7.6 PUBLIC HEALTH

This section presents the methodology and results of a human health risk assessment (HRA) performed to assess potential public health impacts associated with the air toxic emissions from the proposed project. The purpose of the HRA is to evaluate potential public exposure and the potential for adverse health effects due to pollutant emissions from routine project operations. Impacts due to the proposed project's emissions of criteria pollutants, i.e., pollutants for which federal or California ambient air quality standards have been promulgated, are described in Section 7.1, Air Quality. Potential public exposure to accidental releases of hazardous materials on the proposed project site during operation is addressed in Section 7.12, Hazardous Materials Handling.

7.6.1 Affected Environment

The CVP Sentinel Energy Project (CPVS) site is located approximately 8 miles northwest of downtown Palm Springs in Riverside County, California. The area immediately surrounding the proposed project site has been extensively developed for wind energy and electric transmission infrastructure. The remainder of the area within a 3-kilometer (1.86-mile) radius of the site is mainly desert with sparsely populated residences; therefore, for modeling purposes the region is considered rural.

The proposed project's turbine stacks would exhaust combustion gases at a height of 90 feet (27.4 meters) above grade elevation. The lowest grade elevation for the sources of the proposed project is approximately 1,079 feet (329 meters). Topographical features within a 6- and 10-mile radius that are of equal or greater elevation than all CPVS stack exhaust heights are shown in Figure 7.1-1 in Section 7.1, Air Quality.

Certain groups of individuals may be more susceptible to health risks due to chemical exposure, including children, pregnant women, the elderly, and people with chronic illnesses who could have higher sensitivity to toxic pollutants. Consequently, sensitive receptors, such as schools (public and private), daycare facilities, convalescent homes, parks, and hospitals receive particular attention in the health risk analysis. All sensitive receptors located within a 3-mile radius of the proposed project site were included in the HRA, plus any additional sensitive receptors identified out to 6 miles. The closest residence is the Mundhenk house, approximately 330 feet to the east of the 37-acre CPVS property line. The sensitive receptors are shown on Figure 7.6-1; however, the HRA approach treated all receptors as sensitive receptors.

The local public health department (Riverside County Department of Environmental Health) was contacted to determine if any health risk studies have been conducted in the neighborhoods within 6 miles of the proposed project site. An Internet search was also conducted, and no health risk studies were identified.

7.6.2 Environmental Consequences

This section describes the potential public health risks due to construction and operation of the proposed project, and the methodology and results of the HRA. Significant impacts are defined as a maximum incremental cancer risk greater than 10 in 1 million, a chronic total hazard index (THI) grater than 1.0, or an acute THI greater than 1.0. Also, uncertainties in the HRA are discussed and other potential health impacts of the proposed project are described.

7.6.2.1 Public Health Impact Assessment Approach

The potential human health risks posed by the proposed project's emissions were assessed using procedures consistent with the South Coast Air Quality Management District (SCAQMD) Risk Assessment Procedures for Rules 1401 and 212 (SCAQMD, 2005a), Supplemental Guidelines for Preparing Risk Assessments for the Toxics Hot Spots Information and Assessment Act (AB2588)

(SCAQMD, 2005b), and Office of Environmental Health Hazard Assessment (OEHHA) Air Toxics Hot Spots Program Risk Assessment Guidelines (Cal-EPA/OEHHA, 2003). As recommended by the SCAQMD guideline, the California Air Resources Board (CARB) Hotspots Analysis and Reporting Program (HARP) (CARB, 2003) was used to perform a refined SCAQMD Tier 4 and OEHHA Tier 1 health risk assessment for the proposed project. The SCAQMD and OEHHA guidelines were developed to provide risk assessment procedures, as required under the Air Toxics Hot Spots Information and Assessment Act of 1987, Assembly Bill 2588 (Health and Safety Code Sections 44360 et seq.). The Hot Spots law established a statewide program to inventory air toxics emissions from individual facilities, as well as guidance for execution of risk assessments and requirements for public notification of potential health risks.

The HRA was conducted in four steps using the HARP:

- Hazard identification and emission quantification
- Exposure assessment
- Dose-response assessment
- Risk characterization

For the first step, hazard identification was performed to determine the potential health effects that could be associated with the proposed project emissions. The purpose was to identify whether pollutants emitted from the proposed project during plant operation could be characterized as potential human carcinogens, or associated with other types of adverse health effects. From the SCAQMD and OEHHA guidelines, a list of pollutants with potential cancer and noncancer health effects associated with the emissions from the proposed project are presented in Table 7.6-1.

For the second step, an exposure assessment was conducted to estimate the extent of public exposure to the proposed project emissions. Public exposure is dependent on the short- and long-term ground-level concentrations resulting from emissions, the route of exposure, and the duration of exposure to those emissions. Dispersion modeling was performed using the ISCST3 model within HARP to estimate the ground-level concentrations near the proposed project site. The methods used in the dispersion modeling were consistent with the approach described in Section 7.1, Air Quality, and the modeling protocol submitted for the proposed project (URS, 2007).

