TABLE OF CONTENTS

5. Environmental Information 5.6-1

5.6 Public Health 5.6-1
5.6.1 Affected Environment 5.6-3
5.6.2 Environmental Consequences 5.6-4
5.6.2.1 Public Health Impact Assessment Approach 5.6-5
5.6.2.2 Construction Phase Emissions 5.6-9
5.6.2.3 Operational Phase Emissions 5.6-10
5.6.2.4 Model Input Parameters 5.6-22
5.6.2.5 Calculation of Health Effects 5.6-24
5.6.2.6 Health Effects Significance Criteria 5.6-24
5.6.2.7 Estimated Lifetime Cancer Risk 5.6-24
5.6.2.8 Estimated Chronic and Acute Total Hazard Indices 5.6-25
5.6.2.9 Uncertainty in the Public Health Impact Assessment 5.6-26
5.6.2.10 Criteria Pollutants 5.6-27
5.6.3 Cumulative Impact Analysis 5.6-27
5.6.4 Mitigation Measures 5.6-28
5.6.5 Laws, Ordinances, Regulations, and Standards 5.6-28
5.6.5.1 Federal 5.6-28
5.6.5.2 State 5.6-28
5.6.5.3 Local 5.6-30
5.6.6 Involved Agencies and Agency Contacts 5.6-30
5.6.7 Permits Required and Permit Schedule 5.6-30
5.6.8 References 5.6-31

Tables

Table 5.6-1 Summary of all Operational TACs and Toxicity Values Used to Characterize Health Risks
Table 5.6-2 HRSG Combustion Turbine (GE 7FB) Stack TACs Emission Rates
Table 5.6-3 Auxiliary CTG (GE LMS100®) TACs Emission Rates
Table 5.6-4 Cooling Tower TACs Emission Rates
Table 5.6-5 Gasifier Refractory Heater TACs Emission Rates
Table 5.6-6 Auxiliary Boiler TACs Emission Rates
Table 5.6-7 Gasification Flare TACs Emission Rates
Table 5.6-8 SRU Flare TACs Emission Rates
Table 5.6-9 Rectisol Flare TAC Emission Rates
Table 5.6-10 Tail Gas Thermal Oxidizer TACs Emission Rates
Table 5.6-11 Carbon Dioxide Vent TACs Emission Rates
Table 5.6-12 Emergency Generator TACs Emission Rates
Table 5.6-13 Fire Water Pump TACs Emission Rates
Table 5.6-14 EMFAC2007 Heavy Truck Emission Factors and AERMOD Emission Rates
Table 5.6-15 Estimated Cancer Risk and Acute and Chronic Non-cancer THI Due to Project TAC Emissions

Table 5.6-16 Estimated Cancer Risk and Acute and Chronic Non-cancer THI Due to HECA TAC Emissions with Carbon Dioxide Vent Operating
Table 5.6-17 Summary of LORS – Public Health
Table 5.6-20 Agency Contacts

Figures

Figure 5.6-1 Sensitive Receptors within 3 miles of the Project Site
Figure 5.6-2 Other Receptors in the Vicinity of the Project Site
Figure 5.6-3 Locations of Maximum Health Risks

5.6 PUBLIC HEALTH

Hydrogen Energy International LLC (HEI or Applicant) is jointly owned by BP Alternative Energy North America Inc. and Rio Tinto Hydrogen Energy LLC. HEI is proposing to build an Integrated Gasification Combined Cycle power generating facility called Hydrogen Energy California (HECA or Project) in Kern County, California. The Project will produce low-carbon baseload electricity by capturing carbon dioxide (CO_2) and transporting it for CO_2 enhanced oil recovery (EOR) and sequestration (storage)[1].

The 473-acre Project Site is approximately 7 miles west of the outermost edge of the city of Bakersfield and 1.5 miles northwest of the unincorporated community of Tupman in western Kern County, California, as shown in Figure 2-1, Project Vicinity. HEI is also acquiring an additional 628 acres of land adjacent to the Project Site, herein referred to as "Controlled Area" (see Figure 2-4). HEI will own this entire approximately 1,100-acre property and have control over public access and future land use. For the purposes of the Public Health analysis, impacts were determined outside of both the Project Site and the Controlled Area combined.

The Project Site is near a hydrocarbon-producing area known as the Elk Hills Field. The Project Site is currently used for agricultural purposes. Existing surface elevations vary from about 282 feet to 291 feet above mean sea level.

The Project will gasify petroleum coke (petcoke) (or blends of petcoke and coal, as needed) to produce hydrogen to fuel a combustion turbine operating in combined cycle mode. The Gasification Block feeds a 390-gross-megawatt (MW) combined cycle plant. The net electrical generation output from the Project will provide California with approximately 250 MW of low-carbon baseload power to the grid. The Gasification Block will also capture approximately 90 percent of the carbon from the raw syngas at steady-state operation, which will be transported to the Elk Hills Field for CO_2 EOR and Sequestration. In addition, approximately 100 MW of natural gas generated peaking power will be available from the Project.

The Project Site and linear facilities comprise the affected study area and are entirely in Kern County, California. These Project components are described below.

Major on-site Project components will include, as shown on Figure 2-5, Preliminary Plot Plan:

- Solids Handling, Gasification, and Gas Treatment
  - Feedstock delivery, handling and storage
  - Gasification
  - Sour shift/gas cooling
  - Mercury removal
  - Acid gas removal

[1] This carbon dioxide will be compressed and transported via pipeline to the custody transfer point at the adjacent Elk Hills Field, where it will be injected. The CO_2 EOR process involves the injection and reinjection of carbon dioxide to reduce the viscosity and enhance other properties of the trapped oil, thus allowing it to flow through the reservoir and improve extraction. During the process, the injected carbon dioxide becomes sequestered in a secure geologic formation. This process is referred to herein as CO_2 EOR and Sequestration.

- Power Generation
  - Combined cycle power generation
  - Auxiliary combustion turbine generator
  - Electrical switching facilities

- Supporting Process Systems
  - Natural gas fuel systems
  - Air separation unit (ASU)
  - Sulfur recovery unit/Tail Gas Treating Unit
  - Zero liquid discharge (ZLD) units for process and plant waste water streams
  - Carbon dioxide compression
  - Raw water treatment plant
  - Other plant systems

The Project also includes the following off-site facilities, as shown on Figure 2-7, Project Location Map:

- **Electrical Transmission Line** – An electrical transmission line will interconnect the Project to Pacific Gas & Electric's (PG&E) Midway Substation. Two alternative transmission line routes are proposed; each alternative is approximately 8 miles in length.

