.98E-09	2.61E-09	2.63E-09
Fire-Water Pump Engine	2.26E-09	-	-	-	-	2.26E-09
Emergency Generator	3.49E-08	-	-	-	-	3.49E-08
HTF Heater	6.24E-11	1.26E-09	1.89E-10	4.61E-09	6.05E-09	6.12E-09
Total	8.83E-08	1.33E-07	2.00E-08	4.86E-07	6.39E-07	7.27E-07

Non-cancer maximum acute health hazard impact at the PMI was determined to be 0.11. The acute non-cancer PMI is located in elevated terrain approximately 1 kilometer southwest of the PMI for cancer risk and non-cancer chronic health impacts. Non-cancer acute health impacts were based on the maximum short-term (e.g., 1-hour) air concentration.

All estimated health risks at their respective PMI were below the MDAQMD significance criterion of 1-in-one-million for cancer risk and 1.0 for non-cancer chronic and acute health impacts. Based on results of the risk assessment, the VV2 Project poses an insignificant incremental cancer risk and non-cancer health risk impact, according to established regulatory guidelines.

Table 6.11-9
Summary of Cancer Risk At The Point of Maximum Impact
By Air Toxic Contaminant and Pathway

Emission Source	Inhalation	Dermal	Soil Ingestion	Homegrown Vegetables	Oral Exposure	Total
Formaldehyde	1.72E-08	-	-	-	-	1.72E-08
PAH's (Composite)	6.25E-09	1.33E-07	1.99E-08	4.86E-07	6.38E-07	6.45E-07
Benzene	1.39E-08	-	-	-	-	1.39E-08
Acetaldehyde	4.62E-09	-	-	-	-	4.62E-09
Propylene oxide	4.35E-09	-	-	-	-	4.35E-09
Naphthalene	1.80E-09	-	-	-	-	1.80E-09
1,3-Butadiene	2.98E-09	-	-	-	-	2.98E-09
Chloroform	2.44E-14	-	-	-	-	2.44E-14
Trichloroethylene	2.21E-18	-	-	-	-	2.21E-18
p-Dichlorobenzene	2.11E-14	-	-	-	-	2.11E-14
Perchloroethylene	1.46E-16	-	-	-	-	1.46E-16
Arsenic	4.75E-11	3.17E-10	1.54E-10	2.91E-10	7.61E-10	8.09E-10
Beryllium	4.26E-11	-	-	-	-	4.26E-11
Diesel particulate matter	3.71E-08	-	-	-	-	3.71E-08
Total	8.83E-08	1.33E-07	2.00E-08	4.86E-07	6.39E-07	7.27E-07

Maximum Exposed Individual Resident, Worker, and Sensitive Receptors. The MEIR and MEIW were identified based on locations of residential and occupational receptors within a 3-mile radius of the proposed project site (Appendix K.2). A summary of cancer risk and non-cancer health impacts values at maximum exposed individual resident, worker, and sensitive receptors are shown in Table 6.11-10. Cancer and non-cancer risk impacts at the PMI are also shown in Table 6.11-10 for completeness.

Table 6.11-10
Summary of Maximum Impacts

Receptor Type	Maximum Cancer Risk (per million)	Maximum Acute Hazard Index	Maximum Chronic Hazard Index
PMI	0.73 [1]	0.094 [2]	0.0065 [1]
MEIR	0.07	0.025	0.0004
MEIW	0.008	0.016	0.0005
Sensitive	0.005 [3] 0.009 [4]	0.010	0.0004
Significance Criteria	1.0	0.1	0.1

[1] 100-meter fine grid, receptor number 1002.
[2] 100-meter fine grid, receptor number 1366.
[3] 40-year occupational receptor exposure scenario
[4] 9-year child resident receptor exposure scenario

Twelve residential locations were identified for evaluating maximum individual health risk impacts at the MEIR. Cancer risk at the MEIR was determined to be 0.07 in one million. Non-cancer chronic health impact at the MEIR was determined to be 0.0004. Non-cancer acute health impacts at the MEIR were determined to be 0.025. The MEIR for cancer risk and chronic health impacts occurred at the same residential receptor, located approximately 2.6 kilometers northwest of project. The MEIR for non-cancer acute heath impacts acute is located east of the Project in the vicinity of Oro Grande along Route 66.