For the third step of the HRA, a dose-response assessment was performed in HARP to characterize the relationship between pollutant exposure and the incidence of an adverse health effect in exposed populations. The dose-response relationship is expressed in terms of potency factors for cancer risk and reference exposure levels (RELs) for acute and chronic noncancer risks. The OEHHA guidelines provide potency factors and RELs for an extensive list of toxic air contaminants. Potency factors and RELs are constantly being revised by the OEHHA, and the most recent values were applied in this HRA (Cal-EPA/OEHHA, 2005). All exposure pathways were included in this analysis, except the dairy milk, local meat and fish ingestion, and drinking water consumption pathways, because little farming and no water sources are near the proposed project site. For the calculation of cancer risk, the duration of exposure to project emissions was assumed to be 24 hours per day, 365 days per year, for 70 years, at all receptors. The cancer risk was calculated in HARP using the Derived (Adjusted) Method, and the chronic THI was calculated in HARP using the Derived (OEHHA) Method.

For the fourth HRA step, risk characterization was performed to integrate the health effects and public exposure information and provide qualitative estimates of health risks from project emissions. Risk modeling was performed using HARP to estimate cancer and noncancer health risks for the proposed project. The HARP model uses OEHHA equations and algorithms to calculate health risks based on input parameters such as emissions, “unit” ground-level concentrations, and toxicological data.

Detailed descriptions of the model input parameters and results of the HRA are provided in the following sections.

7.6.2.2 Construction Phase Emissions

Due to the relatively short duration of the proposed project construction (i.e., 18 months), significant long-term public health effects are not expected to occur as a result of project construction emissions. Diesel particulate exhaust is the air pollutant with the largest potential for human health risk emitted during the construction period. Diesel particulate has been classified as a toxic air contaminant and a carcinogen. However, the exposure assessment conducted for carcinogens is typically 70 years; due to the short duration of the construction effort, carcinogenic health risks are not predicted.

To ensure worker safety during actual construction, safe work practices will be followed (see Section 7.7, Worker Safety and Health). A detailed analysis of the potential environmental impacts due to criteria pollutant emissions during construction and control of these emissions is discussed in Section 7.1, Air Quality.

7.6.2.3 Operational Phase Emissions

Facility operations were evaluated to determine whether particular substances would be used or generated at the proposed project site that could cause adverse health effects upon their release to the air. The primary sources of potential emissions from facility operations would be the eight natural gas-fired combustion turbine generators (CTGs), as well as the aqueous ammonia slip stream from the selective catalytic reduction (SCR) control system on each turbine. Secondary sources of potential emissions come from the evaporative cooling tower and diesel fuel combustion in the black start and fire water engines. The black start and fire water engines will normally be operated only for short periods in testing mode to ensure operability if needed. The cooling tower will employ a high-efficiency drift elimination system to minimize the release of drift droplets containing trace amounts of hazardous substances. The substances that would be emitted from facility operations (with potential toxicological impacts) are shown in Table 7.6-1. These potential air toxic species were identified in the list of emission factors published in U.S. Environmental Protection Agency (U.S. EPA) AP-42 (U.S. EPA, 1995) and California Air Toxics Emissions Factors (CATEF) (1996). SCAQMD recommends the use of AP-42 emission factors for purposes of HRAs for natural gas turbines. In addition, potential emissions from ammonia slip from the SCR systems were included.

Worst-case estimates of hourly and annual turbine emissions were made by assuming that all turbines would operate simultaneously under full load conditions with a maximum higher heating value (HHV) fuel energy input rate of 875.7 million British thermal units per hour (MMBtu/hr) (100 percent load at 72°F). For the annual emission calculations, it was assumed that Units 1 through 5 would operate for a maximum of 2,805 hours per year (2,628 hours of normal operations plus 300 startups and shutdowns), and Units 6 through 8 would operate for a maximum of 3,406 hours per year (3,200 hours of normal operations plus 350 startups and shutdowns). The exit temperature and velocity for each turbine stack used in the model represented turbine operations at 100 percent load at an ambient temperature of 72°F.

Emission factors for natural gas-fired turbines were obtained from the AP-42 Table 3.1-3 for natural gas-fired stationary turbines (U.S. EPA, 1995), and the speciated polycyclic aromatic hydrocarbon (PAH) emissions came from the CATEF database for natural gas-fired combustion turbines with SCR and carbon monoxide (CO) catalyst. The emission factors and estimated maximum hourly and annual turbine emissions are summarized in Table 7.6-2.

Trace levels of inorganic particles are indicated in the analysis of the source water for the cooling towers and low-level emissions of these pollutants would therefore be contained in the particulate matter emitted as drift from the cooling towers. To calculate the cooling tower emissions, a water circulating rate of

7,860 gallons per minute per cell with one cycle of concentration was used, and a drift elimination system capable of limiting drift to no more than 0.0005 percent of the circulating water rate, as guaranteed by the equipment vendor. Water from the existing onsite well was sampled to determine the maximum concentrations of inorganic chemicals. These values were then used to determine the maximum toxic air contaminant (TAC) emissions from each cooling tower. For the annual emission calculations, it was assumed that the north cooling tower, servicing Units 1 through 5, would operate for a maximum of 2,628 hours per year, and the south cooling tower, servicing Units 6 through 8, would operate for a maximum of 3,200 hours per year. Emission factors and estimated maximum hourly and annual emissions per cooling tower cell are summarized in Table 7.6-3.