- **Natural Gas Supply** – A natural gas interconnection will be made with PG&E or So Cal Gas natural gas pipelines, each of which are located southeast of the Project Site. The natural gas pipeline will be approximately 8 miles in length.

- **Water Supply Pipelines** – The Project will utilize brackish groundwater supplied from the Buena Vista Water Storage District (BVWSD) located to the northwest. The raw water supply pipeline will be approximately 15 miles in length. Potable water for drinking and sanitary use will be supplied by West Kern Water District to the southeast. The potable water supply pipeline will be approximately 7 miles in length.

- **Carbon Dioxide Pipeline** – The carbon dioxide pipeline will transfer the carbon dioxide captured during gasification from the Project Site southwest to the custody transfer point. Two alternative carbon dioxide pipeline routes are proposed; each alternative will be approximately 4 miles in length.

The Project components described above are shown on Figure 2-8, Project Location Map, which depicts the region, the vicinity, the Project Site and its immediate surroundings.

All temporary construction equipment laydown and parking, including construction parking, offices, and construction laydown areas, will be on the Project Site.

To assess the potential impact of the Project on public health, a human health risk assessment (HRA) was performed, based on the Project's emissions of hazardous air pollutants (HAPs) and toxic air contaminants (TACs). The federal Clean Air Act (CAA) regulates HAPs, airborne pollutants that are known to have adverse human health effects. Unlike criteria pollutants, HAPs do not have adopted ambient air quality standards. HAPs have been regulated at the federal level

since the CAA of 1977 under Title 40 of the Code of Federal Regulations, Part 61 (40 CFR Part 61). Similar to the federal program, the California Clean Air Act regulates TACs, a class of airborne pollutants similar to the federal HAPs. Pollutants addressed under this section are generally referred to as TACs, except where federal designation is required.

This section describes the methodology and results of the HRA for this Project. The purpose of the HRA is to evaluate potential public exposure and adverse health effects due to TAC emissions associated with routine Project operations. Impacts due to the Project's emissions of criteria pollutants (i.e., pollutants for which federal or state ambient air quality standards [AAQS] have been promulgated) are described in Section 5.1, Air Quality. Potential public exposure to accidental releases of hazardous materials on the Project Site during operation is addressed in Section 5.12, Hazardous Materials Handling. Potential exposure to hazardous substances encountered due to facility demolition activities in support of the Project is discussed in Section 5.12.

5.6.1 Affected Environment

The Project is near an oil-producing area in Kern County, California, as shown in Figure 2-1. The Project Site is in western unincorporated Kern County, approximately 7 miles west of the city of Bakersfield, 1.5 miles northwest of the unincorporated community of Tupman, and approximately 6 miles southeast of the unincorporated community of Buttonwillow. The Project Site is bounded by Adohr Road on the north, Tupman Road to the east, an irrigation canal to the south, and Dairy Road to the west. Primary access to the site is from Adohr Road. Stockdale Highway and Interstate 5 are about 1 mile to the north and 3 miles to the east, respectively.

The western border of the Tule Elk State Natural Reserve is approximately 1,700 feet to the east of the Project Site and Controlled Area.

The California Energy Commission (CEC) defines sensitive receptors as infants and children, the elderly, the chronically ill, and any other members of the general population who are more susceptible to the effects of exposure to environmental contaminants than the population at large. For the purposes of this analysis, sensitive receptors are defined as the locations occupied by groups of individuals that may be more susceptible than the general population to health risks from a chemical exposure. These individuals include infants and children, the elderly, and the chronically ill. Sensitive receptor locations therefore include schools (public and private), day care facilities, convalescent homes, parks, and hospitals.

Two sensitive receptors exist within 6 miles of the Project (6 miles is the extent of the modeling receptor grid): Elk Hills elementary school, 1.3 miles to the southeast, and the Tule Elk State Natural Reserve, as described above. The Universal Transverse Mercator (UTM) coordinates of Elk Hills elementary school are 285,959.4 meters east and 3,908,409.0 meters north.
Figure 5.6-1, Sensitive Receptors Located within 6 miles of the Project Site, shows the location of these sensitive receptors; however, the HRA approach treats all human receptors as sensitive receptors. The closest residential neighborhood is in the unincorporated community of Tupman, 1.5 miles southeast of the Project boundary. There are also additional single-family residences in the Project vicinity, including residences located approximately 370 feet to the northwest; 1,400 feet to the east; and 3,300 feet to the southeast of the Project Site.

After communicating with the local public health department at Kern County, health studies could not be identified concerning the potentially affected population(s) within a 6-mile radius of the Project Site related to respiratory illnesses, cancers, or related diseases (Chung 2008).

The *Kern County Department of Public Health: Health Status Report – 2003* calculated average cancer mortality rates from 1993 to 2002 in Kern County as 183.0 per 100,000 people, compared to California's average of 185.0/100,000 people (Jinadu 2003). The leading causes of death have remained consistent, with diseases of the heart and cancer as first and second leading causes of death, accounting for more than 60 percent of all deaths. The report compares the county's performance to the national objectives outlined in the U.S. Department of Health and Human Services' report, "Healthy People 2010: Understanding and Improving Health" (U.S. Department of Health and Human Services 2000). "Kern County has made appreciable progress towards the 2010 goals in many areas of health. Yet, in other areas, substantial work still needs to be done to improve the health of our residents." In 2001, the Kern County death rate from heart disease was nearly 20 percent higher than the statewide average rate for California.

Recent data from the California Department of Public Health, 2007 County Profiles, averaged from the start of 2003 through the end of 2004, show Kern County ranked 58 out of 58 counties in age-adjusted death rates from Coronary Heart Disease with 1,320.7 deaths per 100,000 people, compared to the California average of 163.1 per 100,000 people (CDPH 2008). Kern County also ranked last in overall mortality with 5,347.3 deaths per 100,000 people compared to the state average of 716.7 deaths per 100,000.

Coccidioides immites, a fungus that lives in the soils in southwestern United States and northwestern Mexico, is endemic to Kern County. The tiny spores become wind-borne and inhaled into the lungs where they can cause Coccidioidomycosis or "Valley Fever." About 60 percent of the people who breathe in the spores do not get sick at all. For some it may feel like the cold or flu, and for some, pneumonia-like symptoms may occur, requiring medication and bed rest. Approximately 1 out of 200 who do get sick develop the disseminated form (the disease spreads past the lungs to the blood system), which can be fatal. The Health Officer recommends taking the following precautions for construction projects in Kern County:

1. When the top soil of undeveloped land is to be disturbed for construction, the standard precautionary measure of wetting the soil should be aggressively carried out.
2. It is advisable to perform work on non-windy days.
3. Workers doing soil excavation should wear simple dust masks for protection against exposure.