Nine work place locations were identified for evaluating maximum individual health risk impacts at the MEIW. The occupational receptors occurred east of the Project site in the community of Oro Grande, south in the area of the SCLA, and at the VVWRA treatment plant. Cancer risk at the MEIW, based on a worker exposure, was determined to be 0.008 in one million. Non-cancer chronic health impact at the MEIW was determined to be 0.0005. Non-cancer acute health impacts at the MEIW were determined to be 0.016. The MEIW for cancer risk and acute health impacts occurred at the same occupational receptor, the VVWRA plant, located approximately 1 kilometer southeast of the project near the Mojave River. The MEIW for non-cancer chronic heath impacts acute occurred east of the project in the Oro Grande vicinity.

One sensitive receptor, an elementary school, was identified within a 3-mile radius of the proposed VV2 Project site. The school is located approximately 2.2 miles (3.6 km) southeast of the Project, in the Oro Grande area. For evaluating this sensitive receptor, two health risk analyses were conducted. The first was to evaluate potential health risk impacts to children that may be attending the school. The health risk assessment used the 9-year exposure scenario available in the HARP model to estimate health risk to children. This exposure scenario accounts for the higher breathing rate to body mass ratio of a child compared to an adult and is appropriate for use in estimating child exposure. The second assessment was of the school as an occupational (worker) receptor, similar to the analysis performed identification of impacts at the MEIW. Results for assessing cancer risk impacts at the school showed a risk 0.005 in one million based on worker exposure, and 0.009 in one million based on a child resident exposure scenario. Non-cancer impacts were determined to be 0.010 for acute and 0.0004 for chronic impact (non-cancer does not differentiate between child and adult or include alternative exposure periods). Cancer and non-cancer risks at sensitive receptors farther than three miles from the project site would be lower than those reported above.

Estimated cancer risks at all receptors in the health risk analysis were very low, with a worst-case cancer risk impact at the PMI of 0.73-in-one-million, which is less than one percent of the T-BACT threshold. Thus, the project poses an insignificant cancer risk according to established regulatory guidelines. HARP modeling results are presented in Appendix K.3.

Impacts for Non-Chemical Substances. Along with TAC emissions, water systems such as cooling towers can also be sources of bacteria growth, including Legionella. Legionella is the bacterium that can cause Legionellosis, otherwise known as Legionnaires' disease. Outbreaks of Legionellosis have been linked to untreated or inadequately treated cooling water systems in the United States, including Texas and Wisconsin. The EPA has investigated and published about the presence of Legionella in water systems and its possible transmission in air (EPA, 1999). In most cases the EPA has determined that disease outbreaks from Legionella have involved indoor exposure or outdoor exposure within 200 meters of the source. The most prevalent transmission was found to be through the heating, ventilation, and air conditioning (HVAC) systems in older buildings but it is possible for growth to occur in industrial cooling towers. The EPA has not developed a dose-response threshold due to inadequate quantitative data on the infectivity of Legionella in humans. However it is known that normal functioning immune systems would have antibodies to Legionella and would be able to defend against infection. Individuals susceptible to Legionella have a compromised immunization system, including some of the elderly.

The Cooling Technology Institute (CTI), an industry consortium, has issued guidelines for best practices to control Legionella (CTI, 2000). To minimize risks from Legionella, the CTI recommends eliminating to the maximum extent possible water stagnation and nutrient sources that lead into the cooling system, and to maintain the overall system cleanliness which includes the application of corrosion inhibitors, microbiological disinfectants, and the use of high efficiency mist eliminators. The American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE) states that good preventative maintenance is very important in the efficient operation of cooling towers and other evaporative equipment. Preventive maintenance includes having effective drift eliminators, periodically cleaning the system if appropriate, maintaining mechanical components in working order, and maintaining an effective water treatment program with appropriate biocide concentrations. The following management strategies are directed at minimizing colonization/amplification within the cooling tower system:

- Avoid piping that is capped and has no flow (dead legs).
- Control input water temperature to avoid temperature ranges where Legionella grow. Keep cold water below 25° C (77° F) and hot water above 55° C (131° F).
- Apply biocides in accordance with label dosages to control growth of other bacteria, algae, and protozoa that may contribute to nutritional needs of Legionella. Rotating biocides and using different control methods is recommended. These include thermal shock, oxidizing biocides, chlorine-based oxidants and ozone treatment.
- Conduct routine periodic “back-flushes” to remove bio-film buildup on the inside walls of the pipes.