Fine particulates with a diameter equal to or less than 10 microns (PM_{10}) emission factors for the diesel-fired black start and fire pump engines were obtained from the vendor. PM_{10} emissions from the diesel-fired black start engine were estimated assuming it would run at its full rated capacity (1,500 kilowatt [kW]) for 1 hour per month to test the engine. PM_{10} emissions from the diesel-fired fire pump engine were estimated assuming it would run at its full rated capacity (240 hp) for 1 hour per week for emergency preparedness. Actual emergency use of the diesel engines was not included. Emission factors and estimated maximum hourly and annual emissions from the black start and fire pump engines are summarized in Table 7.6-4.

7.6.2.4 Model Input Parameters

The HRA was conducted using worst-case emissions for each source (short and long term) as described above. Cancer and chronic noncancer health effects were evaluated using the HARP model with annual emission estimates. Acute noncancer health effects were analyzed based on the worst-case maximum hourly emissions for all sources.

Dispersion modeling was performed using the ISCST3 model in HARP and methods consistent with the approach (e.g., building downwash or meteorological data) described in Section 7.1, Air Quality, and the modeling protocol submitted for the proposed project (URS, 2007). The ISCST3 model is used with project source emission rates and stack parameters to calculate the concentration of TACs per unit emission rate. HARP then uses this information along with the emission rates for specific TAC compounds (provided in the input file as described above) to calculate ground-level concentrations for each chemical species.

Meteorological data for the years 1988 through 1990 from Wintec Energy, Daggett-Barstow and Desert Rock were processed with PCRAMMET computer program to create the ISC input files. These are the same first 3 years of data used in the air quality modeling analysis described in Section 7.1, Air Quality. Risk values were modeled for all sensitive receptors, grid, boundary, and census receptors within 6 miles of the proposed project site. Boundary receptors were placed every 82 feet (25 meters) along the CPVS property fence line. Grid receptors were spaced every 328 feet (100 meters) out to 6 miles (10 kilometers) from the proposed project site in every direction. Any risks calculated by the HARP model at onsite receptor locations were ignored. To ensure that the maximum potential risks resulting from proposed project emissions would be addressed, all receptors were treated as sensitive receptors.

Toxicological data, cancer potency factors, and RELs for specific chemicals are built into the CARB's HARP model. The pollutant-specific cancer potency factors and RELs used in the HRA are listed in Table 7.6-1. The HARP model uses the toxicological data in conjunction with the other input data described above to perform health risk estimates based on OEHHA equations and algorithms.

7.6.2.5 Calculation of Health Effects

Adverse health effects are expressed in terms of cancer or noncancer health risks. Cancer risk is typically reported as "lifetime cancer risk," which is the estimated maximum increase of risk of developing cancer

caused by long-term exposure to a pollutant suspected of being a carcinogen. The calculation of cancer risk conservatively assumes an individual is exposed continuously to the maximum pollutant concentrations 24 hours per day for 70 years. Although such continuous lifetime exposure to maximum TAC levels is unlikely, the goal of the approach is to produce a conservative worst-case estimate of potential cancer risk. When a cancer risk of greater than 1 in 1 million is predicted, then cancer burden is calculated. Cancer burden is the estimated increase in the occurrence of cancer cases within the portion of the population subject to a cancer risk greater than or equal to 1 in 1 million (1.0×10^{-6}) resulting from exposure to toxic air contaminants.

Noncancer risk is typically reported as a THI. The THI is calculated for each target organ as a fraction of the maximum acceptable exposure level to a pollutant. The acceptable exposure level is generally the level at (or below) which no adverse health effects are expected. These are calculated for both short-term (acute) and long-term (chronic) noncarcinogenic exposures.

Both cancer and noncancer risk estimates produced by the HRA represent incremental risks (i.e., risks due to proposed project sources only) and do not include potential health risks posed by existing background concentrations. The HARP model performs all of the necessary calculations to estimate the potential lifetime cancer risk and the acute and chronic noncancer THIs posed by proposed project emissions.

7.6.2.6 Health Effects Significance Criteria

Various state and local agencies provide different significance criteria for cancer and noncancer health effects. For the proposed project, the SCAQMD and California Energy Commission (CEC) guidelines provide the most stringent significance criteria for potential cancer and noncancer health effects from project-related emissions. For carcinogenic health effects, an exposure is considered potentially significant when the predicted increase in lifetime cancer risk exceeds 10 in 1 million (1.0×10^{-5}). For noncarcinogenic health effects, an exposure that affects each target organ is considered potentially significant when the THI exceeds a value of 1.0.

7.6.2.7 Estimated Lifetime Cancer Risk

The maximum incremental cancer risk resulting from proposed project emissions was estimated to be 0.856 in 1 million, at a location on the eastern CPVS property boundary (receptor located at 539,613 m east, 3,755,378 m north1). The maximum incremental cancer risk predicted at a sensitive receptor was estimated to be 0.047 in 1 million (a farm/residence located approximately 1,000 feet east [740 meters] of the eastern property line [539,953 m east, 3,755,077 m north]). Table 7.6-5 presents the detailed cancer risk results of the HRA for the proposed project operations. The cancer burden is zero since it is the number of people exposed to a cancer risk of 1 in 1 million or greater, and the cancer risk is predicted to be less than 1 in 1 million.

The estimated cancer risks at all locations are well below the significance criterion of 10 in 1 million. Thus, the proposed project emissions are expected to pose a less-than-significant increase in carcinogenic health risk. All HARP model files and all air quality modeling files are provided electronically on a DVD that is supplied separately with this AFC.