Further information on Valley Fever can be found in the "Valley Fever Task Force Report on the Control of *Coccidioides immites"* produced by the Kern County Department of Public Health (Jinadu 1995).

5.6.2 Environmental Consequences

This section describes the evaluation of potential public health risks due to construction and operation of the power plant generation facility, as well as the methodology and results of the

HRA. A significant impact is defined as a maximum incremental cancer risk greater than 10 in 1 million, a chronic total hazard index (THI) greater 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 Project are described.

5.6.2.1 Public Health Impact Assessment Approach

The potential human health risks posed by the Project's emissions were assessed by following the Office of Environmental Health Hazard Assessment (OEHHA) Air Toxics Hot Spots Program Risk Assessment Guidelines (Cal/EPA/OEHHA 2003). The 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 §§ 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.

As recommended by the OEHHA guidelines, the California Air Resources Board (CARB) Hotspots Analysis and Reporting Program (HARP) was used to perform an OEHHA Tier 1 HRA for the Project. HARP includes two modules: a dispersion module and a risk module. The HARP dispersion module incorporates the U.S. Environmental Protection Agency (USEPA) ISCST3 air dispersion model. The HARP risk module implements the latest Risk Assessment Guidelines developed by OEHHA. For consistency with the criteria pollutant modeling, the dispersion modeling was conducted with AERMOD software. CARB has created a software package called HARP On Ramp to convert AERMOD dispersion results into a format that can be read into the HARP risk module. Thus, HARP with AERMOD was used for this HRA.

One exception from AERMOD was required because the carbon dioxide vent source emits a plume that will be essentially all carbon dioxide and emitted at ambient temperature. The result is a plume that is approximately 50 percent denser than ambient air. AERMOD is not suitable for modeling dense plumes. The USEPA-approved dense plume dispersion model DEGADIS was used to model the carbon dioxide vent. The only air toxic compounds in the inventory for the carbon dioxide vent are hydrogen sulfide (H_2S) and carbonyl sulfide (COS). Additional discussion on the modeling of the carbon dioxide vent is provided later in this section.

The HRA was conducted in four steps using the HARP:

1. Hazard identification and emission quantification
2. Exposure assessment
3. Dose-response assessment
4. Risk characterization

First, hazard identification was performed to determine the potential health effects that could be associated with Project emissions. The purpose was to identify whether pollutants emitted during power plant operation could be characterized as potential human carcinogens, or associated with other types of adverse health effects. Based on OEHHA guidelines, a list of pollutants with potential cancer and non-cancer health effects associated with the emissions from the Project has been constructed in Table 5.6-1, Summary of all Operational TACs and Toxicity

Values Used to Characterize Health Risks. Three compounds in this table are not carcinogens, nor do they have chronic or acute health effects: COS, cobalt, and zinc. These compounds are included in the table for completeness in the disclosure of all toxic compounds emitted from Project operations. However, they do not contribute to the calculation of health risks. The sources emitting the TACs listed in Table 5.6-1 are summarized in Section 5.6.2.3 the table.

Second, an exposure assessment was conducted to estimate the extent of public exposure to the Project emissions. Public exposure is quantified based on the predicted maximum short- and long-term ground level concentrations resulting from project emissions, the exposure pathway(s), and the duration of exposure to those emissions. Dispersion modeling was performed using the AERMOD model to estimate the highest ground level concentrations near the Project Site and Controlled Area boundary. The methods used in the dispersion modeling were consistent with the approach described in Section 5.1, Air Quality, and the modeling protocol submitted for the Project to CEC, USEPA, and San Joaquin Valley Air Pollution Control District (SJVAPCD) (URS 2009).

Third, a dose-response assessment was performed in HARP that incorporated the maximum 1-hour and annual ground-level concentrations predicted by AERMOD to characterize the relationship between pollutant exposure and the potential incidence of an adverse health effect in the 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 non-cancer risks. The OEHHA guidelines provide potency factors and RELs for an extensive list of TACs, including those listed in Table 5.6-1, Summary of Operational TACs and Toxicity Values Used to Characterize Health Risks. All exposure pathways were included in this analysis except the fish ingestion and drinking water consumption pathways, no unenclosed water storage reservoirs exist near the site.

For the calculation of cancer risk, the duration of exposure to Project emissions was assumed to be 24 hours per day for 70 years, at all receptors. For the calculation of acute risk, it was assumed that acute exposure is one that occurs over a 1-hour or less time period. For the calculation of chronic risk, it was assumed that chronic exposure is one that occurs over more than 12 percent of a 70-year lifetime. 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.

Fourth, risk characterization was performed to integrate the health effects and public exposure information and provide quantitative estimates of health risks resulting from Project emissions. Risk modeling was performed using HARP to estimate cancer and non-cancer health risks due to Project operational emissions. The HARP model uses OEHHA equations and algorithms to calculate health risks based on input parameters such as emissions, ground level concentrations, and toxicological data.

The plume from the intermittent carbon dioxide vent is denser than air; as such, it was necessary to model the impacts from the carbon dioxide vent using DEGADIS rather than AERMOD. DEGADIS is a dense gas dispersion model supported by USEPA. The SCREEN3 model was used to extend the then neutral density plume downwind to locations offsite when DEGADIS predicted a ground-level maximum within the Project Site and Controlled Area boundary.

Table 5.6-1
Summary of Operational TACs and Toxicity Values Used to Characterize Health Risks