Regulatory agencies have addressed the question of controlling bacteria levels in water systems. The EPA also published a Legionella Drinking Water Health Advisory (EPA, 2001), which suggests control measures for disinfecting water in cooling systems, including thermal, hyperchlorination, copper-silver ionization, ultraviolet light sterilization, ozonation, and instantaneous steam heating systems.

The California Department of Health Services regulates microbial growth and reduction of the potential for Legionella in the California Code of Regulations, Title 22, Section 60306. The section states, in part, that whenever a cooling system, using recycled water in conjunction with an air conditioning facility, utilizes a cooling tower or otherwise creates a mist that could come into contact with employees or members of the public, the cooling system will operate a drift eliminator whenever the cooling system is in operation and that chlorine or another biocide will be used to treat the cooling system recirculating water to minimize the growth of Legionella and other microorganisms.

The County of San Bernardino Department of Environmental Health recommends that when using recycled water in cooling towers, drift eliminators should be used and a chlorine or other biocide to treat cooling water to minimize growth of bacteria, including Legionella. The MDAQMD does not regulate bacteria in water systems but does require controls for reducing drift and aerosolization of water particles that may contain pollutants.

A 2004 Staff report to the CEC carefully evaluated the possibility of Legionella exposure to people as a result of water drift from cooling towers. The report concluded that, although the possibility of bacteria growth in cooling towers exist, it is very remote and can be controlled almost entirely though what have become standard practices of bacteria control in water systems.

6.11.3.5 Cumulative Impacts

According to the MDAQMD there are no specific guidelines regarding cumulative TAC emissions for addressing health risk impacts on a regional basin-wide scale (MDAQMD, 2006). The significance threshold of 1-in-a-million for maximum incremental lifetime cancer risk and 0.1 for non-cancer health impacts established by the MDAQMD CEQA Guidelines apply to the evaluation of individual projects. Additionally, there have not been any studies in the MDAB that have measured regional background air toxic levels. However a qualitative assessment of cumulative impacts to public health risks may be evaluated here in terms of comparing health risks posed by other similar operations in the project area and by sources of similar chemical substance emissions to those risks posed by the proposed VV2 Project.

Section 6.1.2 of the AFC discussed cumulative projects that may contribute to adverse impacts on public health. As required under CEQA, the impacts of the VV2 Project must be considered together with those of other past, present, and reasonably foreseeable future projects in the area that may produce related or cumulative impacts. Cumulative projects include the SCLA expansion, SCLA Rail Service (also referred to as the “Intermodal” project), and the VVWRA expansion project. Emission from the SCLA Intermodal project are expected to be generated primarily from mobile sources, such as movement of freight that involves various transfers between rail and truck and rail to rail.

The majority of emissions from the SCLA Expansion Project will be during construction and operations will be primarily associated with storage and warehousing activates. The certified EIR for the SCLA Intermodal project found there would be no significant adverse impact to public health as a result of operations. The VVWRA Expansion project includes construction of new water treatment facilities, aeration tanks, percolation ponds, a new blower building, several new or modified pumping stations, and new metering facilities. These facilities would have minimal emissions during operation, and emissions will be primarily due to short-term construction.

In 1998, the OEHHA listed diesel particulate matter (DPM), a primary combustion product from diesel engines, as a TAC, based on its potential to cause cancer, premature deaths, and other health problems. According to ARB and EPA, mobile source emissions account for much of the sources of cancer risk associated with air toxics. According to EPA estimates, mobile sources (car, truck, and bus) of air toxics account for as much as half of all cancers attributed to outdoor sources of air toxics (EPA, 1994). More recent research from ARB illustrates that health risks from DPM are highest in areas of concentrated emissions, such as near ports, rail yards, freeways, or warehouse distribution centers (ARB, 2004). Additionally, the MATES-II study showed that mobile sources (e.g., cars, trucks, trains, ships, and aircraft) in the South Coast Air Basin represent the greatest contributors to the estimated cancer risks (about 70 percent).