7.6.2.8 Estimated Chronic and Acute Total Hazard Indices

The maximum chronic THI resulting from proposed project's operational emissions was estimated to be 0.030 at a location on the eastern property boundary (receptor located at 539,613 m east, 3,755,478 m north). The maximum predicted chronic THI at a sensitive receptor due to TAC emissions of the

[1] Coordinates are provided in accordance with the Universal Transverse Mercator and North American Datum, 1983, Zone 11.

proposed project was 0.001. This receptor is the Sands RV Country Club located approximately 5 miles (8 kilometers) east of the proposed Unit 4 (at 547,651 m east, 3,754,053 m north).

The maximum acute THI resulting from the proposed project emissions was estimated to be 0.115 at a grid receptor located approximately 2 miles (3.5 kilometers) west-northwest of the proposed project site (at 536,211 m east, 3,756,410 m north). The maximum acute THI at a sensitive receptor was estimated to be 0.053 at St John's School, which is approximately 4 miles (7 kilometers) west-northwest of the proposed project site (at 532,883 m east, 3,756,842 m north). Table 7.6-5 presents the detailed noncancer results of the HRA for the proposed project operations.

The estimated chronic and acute THIs are well below the significance criterion of 1.0. Thus, the proposed project emissions of noncarcinogenic TACs would not be expected to pose a significant risk.

To satisfy SCAQMD Rule 1401, the maximum cancer risk and noncancer chronic and acute hazard indices from each permit unit must be below the significance thresholds presented in Section 7.6.2.6. Since the total project cancer risk, noncancer acute, and chronic hazard indices are all below the significance thresholds, each permit unit would individually be below the significance thresholds.

7.6.2.9 Uncertainty in the Public Health Impact Assessment

Sources of uncertainty in the results of HRAs include emissions estimates, dispersion modeling, exposure characteristics, and extrapolation of toxicity data in animals to humans. For this reason, assumptions used in HRAs are typically designed to provide sufficient health protection to avoid underestimation of risk to the public. Some sources of uncertainty applicable to this HRA are discussed below.

The turbine emission rates were derived using vendor data for ammonia slip and from emission factors from AP-42 (U.S. EPA, 1995) and CATEF (1996) for the other air toxics. Both the short- and long-term turbine emissions estimates were developed assuming all turbines would operate at full load and continuously at the same time. Under actual operating conditions, the turbines would operate less hours per year and at a lower load. Consequently, the emissions used for this HRA are likely to be higher than what would be experienced under normal plant operation.

Dispersion models approved for regulatory applications contain assumptions that tend to overpredict ground-level concentrations. For example, the modeling performed in the HRA assumed a conservation of mass (i.e., all of the pollutants emitted from the sources remained in the atmosphere while being transported downwind). During the transport of pollutants from sources toward receptors, none of the emitted material was assumed to be removed from the source plumes through chemical reaction or lost at the ground surface through reaction, gravitational settling, or turbulent impaction. In reality, these mechanisms work to reduce the level of pollutants remaining in the atmosphere during plume travel.

The exposure characteristics assessed in the HRA included the assumption that residents would be exposed to turbine emissions continuously at the same location for 24 hours per day, 365 days per year, for 70 years. It is extremely unlikely that any resident would meet this condition. The conservative exposure assumption tends to overpredict risk estimates in the HRA process.

The toxicity data used in the HRA contain uncertainties due to the extrapolation of data from animals to humans. Typically, safety factors are applied when doing the extrapolation. Furthermore, the human population is much more diverse, both genetically and culturally, than bred experimental animals. The interspecies variability among humans is expected to be much greater than in laboratory animals. With all of the uncertainty in the assumptions used to extrapolate toxicity data, significant measures are taken to ensure that sufficient health protection is built into the available health effects data.

Conservative measures to compensate for all of these uncertainties and ensure that potential health risks are not underestimated, are compounded in the final HRA predictions. Therefore, the actual risk numbers are expected to be well below the values presented in this analysis.

7.6.2.10 Criteria Pollutants

The dispersion of the criteria pollutants (nitrogen dioxide [NO_2], CO, sulfur dioxide [SO_2], PM_{10}, and PM with a diameter equal to or less than 2.5 microns [$PM_{2.5}$]) was modeled, and an evaluation of their impacts on air quality is presented in Section 7.1, Air Quality. The federal and state ambient air quality standards (AAQS) set limits on the allowable level of air pollutants in the ambient air necessary to protect public health. The results show that the proposed project would not cause a violation of any state or federal AAQS and would not significantly contribute to existing violations of federal and state PM_{10} and $PM_{2.5}$ standards. Therefore, no significant adverse health effects are anticipated from the proposed project's criteria pollutant emissions.

7.6.3 Cumulative Impacts

Each risk from the proposed project is evaluated separately and then compared to the applicable significance criteria. The cumulative effects from sources other than the proposed project are not considered. CEC requirements specify that an analysis must be conducted to determine the cumulative impacts of a proposed project and other projects within a 6-mile radius that have received construction permits but are not yet operational or that are in the permitting process or can be expected to do so in the near future. Information requests have been made to SCAQMD to obtain data on new projects planned within 6 miles from the proposed CPVS site. When this information is received, it will be forwarded to CEC for approval as the basis for the full cumulative analysis. The results of the final cumulative impact analysis will be reported under separate cover.