Compound	CAS #	Acute REL ($\mu g/m^3$)	Chronic REL ($\mu g/m^3$)	Inhalation Cancer Potency Factor $(mg/kg\text{-}day)^{-1}$
1,3-Butadiene	106-99-0	–	2.1E+01	6.0E-01
Acetaldehyde	75-07-0	–	9.0E+00	1.0E-02
Acrolein	107-02-8	1.9E-01	6.0E-02	–
Ammonia	7664-41-7	3.2E+03	2.0E+02	–
Antimony	7440-36-0	–	–	–
Arsenic	7440-38-2	1.9E-01	3.0E-02	1.2E+01
Barium	7440-39-3	–	–	–
Benzene	71-43-2	1.3E+03	6.0E+01	1.0E-01
Beryllium	7440-41-7	–	7.0E-03	8.4E+00
Cadmium	7440-43-9	–	2.0E-02	1.5E+01
Carbon Disulfide	75-15-0	6.2E+03	8.0E+02	–
Carbonyl Sulfide	463-58-1	–	–	–
Chromium	7440-47-3	–	2.0E-01	5.1E+02
Chromium, (hexavalent)	18540-29-9	–	2.0E-01	5.1E+02
Chromium, Total	0-00-5	–	2.0E-01	5.1E+02
Cobalt	7440-48-4	–	–	–
Copper	7440-50-8	1.0E+02	–	–
Cyanides	57-12-5	3.4E+02	9.0E+00	–
Dichlorobenzene	25321226	–	1.0E+03	–
Ethylbenzene	100-41-4	–	2.0E+03	8.7E-03
Fluoride	–	2.4E+02	1.3E+01	–
Formaldehyde	50-00-0	9.4E+01	3.0E+00	2.1E-02
Hexane	110-54-3	–	7.0E+03	–
Hydrochloric Acid	7647-01-0	2.1E+03	9.0E+00	–
Hydrogen Fluoride (Hydrofluoric Acid)	7664-39-3	2.4E+02	1.4E+01	–
Hydrogen Sulfide	7783-06-4	4.2E+01	1.0E+01	–
Lead	7439-92-1	–	–	4.2E-02
Manganese	7439-96-5	–	2.0E-01	–
Mercury	7439-97-6	1.8E+00	9.0E-02	–
Methyl Bromide (Bromomethane)	74-83-9	3.9E+03	5.0E+00	–
Methylene Chloride (Dichloromethane)	75-09-2	1.4E+04	4.0E+02	3.5E-03
Naphthalene	91-20-3	–	9.0E+00	1.2E-01
n-Hexane	110-54-3	–	7.0E+03	–
Nickel	7440-02-0	6.0E+00	5.0E-02	9.1E-01
Phenol	108-95-2	5.8E+03	2.0E+02	–

Table 5.6-1
Summary of Operational TACs and Toxicity Values Used to Characterize Health Risks (Continued)

Compound	CAS #	Acute REL ($\mu g/m^3$)	Chronic REL ($\mu g/m^3$)	Inhalation Cancer Potency Factor $(mg/kg\text{-}day)^{-1}$
Propylene	115-07-1	–	3.0E+03	–
Propylene Oxide	75-56-9	3.1E+03	3.0E+01	1.3E-02
Selenium	7782-49-2	–	2.0E+01	–
Sulfuric Acid and Sulfates	7664-93-9	1.2E+02	1.0E+00	–
Toluene	108-88-3	3.7E+04	3.0E+02	–
Vanadium	7440-62-2	3.0E+01	–	–
Xylenes	1330-20-7	2.2E+04	7.0E+02	–
Zinc	7440-66-6	–	–	–
Diesel Particulate Matter	DPM	–	5.0E+00	1.1E+00–
2-Methylnaphthalene	PAH	–	–	–
3-Methylchloranthrene	PAH	–	–	2.2E+01
7,12-Dimethylbenz(a)anthracene	PAH	–	–	2.5E+02
Acenaphthene	PAH	–	–	–
Acenaphthylene	PAH	–	–	–
Anthracene	PAH	–	–	–
Benz(a)anthracene	PAH	–	–	3.9E-01
Benzo(a)pyrene	PAH	–	–	3.9E+00
Benzo(b)fluoranthene	PAH	–	–	3.9E-01
Benzo(g,h,i)perylene	PAH	–	–	–
Benzo(k)fluoranthene	PAH	–	–	3.9E-01
Chrysene	PAH	–	–	3.0E-02
Dibenzo(a,h)anthracene	PAH	–	–	4.1E+00
Fluoranthene	PAH	–	–	–
Fluorene	PAH	–	–	–
Indeno(1,2,3-cd)pyrene	PAH	–	–	3.9E-01
PAH (excluding Naphthalene)	PAH	–	–	3.9E+00
Phenanthrene	PAH	–	–	–
Pyrene	PAH	–	–	–

Source: HECA Project

Notes:
1) Data from OEHHA/CARB (2008)
2) No REL established

CAS # = Chemical Abstracts Service Registry Number
DPM = diesel particulate matter
PAH = polycyclic aromatic hydrocarbons
REL = reference exposure level
$\mu g/m^3$ = micrograms per cubic meter
mg/kg-day = milligrams per kilogram per day

Hydrogen sulfide is the only toxic compound in the carbon dioxide vent stream associated with chronic and acute health effects and is not a carcinogen; therefore, this was the only toxic compound modeled with DEGADIS/SCREEN3. Carbon monoxide would also be emitted from the carbon dioxide vent; this was modeled in the air quality analysis in Section 5.1. COS may also be present in the carbon dioxide vent stream, but only hydrogen sulfide was considered for purposes of the HRA because no potency factors for cancer risk or RELs for acute and chronic non-cancer risks are available for COS.

The location of the maximum chronic and acute health risks from all toxic compounds associated with Project operations was identified. The method with which impacts from all toxic compounds (including hydrogen sulfide) were combined is discussed below.

The point of maximum acute impact was predicted at a point approximately 3.6 kilometers (km) southwest of the Project Site and Controlled Area boundary. DEGADIS/SCREEN3 was run to calculate hydrogen sulfide impacts at this location. The DEGADIS/SCREEN3 acute hydrogen sulfide impact was then added to the HARP maximum impact. In addition, the point of maximum chronic impact was predicted at a point on the southern Project Site and Controlled Area boundary, and DEGADIS/SCREEN3 was run to calculate hydrogen sulfide impacts at this location as well. The DEGADIS/SCREEN3 chronic hydrogen sulfide impact was then added to the HARP maximum impact.

To complete the analysis, DEGADIS/SCREEN3 modeled the location of maximum hydrogen sulfide ground level concentration at a point along the northwestern interior corner which is the closest Project Site and Controlled Area boundary to the carbon dioxide vent. HARP modeled the chronic and acute health effects for all other toxic compounds at this maximum DEGADIS/SCREEN3 location, and the chronic and acute risks from DEGADIS/SCREEN3 and HARP were added together at this point.

Detailed descriptions of the model input parameters and results of the HRA are given in Section 5.6.2.4, Model Input Parameters.

5.6.2.2 Construction Phase Emissions

Due to the relatively short duration of Project site preparation and construction (i.e., 37 months), significant long-term exposure is not expected to occur as a result of Project construction emissions. Of air pollutants emitted during the construction period, diesel particulate matter has the largest potential for human health risk. Diesel particulate matter has been classified by CARB and OEHHA as a TAC and a carcinogen. However, the exposure assessment conducted for carcinogens is typically 70 years. Due to the short duration of the construction effort, significant carcinogenic health risks are not predicted for the construction period.

To ensure worker safety during construction, safe work practices will be followed (see Section 5.7, Worker Safety and Health). Section 5.1, Air Quality, presents a detailed analysis of the potential environmental impacts due to criteria pollutant emissions during construction, and a discussion of measures that will be implemented to control or reduce these emissions.