New standards have been adopted by ARB and the EPA to reduce DPM emissions from new on-road heavy duty vehicles. EPA estimates that, when fully implemented, the new program will result in particulate emission levels, and the corresponding health impacts that are 95 percent below today's levels (EPA, 2000). Further, the current ARB emissions inventory shows DPM emission levels will decrease in the MDAB by 22 percent below today's levels by 2010.

Air toxic impacts from stationary and mobile sources tend to decrease with distance from the source. Given the relatively large distances from the VV2 Project site to any population centriods or individual receptors and the low level of air toxics impacts produced by the VV2 Project, the probability of significant cumulative air toxic impact is also very low. In addition, ongoing Federal and State diesel motor vehicle emission reduction programs are in place and projected to create significant reductions in DPM emissions, and corresponding health impacts, in the region. Current MDAQMD health-based regulations also ensure that new sources of air pollutants are not introduced that will create significant health impacts. Combined, these factors will ensure that the Project's potential net health impact will not be cumulatively considerable.

6.11.4 Mitigation Measures

6.11.4.1 Chemical Substances of Potential Concern

Emissions of criteria pollutants will be minimized by applying Best Available Control Technology (BACT) to the emission sources, which will include the use of natural gas and oxidation catalysts in the combustion turbines. These measures also effectively minimize and control TAC/HAP emissions. Power generation with solar energy will also reduce the health risks per MW produced from this project. As demonstrated in the health risk analysis, no significant public health impact is expected. Therefore, no TAC emissions mitigation beyond that proposed for air quality is needed to protect public health.

6.11.4.2 Non-Chemical Substances of Potential Concern

To control bacteria levels in cooling water, the VV2 Project operators will accept a condition of certification to ensure that the potential for bacterial growth is kept to a minimum by establishing and implementing a cooling tower Biocide Use, Biofilm Prevention, and Legionella Monitoring Program.

To minimize cooling tower drift, the VV2 Project will install a high efficiency drift eliminator and implement a drift eliminator inspection and maintenance program. Drift eliminators on the cooling tower will control misting and significantly reduce non-criteria emissions from the cooling tower by minimizing cooling tower drift, mist, and water aerosolization, and any contaminants in the cooling source water that may become entrained in liquid water droplets. The drift eliminators must be properly installed and maintained in order to achieve efficient operation over the life of the facility. Following installation, proper maintenance includes periodic inspection and repair or replacement of any components found to be broken or missing. The VV2 Project operators will develop and implement a Cooling Tower maintenance plan in accordance with the CEC Cooling Water Management Program Guidelines (May, 2004). The Program will be documented and submitted to the CEC for review and approval prior to commencement of cooling tower operation.

Although impacts are expected to be minimal, the measures listed below will be implemented to further mitigate any potential adverse impacts to public health.

PH-1 The VV2 Project owner shall develop and implement a drift eliminator inspection and maintenance program. Following installation, proper maintenance includes periodic inspection and repair or replacement of any components found to be broken or missing.

PH-2 The VV2 Project owner shall develop and implement a Cooling Tower Monitoring Program in accordance with the CEC Cooling Water Management Program Guidelines (May, 2004). The Program will be documented and submitted to the CEC for review and approval prior to commencement of cooling tower operation. The plan will contain the following components:

- Selection of Biocide – Description of the biocide(s) selected and the reasons for their selection.
- Biocide Control Ranges – Description of how the biocide is to be administered (continuous or intermittent feed, level of residual concentrations, etc.)
- Microbial Testing – Document the microbial testing protocol to be used, including a detailed description of the Legionella monitoring.
- Upsets – Description of how the system will be returned to normal microbial control following an upset.
- Cooling Tower Shutdown, Startup, and Maintenance – Description of cooling tower shutdown, startup, and maintenance procedures.
- Record Keeping – Description of documents relating to maintaining the microbiological control program.