7.6.4 Mitigation Measures

The criteria pollutant emissions from the proposed project will be mitigated by the use of Best Available Control Technology (BACT) and through emissions offsets; these measures are presented in Section 7.1, Air Quality. The toxic pollutant emissions from the proposed project will also be mitigated by the exclusive use of natural gas fuel. In addition, pollution control technologies employed to control criteria pollutants (specifically, the oxidation catalyst on the turbines) will also significantly reduce organic TACs, such as those listed in Table 7.6-1. These measures satisfy the SCAQMD requirements for toxics (T-BACT) for natural gas-fired generation units.

The HRA presented in the previous subsections shows that the health effects impacts of the CPVS as proposed would be well below the significance thresholds identified in Section 7.6.2.6. Therefore, no further mitigation of emissions from the proposed project is required to protect public health.

7.6.5 Laws, Ordinances, Regulations, and Standards

The proposed project will be constructed and operated in accordance with all laws, ordinances, regulations, and standards (LORS) applicable to protecting public health. The applicable LORS related to public health impacts from the proposed project are identified in Table 7.6-6. This table also summarizes the agencies that are principally responsible for public health, as well as the general category(ies) of public health concerns regulated by each of these agencies. The conformity of the proposed project to each of the LORS applicable to public health is also presented in this table, as well as references to the locations in this document where each of these issues is addressed.

7.6.6 Involved Agencies and Agency Contacts

Agency Contacts		
Agency	**Contact/Title**	**Telephone**
California Energy Commission	Keith Golden Air Quality Specialist 1516 Ninth Street Sacramento, CA 95814	(916) 654-4287
	Mike Ringer Public Health Specialist 1516 Ninth Street Sacramento, CA 95814	(916) 654-4287
California Air Resources Board	Mike Tollstrup 1001 I Street Sacramento, CA 95814	(916) 322-6026
South Coast Air Quality Management District	Tom Chico SCAQMD 21865 Copley Dr, Diamond Bar, CA 91765	(909) 396-3149

7.6.7 Permits Required and Permit Schedule

The Permit to Construct (PTC) permitting process that would otherwise apply is superseded in the case of CEC licensing projects by the Determination of Compliance (DOC) process, which is its functional equivalent. The CEC's final decision on this AFC application will serve as the principal approval required to ensure that the proposed project's impacts to public health would be within acceptable levels. However, a Permit to Operate (PTO) would be awarded following SCAQMD confirmation that the project has been constructed to operate as described in the permit applications.

7.6.8 References

Cal-EPA/OEHHA (California Environmental Protection Agency and Office of Environmental Health Hazard Assessment), 1999. Air Toxics Hot Spots Risk Assessment Guidelines, Part I. Technical Support Document for the Determination of Acute Reference Exposure Levels for Airborne Toxicants.

Cal-EPA/OEHHA (California Environmental Protection Agency and Office of Environmental Health Hazard Assessment), 2003. Air Toxics Hot Spots Program Risk Assessment Guidelines – The Air Toxics Hot Spots Program Guidance Manual for U.S. EPA Preparation of Health Risk Assessments; Air Toxics Hot Spots Risk Assessment Guidelines, Part II: Technical Support Document for the Determination of Noncancer Chronic Reference Exposure Levels.

Cal-EPA/OEHHA (California Environmental Protection Agency and Office of Environmental Health Hazard Assessment), 2005. Air Toxics Hot Spots Risk Assessment Guidelines, Part II: Technical Support Document for Describing Available Cancer Potency Factors.

CARB (California Air Resources Board), 2003. HARP User Guide – Software for Emission Inventory Database Management, Air Dispersion Modeling Analyses, and Health Risk Assessment version 1.3, Air Resources, Board, California Environmental Protection Agency. December 2003.

CARB (California Air Resources Board), 1996. California Air Toxics Emission Factor (CATEF) Database, Version 1.2.

SCAQMD (South Coast Air Quality Management), 2005a. Risk Assessment Procedure for Rules 1401 and 212, Version 7, July.

SCAQMD (South Coast Air Quality Management), 2005b. Supplemental Guidelines for Preparing Risk Assessments for the Toxics "Hot Spots" Information and Assessment Act (AB2588), July.

U.S. EPA (U.S. Environmental Protection Agency), 1995. AP-42 Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition.

URS Corporation, 2007. Modeling Protocol for the CPV Ocotillo Energy Project, Riverside County, California. Prepared by URS for South Coast Air Quality Management District and California Energy Commission.