5.6.2.3 Operational Phase Emissions

Stationary Sources

The following operational sources associated with the Project will generate emissions of TACs. These emissions will be generated from the combustion of natural gas, syngas, diesel fuel, and process vent gasses, in addition to the operation of the cooling towers.

Power Block	Gasification Block	Ancillary Equipment
• HRSG Combustion Turbine (GE 7FB) • Auxiliary CTG (GE LMS100® PA) • Power Block Cooling Towers	• Gasifier Refractory Heaters • Auxiliary Boiler • Gasification Flare • SRU Flare • Rectisol Flare • Tail Gas Thermal Oxidizer • ASU and Gasification Cooling Towers • Carbon Dioxide Vent	• Diesel Generator • Fire Pump Engine

A summary of the TACs that are expected to be emitted as a result of operations and the corresponding toxicity values used for evaluation are shown in Table 5.6-1, Summary of Operational TACs and Toxicity Values Used to Characterize Health Risks.

Tables 5.6-2 through 5.6-13 outline the estimated TAC emission rates for each source listed above. These rates were determined based on the size, capacity, and expected annual operating hours of each piece of equipment. Emission factors for these calculations were derived from a variety of sources including: *California Air Toxics Emission Factor* (CATEF), USEPA AP-42, Wabash River test data, Air District Guidance, and analytical water tests. In addition, emissions resulting from ammonia slip from the heat recovery steam generator (HRSG) and auxiliary combustion turbine generator (CTG) selective catalytic reduction (SCR) systems were included.

TAC emission estimates were made using the following assumptions for each source:

- HRSG Combustion Turbine (GE 7FB) – TAC emissions from the combustion turbine were assumed based on operating conditions firing hydrogen-rich fuel. Hourly emission rates were calculated based on the hourly heat input required for operation at 100 percent load at winter minimum temperature (20 ^{o}F) with duct firing. Annual emissions rates were calculated based on 8,322 hours per year at 100 percent load at annual average temperature (65 ^{o}F) with duct firing. Emission factors were taken from the references cited and are considered the most representative because of the use of similar technology.

- Auxiliary CTG (GE LMS100®) – Hourly emissions were calculated based on the maximum hourly heat input, which corresponds to 100 percent load at annual average temperature (65 ^{o}F) with evaporative cooling. Annual emissions rates were calculated based on 4,110 hours per year at 100 percent load at annual average temperature (65 ^{o}F) with duct firing.

Table 5.6-2
HRSG Combustion Turbine (GE 7FB) Stack TACs Emission Rates

Compound	CAS #	Emission Factor ($lb/10^{12}$ Btu fuel)	Hourly (lb/hr)	Annual (lb/yr)
Acetaldehyde	75-07-0	1.8	4.41E-03	3.64E+01
Ammonia	7664-41-7		1.84E+01	1.53E+05
Antimony	7440-36-0	1.1	2.69E-03	2.23E+01
Arsenic	7440-38-2	2.4	5.88E-03	4.86E+01
Benz(a)anthracene	56-55-3	0.0023	5.63E-06	4.66E-02
Benzene	71-43-2	2.4	5.88E-03	4.86E+01
Beryllium	7440-41-7	0.26	6.37E-04	5.26E+00
Cadmium	7440-43-9	9.6	2.35E-02	1.94E+02
Carbon Disulfide	75-15-0	46	1.13E-01	9.31E+02
Chromium, (hexavalent)	18540-29-9	0.15	3.75E-04	3.10E+00
Chromium, Total	0-00-5	0.51	1.25E-03	1.03E+01
Cobalt	7440-48-4	0.26	6.37E-04	5.26E+00
Cyanides	57-12-5	5.7	1.40E-02	1.15E+02
Formaldehyde	50-00-0	17	4.16E-02	3.44E+02
Hydrochloric Acid	7647-01-0	13	3.18E-02	2.63E+02
Hydrogen fluoride (Hydrofluoric acid)	7664-39-3	50	1.22E-01	1.01E+03
Lead	7439-92-1	0.56	1.37E-03	1.13E+01
Manganese	7439-96-5	1.0	2.55E-03	2.11E+01
Mercury	7439-97-6	1.2	2.94E-03	2.43E+01
Methyl Bromide (Bromomethane)	74-83-9	47.7	1.17E-01	9.66E+02
Methylene Chloride (Dichloromethane)	75-09-2	2.2	5.39E-03	4.45E+01
Naphthalene	91-20-3	2.5	6.12E-03	5.06E+01
Nickel	7440-02-0	0.39	9.55E-04	7.90E+00
Phenol	108-95-2	36.8	9.01E-02	7.45E+02
Selenium	7782-49-2	0.56	1.37E-03	1.13E+01
Sulfuric Acid and Sulfates	7664-93-9	572	1.40E+00	1.16E+04
Toluene	108-88-3	0.033	8.08E-05	6.68E-01

Source: HECA Project

Notes:
1) HRSG (Firing Syngas) Operating Hours = 8,322 hr/yr
2) Hourly emissions based on 100% load at winter minimum temperature (20 °F)
3) Annual emissions based on 100% load at annual average temperature (65 °F)
4) Emission rates are taken from Wabash River test data and the National Energy Technology Laboratory, U.S. Dept of Energy, Major Environmental Aspects of Gasification-based Power Generation Technologies, Final Report, December 2002.
5) Ammonia slip from the SCR (5 parts per million volumetric dry [ppmvd] @ 15% oxygen) – provided by Fluor – see Criteria Pollutant emission spreadsheet for details

CAS # = Chemical Abstracts Service Registry Number
HRSG = heat recovery steam generator
TAC = toxic air contaminant
lb/hr = pounds per hour
lb/yr = pounds per year