6.11.5 References

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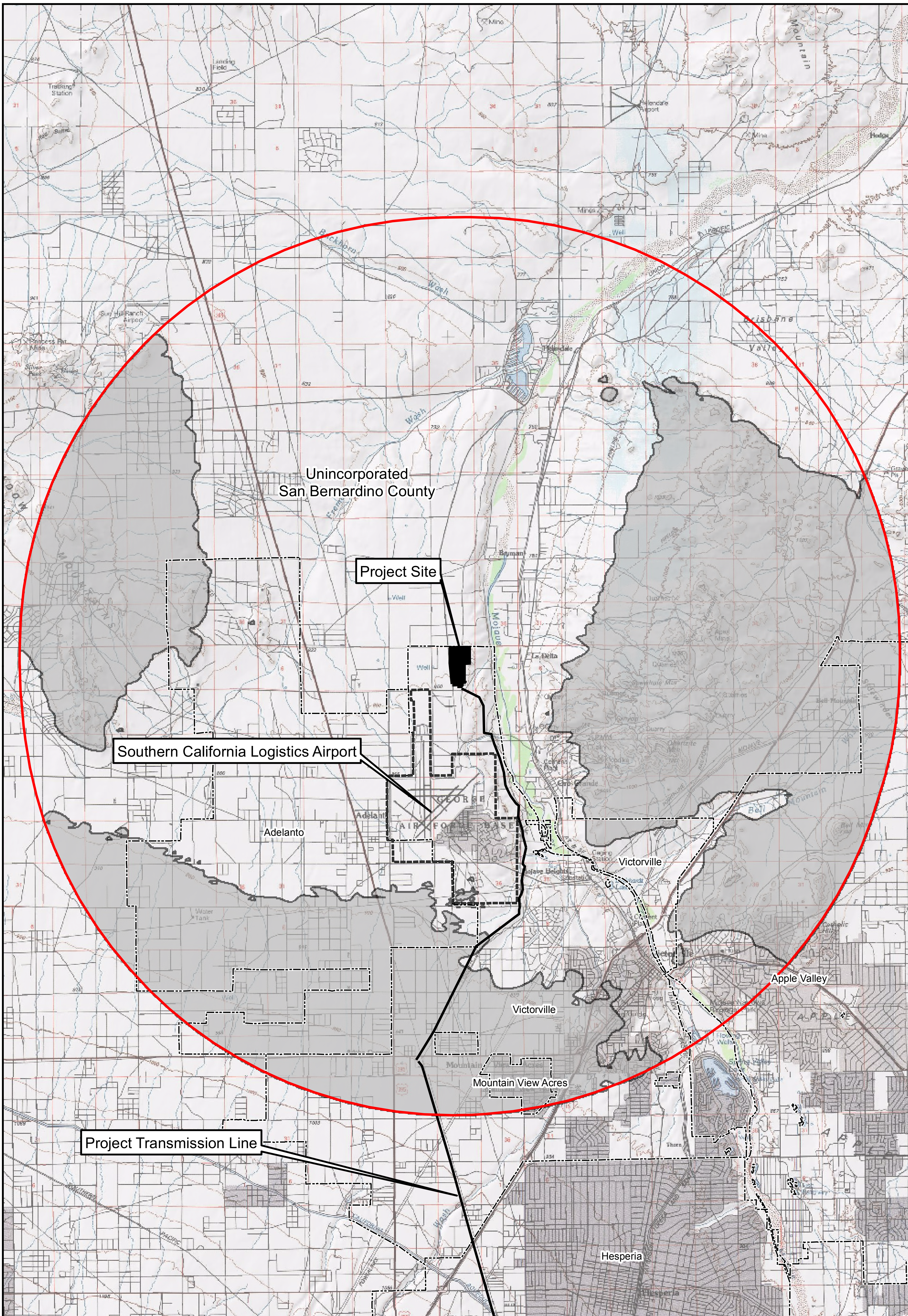

Terrain Above Stack Height
Victorville 2 Hybrid Power Project

Legend

10 Mile Project Radius
Incorporated City Boundary
SCLA Boundary
Terrain Above Stack Height

Scale: 1:200,000

0 1 2 4 6 8 Miles

Inland Energy, Inc.