Table 7.6-1
Toxicity Values Used To Characterize Health Risks

Compound	Sources of Emissions	Inhalation Cancer Potency Factor $(mg/kg\text{-}day)^{-1}$	Chronic REL ($\mu g/m^3$)	Acute REL ($\mu g/m^3$)
Diesel particulate (PM_{10})	Black start engine and fire pump	1.10E+00	5.00E+00	--
Ammonia	Gas turbine stacks	--	2.00E+02	3.20E+03
1,3-Butadiene	Gas turbine stacks	6.00E-01	2.00E+01	--
Acetaldehyde	Gas turbine stacks	1.00E-02	9.00E+00	--
Acrolein	Gas turbine stacks	--	6.00E-02	1.90E-01
Benzene	Gas turbine stacks	1.00E-01	6.00E+01	1.30E+03
Ethylbenzene	Gas turbine stacks	--	2.00E+03	--
Formaldehyde	Gas turbine stacks	2.10E-02	3.00E+00	9.40E+01
Propylene oxide	Gas turbine stacks	1.30E-02	3.00E+01	3.10E+03
Toluene	Gas turbine stacks	--	3.00E+02	3.70E+04
Xylenes	Gas turbine stacks	--	7.00E+02	2.20E+04
Benzo(a)anthracene	Gas turbine stacks	3.90E-01	--	--
Benzo(a)pyrene	Gas turbine stacks	3.90E+00	--	--
Benzo(b)fluoranthene	Gas turbine stacks	3.90E-01	--	--
Benzo(k)fluoranthene	Gas turbine stacks	3.90E-01	--	--
Chrysene	Gas turbine stacks	3.90E-02	--	--
Dibenz(a,h)anthracene	Gas turbine stacks	4.10E+00	--	--
Indeno(1,2,3-cd)pyrene	Gas turbine stacks	3.90E-01	--	--
Naphthalene	Gas turbine stacks	1.20E-01	9.00E+00	--
Antimony	Cooling tower	--	2.00E-01	--
Arsenic	Cooling tower	1.20E+01	3.00E-02	1.90E-01
Chlorine	Cooling tower	--	2.00E-01	2.10E+02
Chromium	Cooling tower	5.10E+02	2.00E-01	--
Copper	Cooling tower	--	2.40E+00	1.00E+02
Fluoride	Cooling tower	--	1.30E+01	2.40E+02
Lead	Cooling tower	4.20E-02	--	--
Selenium	Cooling tower	--	2.00E+01	--
Silica	Cooling tower	--	3.00E+00	--
Sulfate	Cooling tower	--	2.50E+01	1.20E+02
Vanadium	Cooling tower	--	--	3.00E+01
Zinc	Cooling tower	--	3.50E+01	--

Source: Cal-EPA/OEHHA, 2005
Notes:
-- = not applicable
mg/kg-day = milligrams per kilogram per day
$\mu g/m^3$ = micrograms per cubic meter
REL = reference exposure levels

Table 7.6-2
Toxic Air Contaminant Emission Rates From Operation of the Natural Gas-Fired Combustion Turbines

Chemical Species	Emission Factor (lb/MMBtu)[1]	Maximum Hourly Emissions per Turbine (lb/hr)	Annual Emissions Per Turbine (Units 1-5) (lb/yr)	Annual Emissions Per Turbine (Units 6-7) (lb/yr)
Ammonia[2]	5 ppm[3]	5.867	1.65E+04	2.00E+04
1,3-Butadiene	4.30E-07	3.77E-04	1.06E+00	1.28E+00
Acetaldehyde	4.00E-05	3.50E-02	9.82E+01	1.19E+02
Acrolein	3.62E-06	3.17E-03	8.89E+00	1.08E+01
Benzene	3.26E-06	2.85E-03	8.01E+00	9.72E+00
Ethylbenzene	3.20E-05	2.80E-02	7.86E+01	9.54E+01
Formaldehyde	3.60E-04	3.15E-01	8.84E+02	1.07E+03
Propylene Oxide	2.90E-05	2.54E-02	7.12E+01	8.65E+01
Toluene	1.30E-04	1.14E-01	3.19E+02	3.88E+02
Xylenes	6.40E-05	5.60E-02	1.57E+02	1.91E+02
Polycyclic Aromatic Hydrocarbons (PAH)				
Benzo(a)anthracene	2.22E-08	1.94E-05	5.45E-02	6.62E-02
Benzo(a)pyrene	1.37E-08	1.20E-05	1.32E-01	4.07E-02
Benzo(b)fluoranthene	1.11E-08	9.72E-06	2.73E-02	3.31E-02
Benzo(k)fluoranthene	1.08E-08	9.46E-06	2.65E-02	3.22E-02
Chrysene	2.48E-08	2.17E-05	6.08E-02	7.38E-02
Dibenz(a,h)anthracene	2.31E-08	2.02E-05	5.67E-02	6.88E-02
Indeno(1,2,3-cd)pyrene	2.31E-08	2.02E-05	5.67E-02	6.88E-02
Naphthalene	1.63E-06	1.43E-03	4.01E+00	4.86E+00

Notes:

[1] See Appendix N for detailed emission calculations. Emission factors obtained from U.S. EPA AP-42 Table 3.1-3 for uncontrolled natural gas-fired stationary turbines. Formaldehyde, benzene, and acrolein emission factors are from the Background document for AP-42 Section 3.1, Table 3.4-1 for a natural gas-fired combustion turbine with a CO catalyst. PAH emission factors obtained from the CATEF database for natural gas-fired combustion turbines with Selective Catalytic Reduction and CO catalyst.
[2] Not a Clean Air Act Hazardous Air Pollutant.
[3] Based on estimated ammonia slip from for the nitrogen oxide (NO_x control, 5 parts per million by volume, dry at 15 percent oxygen).
lb/hr = pounds per hour
lb/yr = pounds per year
lb/MMBtu = pounds per million British thermal units
PAH = Polycyclic aromatic hydrocarbon
ppm = parts per million
TAC = toxic air contaminant

Table 7.6-3
Toxic Air Contaminant Emission Rates From Operation of the Cooling Towers