Table 5.6-3
Auxiliary CTG (GE LMS100®) TACs Emission Rates

Compound	CAS #	Emission Factor ($lb/10^6$ Btu fuel)	Hourly (lb/hr)	Annual (lb/yr)
1,3-Butadiene	106-99-0	1.24E-07	1.13E-04	4.64E-01
Acetaldehyde	75-07-0	1.34E-04	1.22E-01	5.02E+02
Acrolein	107-02-8	3.62E-06	3.30E-03	1.36E+01
Ammonia	7664-41-7		1.20E+01	4.95E+04
Benzene	71-43-2	3.26E-06	2.97E-03	1.22E+01
Ethylbenzene	100-41-4	1.75E-05	1.59E-02	6.55E+01
Formaldehyde	50-00-0	3.60E-04	3.28E-01	1.35E+03
Hexane	110-54-3	2.53E-04	2.30E-01	9.47E+02
Propylene	115-07-1	7.53E-04	6.86E-01	2.82E+03
Propylene Oxide	75-56-9	4.67E-05	4.25E-02	1.75E+02
Toluene	108-88-3	6.93E-05	6.31E-02	2.59E+02
Xylenes	1330-20-7	2.55E-05	2.32E-02	9.55E+01
Benzo(a)anthracene	PAH	2.21E-08	2.01E-05	8.27E-02
Benzo(a)pyrene	PAH	1.36E-08	1.24E-05	5.09E-02
Benzo(b)fluoranthene	PAH	1.10E-08	1.00E-05	4.12E-02
Benzo(k)fluoranthene	PAH	1.07E-08	9.75E-06	4.01E-02
Chrysene	PAH	2.46E-08	2.24E-05	9.21E-02
Dibenzo(a,h)anthracene	PAH	2.29E-08	2.09E-05	8.57E-02
Indeno(1,2,3-cd)pyrene	PAH	2.29E-08	2.09E-05	8.57E-02
Naphthalene	PAH	1.62E-06	1.48E-03	6.06E+00

Notes:
1 Auxiliary CTG Operating Hours = 4,110
2) Hourly and annual emissions based on 100% load at annual average temperature (65 °F) with evaporative cooling. This scenario represents worst-case heat input for both averaging periods.
3) Emission factors obtained from the CATEF database for natural-gas–fired combustion turbines. Formaldehyde, benzene, and acrolein emission factors are from the background document for AP-42, Section 3.1, Table 3.1-3, because these factors are for turbines equipped with CO catalyst.
4) Ammonia emission rate based on an exhaust ammonia limit of 10 parts per million volumetric dry at 15 % oxygen.

Btu = British thermal units
CAS = Chemical Abstracts Service Registry Number
CATEF = California Air Toxics Emission Factor
CTG = combustion turbine generator
PAH = polycyclic aromatic hydrocarbons
TAC = toxic air contaminant

Table 5.6-4
Cooling Tower TACs Emission Rates

Compound	CAS #	Emission Factor (ppm)	Hourly (lb/hr)	Annual (lb/yr)
Power Block				
Arsenic	7440-38-2	0.026	1.13E-05	9.38E-02
Copper	7440-50-8	0.005	2.19E-06	1.82E-02
Fluoride		0.45	1.97E-04	1.64E+00
Manganese	7439-96-5	1.29	5.63E-04	4.68E+00
Selenium	7782-49-2	0.02	9.36E-06	7.79E-02
Zinc	7440-66-6	0.01	4.38E-06	3.64E-02
Process Area				
Arsenic	7440-38-2	0.026	2.72E-06	2.27E-02
Copper	7440-50-8	0.005	5.29E-07	4.40E-03
Fluoride		0.45	4.76E-05	3.96E-01
Manganese	7439-96-5	1.29	1.36E-04	1.13E+00
Selenium	7782-49-2	0.02	2.26E-06	1.88E-02
Zinc	7440-66-6	0.01	1.06E-06	8.80E-03
ASU				
Arsenic	7440-38-2	0.026	2.59E-06	2.15E-02
Copper	7440-50-8	0.005	5.03E-07	4.18E-03
Fluoride		0.45	4.52E-05	3.76E-01
Manganese	7439-96-5	1.29	1.29E-04	1.08E+00
Selenium	7782-49-2	0.02	2.15E-06	1.79E-02
Zinc	7440-66-6	0.01	1.01E-06	8.36E-03

Notes:
1) Cooling Tower Operating Hours = 8,322 hr/yr
2) Arsenic ppm value shown taken as average of analytical test results (Fruit Growers Laboratory)
3) Copper ppm value shown is one-half of stated detection limit
4) Fluoride ppm value shown taken as average of analytical test results (Fruit Growers Laboratory)
5) Manganese ppm value shown taken as average of analytical test results (Fruit Growers Laboratory)
5) Selenium ppm value shown taken as average of analytical test results (California Department of Water Resources)
7) Zinc ppm value shown is one-half of stated detection limit
ASU = air separation unit
CAS = Chemical Abstracts Service Registry Number
ppm = parts per million
TAC = toxic air contaminant

Table 5.6-5
Gasifier Refractory Heater TACs Emission Rates

Compound	CAS #	Emission Factor ($lb/10^6$ scf)	Hourly (lb/hr)	Annual (lb/yr)
Arsenic	7440-38-2	2.00E-04	3.43E-06	6.17E-03
Benzene	71-43-2	2.10E-03	3.60E-05	6.48E-02
Beryllium	7440-41-7	1.20E-05	2.06E-07	3.70E-04
Cadmium	7440-43-9	1.10E-03	1.89E-05	3.39E-02
Chromium	7440-47-3	1.40E-03	2.40E-05	4.32E-02
Cobalt	7440-48-4	8.40E-05	1.44E-06	2.59E-03
Copper	7440-50-8	8.50E-04	1.46E-05	2.62E-02
Formaldehyde	50-00-0	7.50E-02	1.29E-03	2.31E+00
Hexane	110-54-3	1.80E+00	3.09E-02	5.55E+01
Manganese	7439-96-5	3.80E-04	6.51E-06	1.17E-02
Mercury	7439-97-6	2.60E-04	4.46E-06	8.02E-03
Naphthalene	91-20-3	6.10E-04	1.05E-05	1.88E-02
Nickel	7440-02-0	2.10E-03	3.60E-05	6.48E-02
Selenium	7782-49-2	2.40E-05	4.11E-07	7.41E-04
Toluene	108-88-3	3.40E-03	5.83E-05	1.05E-01
Vanadium	7440-62-2	2.30E-03	3.94E-05	7.10E-02
Benzo(a)pyrene	PAH	1.20E-06	2.06E-08	3.70E-05
Benz(a)anthracene	PAH	1.80E-06	3.09E-08	5.55E-05
Benzo(b)fluoranthene	PAH	1.80E-06	3.09E-08	5.55E-05
Chrysene	PAH	1.80E-06	3.09E-08	5.55E-05
Dibenzo(a,h)anthracene	PAH	1.20E-06	2.06E-08	3.70E-05
Indeno(1,2,3-cd)pyrene	PAH	1.80E-06	3.09E-08	5.55E-05
2-Methylnaphthalene	PAH	2.40E-05	4.11E-07	7.41E-04
3-Methylchloranthrene	PAH	1.80E-06	3.09E-08	5.55E-05
7,12-Dimethylbenz(a)anthracene	PAH	1.60E-05	2.74E-07	4.94E-04
Acenaphthene	PAH	1.80E-06	3.09E-08	5.55E-05
Acenaphthylene	PAH	1.80E-06	3.09E-08	5.55E-05
Anthracene	PAH	2.40E-06	4.11E-08	7.41E-05
Benzo(g,h,i)perylene	PAH	1.20E-06	2.06E-08	3.70E-05
Benzo(k)fluoranthene	PAH	1.80E-06	3.09E-08	5.55E-05
Fluoranthene	PAH	3.00E-06	5.14E-08	9.26E-05
Fluorene	PAH	2.80E-06	4.80E-08	8.64E-05
Phenanthrene	PAH	1.70E-05	2.91E-07	5.25E-04
Pyrene	PAH	5.00E-06	8.57E-08	1.54E-04