ENSR | AECOM

Figure: 6.11-1

Date January 2007

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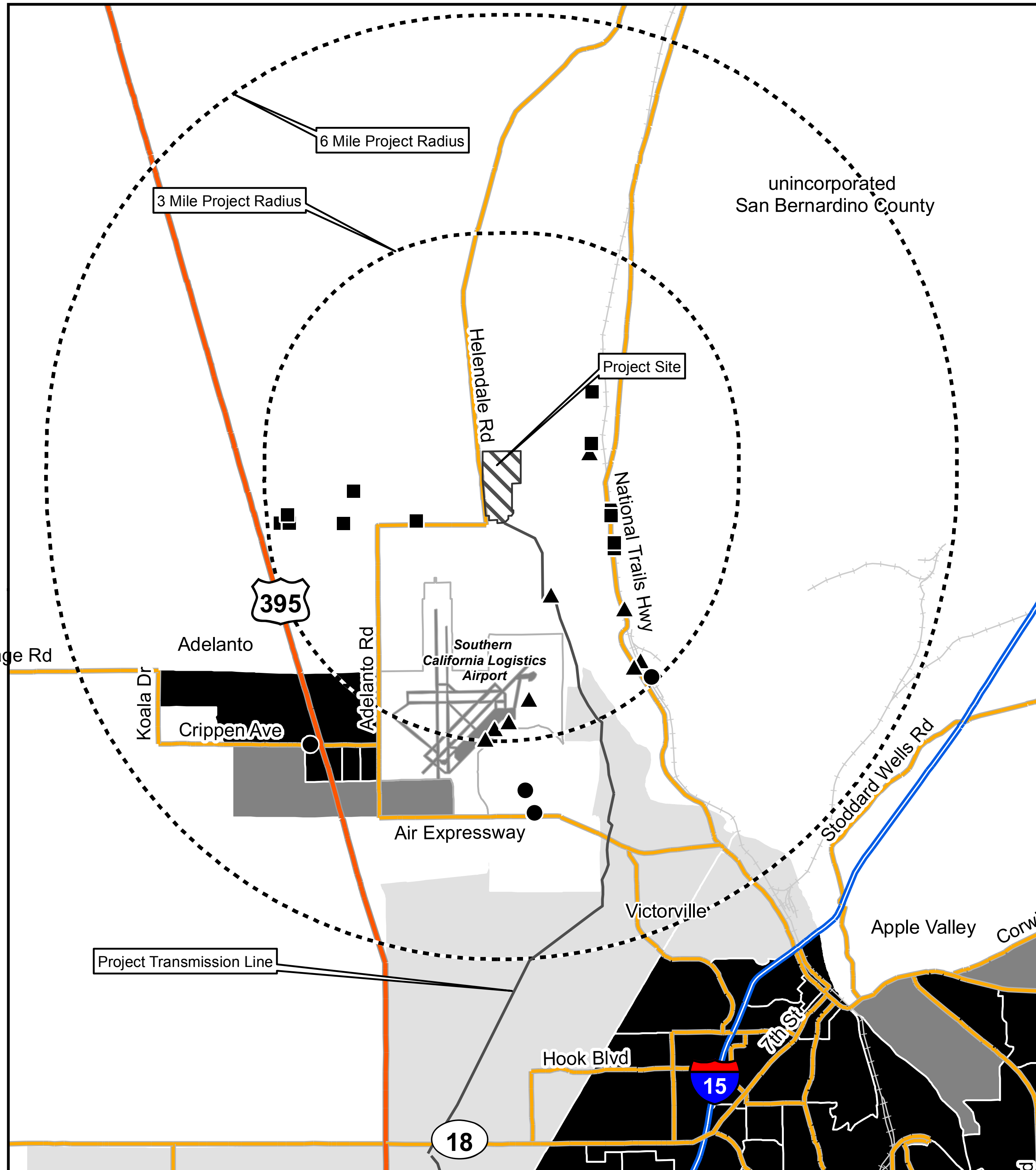

Locus Map

Sensitive Receptors and Population Density within 6 miles of Project Site
Victorville 2 Hybrid Power Project

Population Per Square Mile (2004)

- 0-250
- 250-500
- 500-1000
- >1000

- Occupational Receptors
- Residential Receptors
- Sensitive Receptors

Scale: 1:120,000

0 0.5 1 2 3 4 Miles

City of Victorville, California

Inland Energy, Inc.

ENSR | AECOM

Figure: 6.11-2

Date: February 2007

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