Chemical Species	TAC Concentration in Water (μg/L)[1]	Maximum Hourly Emissions per Cooling Tower Cell (lb/hr)	Annual Emissions per Cooling Tower Cell (Units 1-5) (lb/yr)	Annual Emissions per Cooling Tower Cell (Units 6-7) (lb/yr)
Antimony	0.34	6.69E-09	1.76E-05	2.14E-05
Arsenic	2.3	4.53E-08	1.19E-04	1.45E-04
Chlorine	27000	5.31E-04	1.40E+00	1.70E+00
Chromium	0.91	1.79E-08	4.71E-05	5.73E-05
Copper[2]	0.85	1.67E-08	4.40E-05	5.35E-05
Fluoride[2]	570	1.12E-05	2.95E-02	3.59E-02
Lead	0.21	4.13E-09	1.09E-05	1.32E-05
Selenium	1.3	2.56E-08	6.72E-05	8.19E-05
Silica[2]	11000	2.16E-04	5.69E-01	6.93E-01
Sulfate[2]	8300	1.63E-04	4.29E-01	5.23E-01
Vanadium[2]	38.3	7.54E-07	1.98E-03	2.41E-03
Zinc[2]	70	1.38E-06	3.62E-03	4.41E-03

Notes:

[1] See Appendix N for detailed emission calculations. The maximum concentration for each TAC as determined from water samples collected from the existing onsite well.
[2] Not a Clean Air Act Hazardous Air Pollutant.
μg/L = micrograms per liter
lb/hr = pounds per hour
lb/yr = pounds per year
TAC = toxic air contaminant

Table 7.6-4
Toxic Air Contaminant Emission Rates From Operation of the Diesel Black Start and Fire Pump Engines

Engine	Chemical Species	Emission Factor[1]	Maximum Hourly Emissions per Engine (lb/hr)	Annual Emissions Per Engine (lb/yr)
Black Start	Diesel Particulate (PM_{10})[2]	0.20 g/kW-hr	0.661	7.930
Fire Pump	Diesel Particulate (PM_{10})[2]	0.14 g/hp-hr	0.074	3.848

Notes:
[1] See Appendix N for detailed emission calculations. Emission factors obtained from engine vendors.
[2] Not a Clean Air Act Hazardous Air Pollutant (HAP).
g/kW-hr = grams per kilowatt hour
g/hp-hr = grams per horsepower hour
lb/hr = pounds per hour
lb/yr = pounds per year
TAC = toxic air contaminant

Table 7.6-5
Total Project Estimated Cancer Risk and Acute and Chronic Noncancer Total Hazard Indices

Location	Cancer Risk	Chronic Hazard Index	Acute Risk Hazard Index
Point of maximum impact	0.856 excess risk in 1 million	0.030 total hazard index	0.115 total hazard index
Nearest sensitive receptor	0.047 excess risk in 1 million	0.001 total hazard index	0.053 total hazard index