Source: HECA Project

Notes:
1) Gasifier Operating Hours = 1,800 hr/yr
2) Emission factor source USEPA AP-42 Section 1.4
3) Calculation assumes a typical fuel heating value, ranging from 1,020 to 1,050 Btu/scf.
4) Please note that there are three gasifier heaters. However, the current assumption is that only one gasifier heater is expected to operate at any one time. The health risk assessment included the operation of only one gasifier heater.

Btu = British thermal units
CAS = Chemical Abstracts Service Registry Number
USEPA = U.S. Environmental Protection Agency
HHV = higher heating value
scf = standard cubic feet
TAC = toxic air contaminant

Table 5.6-6
Auxiliary Boiler TACs Emission Rates

Compound	CAS #	Emission Factor ($lb/10^6$ scf)	Hourly (lb/hr)	Annual (lb/yr)
Arsenic	7440-38-2	2.00E-04	2.70E-05	5.92E-02
Benzene	71-43-2	2.10E-03	2.84E-04	6.22E-01
Beryllium	7440-41-7	1.20E-05	1.62E-06	3.55E-03
Cadmium	7440-43-9	1.10E-03	1.49E-04	3.26E-01
Chromium	7440-47-3	1.40E-03	1.89E-04	4.15E-01
Cobalt	7440-48-4	8.40E-05	1.14E-05	2.49E-02
Copper	7440-50-8	8.50E-04	1.15E-04	2.52E-01
Formaldehyde	50-00-0	7.50E-02	1.01E-02	2.22E+01
Hexane	110-54-3	1.80E+00	2.43E-01	5.33E+02
Manganese	7439-96-5	3.80E-04	5.14E-05	1.13E-01
Mercury	7439-97-6	2.60E-04	3.52E-05	7.70E-02
Naphthalene	91-20-3	6.10E-04	8.25E-05	1.81E-01
Nickel	7440-02-0	2.10E-03	2.84E-04	6.22E-01
Selenium	7782-49-2	2.40E-05	3.25E-06	7.11E-03
Toluene	108-88-3	3.40E-03	4.60E-04	1.01E+00
Vanadium	7440-62-2	2.30E-03	3.11E-04	6.81E-01
Benzo(a)pyrene	PAH	1.20E-06	1.62E-07	3.55E-04
Benz(a)anthracene	PAH	1.80E-06	2.43E-07	5.33E-04
Benzo(b)fluoranthene	PAH	1.80E-06	2.43E-07	5.33E-04
Chrysene	PAH	1.80E-06	2.43E-07	5.33E-04
Dibenzo(a,h)anthracene	PAH	1.20E-06	1.62E-07	3.55E-04
Indeno(1,2,3-cd)pyrene	PAH	1.80E-06	2.43E-07	5.33E-04
2-Methylnaphthalene	PAH	2.40E-05	3.25E-06	7.11E-03
3-Methylchloranthrene	PAH	1.80E-06	2.43E-07	5.33E-04
7,12-Dimethylbenz(a)anthracene	PAH	1.60E-05	2.16E-06	4.74E-03
Acenaphthene	PAH	1.80E-06	2.43E-07	5.33E-04
Acenaphthylene	PAH	1.80E-06	2.43E-07	5.33E-04
Anthracene	PAH	2.40E-06	3.25E-07	7.11E-04
Benzo(g,h,i)perylene	PAH	1.20E-06	1.62E-07	3.55E-04
Benzo(k)fluoranthene	PAH	1.80E-06	2.43E-07	5.33E-04
Fluoranthene	PAH	3.00E-06	4.06E-07	8.89E-04
Fluorene	PAH	2.80E-06	3.79E-07	8.29E-04
Phenanthrene	PAH	1.70E-05	2.30E-06	5.03E-03
Pyrene	PAH	5.00E-06	6.76E-07	1.48E-03

Source: HECA Project

Notes:
1) Aux Boiler Operating Hours = 2,190 hr/yr
2) Emission factor source USEPA AP-42 Section 1.4
3) Calculation assumes a typical fuel heating value, ranging from 1,020 to 1,050 Btu/scf.

Btu = British thermal units
CAS = Chemical Abstracts Service Registry Number
USEPA = U.S. Environmental Protection Agency
HHV = higher heating value
PAH = polycyclic aromatic hydrocarbons
scf = standard cubic feet
TAC = toxic air contaminant

Table 5.6-7
Gasification Flare TACs Emission Rates

Compound	CAS #	Emission Factor ($lb/10^6$ scf)	Hourly (lb/hr)	Annual (lb/yr)
Acetaldehyde	75-07-0	0.043	9.07E-02	4.91E+00
Acrolein	107-02-8	0.01	2.11E-02	1.14E+00
Benzene	71-43-2	0.159	3.35E-01	1.82E+01
Ethylbenzene	100-41-4	1.444	3.05E+00	1.65E+02
Formaldehyde	50-00-0	1.169	2.47E+00	1.33E+02
Naphthalene	91-20-3	0.011	2.32E-02	1.26E+00
n-Hexane	110-54-3	0.029	6.12E-02	3.31E+00
PAH (excluding Naphthalene)	PAH	0.003	6.33E-03	3.43E-01
Propylene	115-07-1	2.44	5.15E+00	2.79E+02
Toluene	108-88-3	0.058	1.22E-01	6.62E+00
Xylenes	1330-20-7	0.029	6.12E-02	3.31E+00
Arsenic	7440-38-2	2.00E-04	4.22E-04	2.28E-02
Beryllium	7440-41-7	1.20E-05	2.53E-05	1.37E-03
Cadmium	7440-43-9	1.10E-03	2.32E-03	1.26E-01
Chromium	7440-47-3	1.40E-03	2.95E-03	1.60E-01
Cobalt	7440-48-4	8.40E-05	1.77E-04	9.59E-03
Copper	7440-50-8	8.50E-04	1.79E-03	9.70E-02
Lead	7439-92-1	5.00E-04	1.05E-03	5.71E-02
Manganese	7439-96-5	3.80E-04	8.02E-04	4.34E-02
Mercury	7439-97-6	2.60E-04	5.49E-04	2.97E-02
Nickel	7440-02-0	2.10E-03	4.43E-03	2.40E-01
Selenium	7782-49-2	2.40E-05	5.06E-05	2.74E-03
Vanadium	7440-62-2	2.30E-03	4.85E-03	2.63E-01
Zinc	7440-66-6	2.90E-02	6.12E-02	3.31E+00