Table 7.6-6
Laws, Ordinances, Regulations, and Standards

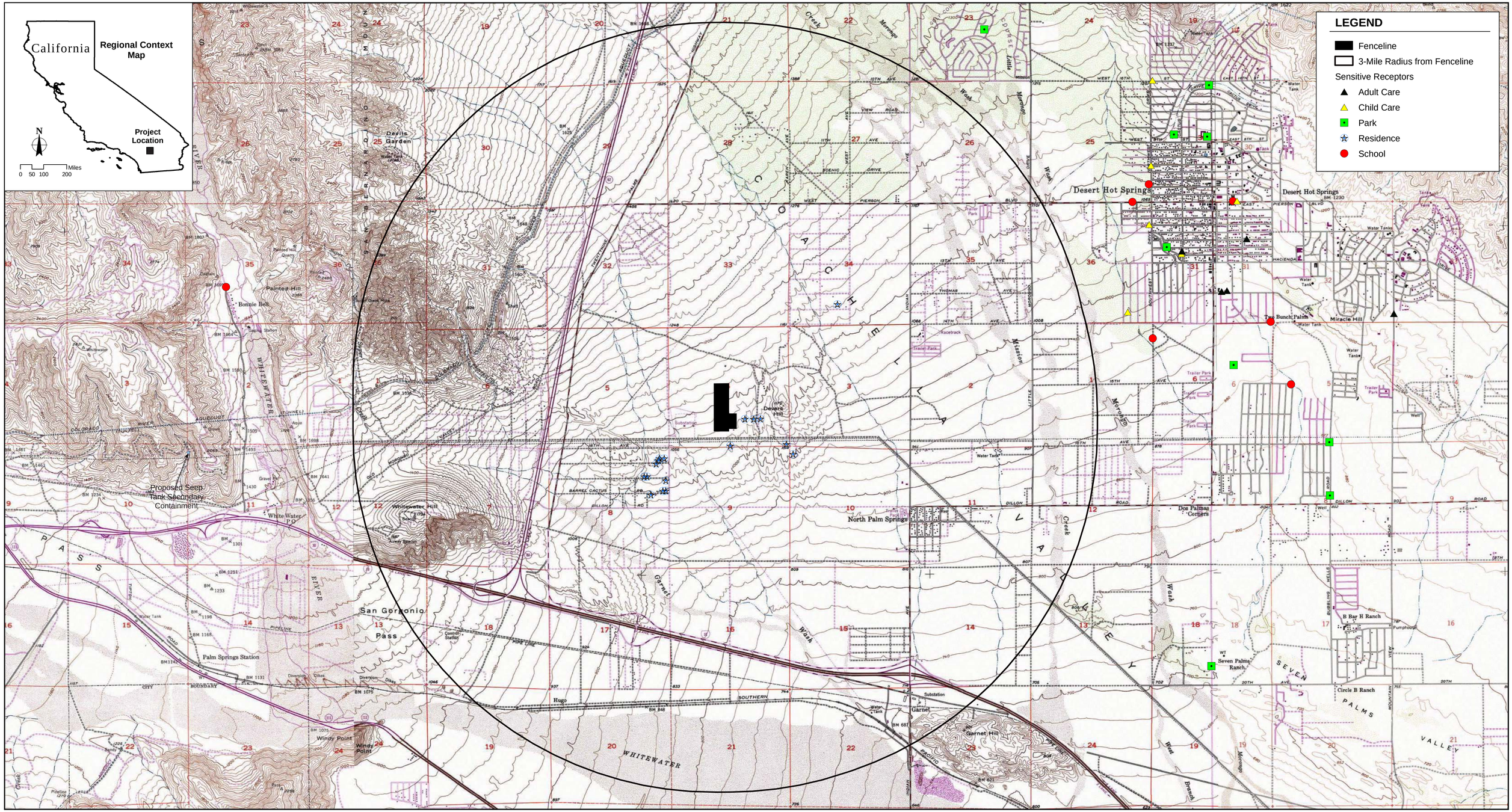
Authority	Administering Agency	Requirement	Project Compliance
Federal			
Clean Air Act (CAA)	U.S. EPA CARB SCAQMD	Protect public from unhealthful exposure to air pollutants.	Based on the results of the risk assessment, health risks due to proposed project emissions of air toxics would not exceed acceptable levels (Section 7.6, Public Health). Emissions of criteria pollutants will be minimized by applying BACT to the facility. Increases in emissions of criteria pollutants will be fully offset (Section 7.1 Air Quality).
State			
California Public Resource Code § 25523(a); 20 CCR § 1752.5, 2300-2309, and Division 2 Chapter 5, Article 1, Appendix B, Part (1)	CEC	Assure protection of environmental quality; requires quantitative HRA.	The HRA in Section 7.6, Public Health, of this AFC satisfies this requirement.
California Clean Air Act, TAC Program, H&SC § 39650, et seq.	SCAQMD with CARB oversight	Requires quantification of TAC emissions, use of BACT, and preparation of an HRA.	The proposed project would not cause unsafe exposure to TACs based on results of HRA (Section 7.6, Public Health), and has performed a BACT assessment (Section 7.1, Air Quality).
H&SC, Part 6, § 44300 et seq. (Air Toxics "Hot Spots")	SCAQMD with CARB/ OEHHA oversight	Requires inventorying of TACs and HRA, as well as public notification of predicted health risks.	The HRA presented in Section 7.6, Public Health, of this AFC satisfies this requirement.
H&SC § 41700	SCAQMD with CARB oversight	Prohibits emissions in quantities that adversely affect public health, other businesses or property.	Section 7.1, Air Quality, and the HRA (Section 7.6, Public Health) presented in this AFC satisfy this requirement.
Local			
SCAQMD Rule 1401	SCAQMD	Requires use of T-BACT for major sources and an HRA to predict health risks.	T-BACT will be applied. The HRA presented in Section 7.6, Public Health, of this AFC has been conducted in accordance with requirements of this rule.

Table 7.6-6
Laws, Ordinances, Regulations, and Standards

Authority	Administering Agency	Requirement	Project Compliance
SCAQMD Rule 301	SCAQMD	Requires annual fees for toxic air contaminants or ozone depleting compounds.	The HRA presented in Section 7.6, Public Health, of this AFC and the payment of fees to SCAQMD will satisfy these requirements.
SCAQMD Rule 212	SCAQMD	Requires an HRA to estimate the maximum cancer risk for purpose of approving the permit to operate and issuing public notice if necessary.	The HRA presented in Section 7.6, Public Health, of this AFC satisfies this requirement.

Notes:

BACT = Best Available Control Technology
CARB = California Air Resources Board
CCR = California Code of Regulations
CEC = California Energy Commission
CUPA = Certified Unified Program Agency
H&SC = Health and Safety Code
HRA = Health Risk Assessment
SCAQMD = South Coast Air Quality Management District
LORS = Laws, Ordinances, Regulations, and Standards
OEHHA = Office of Environmental Health Hazard Assessment
OES = Office of Emergency Services
RMP = Risk Management Plan
AFC = Application for Certification
TAC = toxic air contaminant
T-BACT = Toxic Best Available Control Technology
U.S. EPA = United States Environmental Protection Agency



N

0 2,000 4,000

Scale in Feet

1:24,000

Source: USGS TOPO! (24K quads: White Water 1988, Desert Hot Springs 1978, Seven Palms Valley 1978).

SENSITIVE RECEPTORS WITHIN 3 MILES OF THE PROPOSED PROJECT SITE

June 2007
28067168

CPV Sentinel Energy Project
CPV Sentinel, LLC
Riverside County, California

URS

FIGURE 7.6-1

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