Source: HECA Project

Notes:

1) Annual operation assumes total pilot operation of 8,760 hr/yr and 115,500 10^6 Btu/yr during gasifier startup and shutdown.
2) Emission factors based on AP-42 Chapter 1.4 (for metals) and Ventura County Air Pollution Control District AB2588 (for non-metals).
3) Calculation assumes a typical fuel heating value, ranging from 1,020 to 1,050 Btu/scf.

Btu = British thermal units
CAS = Chemical Abstracts Service Registry Number
HHV = higher heating value
scf = standard cubic feet
TAC = toxic air contaminant

Table 5.6-8
SRU Flare TACs Emission Rates

Compound	CAS #	Emission Factor ($lb/10^6$ scf)	Hourly (lb/hr)	Annual (lb/yr)
Acetaldehyde	75-07-0	0.043	1.49E-03	1.16E-01
Acrolein	107-02-8	0.01	3.46E-04	2.71E-02
Benzene	71-43-2	0.159	5.50E-03	4.31E-01
Ethylbenzene	100-41-4	1.444	4.99E-02	3.91E+00
Formaldehyde	50-00-0	1.169	4.04E-02	3.17E+00
Naphthalene	91-20-3	0.011	3.80E-04	2.98E-02
n-Hexane	110-54-3	0.029	1.00E-03	7.85E-02
PAH (excluding Naphthalene)	PAH	0.003	1.04E-04	8.13E-03
Propylene	115-07-1	2.44	8.44E-02	6.61E+00
Toluene	108-88-3	0.058	2.01E-03	1.57E-01
Xylenes	1330-20-7	0.029	1.00E-03	7.85E-02
Arsenic	7440-38-2	2.00E-04	6.91E-06	5.42E-04
Beryllium	7440-41-7	1.20E-05	4.15E-07	3.25E-05
Cadmium	7440-43-9	1.10E-03	3.80E-05	2.98E-03
Chromium	7440-47-3	1.40E-03	4.84E-05	3.79E-03
Cobalt	7440-48-4	8.40E-05	2.90E-06	2.28E-04
Copper	7440-50-8	8.50E-04	2.94E-05	2.30E-03
Lead	7439-92-1	5.00E-04	1.73E-05	1.35E-03
Manganese	7439-96-5	3.80E-04	1.31E-05	1.03E-03
Mercury	7439-97-6	2.60E-04	8.99E-06	7.04E-04
Nickel	7440-02-0	2.10E-03	7.26E-05	5.69E-03
Selenium	7782-49-2	2.40E-05	8.30E-07	6.50E-05
Vanadium	7440-62-2	2.30E-03	7.95E-05	6.23E-03
Zinc	7440-66-6	2.90E-02	1.00E-03	7.85E-02

Source: HECA Project

Notes:
1) Annual operation assumes total pilot operation of 8,760 hr/yr and 6 hr/yr during SRU startup and shutdown with assist gas.
2) Emission factors based on AP-42 Chapter 1.4 (for metals) and Ventura County Air Pollution Control District AB2588 (for non-metals).
3) Calculation assumes a typical fuel heating value, ranging from 1,020 to 1,050 Btu/scf.

Btu = British thermal units
CAS = Chemical Abstracts Service Registry Number
HHV = higher heating value
scf = standard cubic feet
TAC = toxic air contaminant

Table 5.6-9
Rectisol Flare TAC Emission Rates

Compound	CAS Number	Emission Factor ($lb/10^6$ scf)	Hourly (lb/hr)	Annual (lb/yr)
2-Methylnaphthalene	91576	2.40E-05	7.06E-09	6.18E-05
3-Methylchloranthrene	56495	1.80E-06	5.29E-10	4.64E-06
7,12-Dimethylbenz(a)anthracene	57976	1.60E-05	4.71E-09	4.12E-05
Acenaphthene	83329	1.80E-06	5.29E-10	4.64E-06
Acenaphthylene	208968	1.80E-06	5.29E-10	4.64E-06
Anthracene	120127	2.40E-06	7.06E-10	6.18E-06
Benz(a)anthracene	56553	1.80E-06	5.29E-10	4.64E-06
Benzene	71432	2.10E-03	6.18E-07	5.41E-03
Benzo(a)pyrene	50328	1.20E-06	3.53E-10	3.09E-06
Benzo(b)fluoranthene	205992	1.80E-06	5.29E-10	4.64E-06
Benzo(g,h,i)perylene	191242	1.20E-06	3.53E-10	3.09E-06
Benzo(k)fluoranthene	205823	1.80E-06	5.29E-10	4.64E-06
Butane	106978	2.10E+00	6.18E-04	5.41E+00
Chrysene	218019	1.80E-06	5.29E-10	4.64E-06
Dibenzo(a,h)anthracene	53703	1.20E-06	3.53E-10	3.09E-06
Dichlorobenzene	25321226	1.20E-03	3.53E-07	3.09E-03
Ethane	74840	3.10E+00	9.12E-04	7.99E+00
Fluoranthene	206440	3.00E-06	8.82E-10	7.73E-06
Fluorene	86737	2.80E-06	8.24E-10	7.21E-06
Formaldehyde	50000	7.50E-02	2.21E-05	1.93E-01
Hexane	110543	1.80E+00	5.29E-04	4.64E+00
Indeno(1,2,3-cd)pyrene	193395	1.80E-06	5.29E-10	4.64E-06
Naphthalene	91203	6.10E-04	1.79E-07	1.57E-03
Pentane	109660	2.60E+00	7.65E-04	6.70E+00
Phenanthrene	85018	1.70E-05	5.00E-09	4.38E-05
Propane	74986	1.60E+00	4.71E-04	4.12E+00
Pyrene	129000	5.00E-06	1.47E-09	1.29E-05
Toluene	108883	3.40E-03	1.00E-06	8.76E-03
Arsenic	7440382	2.00E-04	5.88E-08	5.15E-04
Barium	7440393	4.40E-03	1.29E-06	1.13E-02
Beryllium	7440417	1.20E-05	3.53E-09	3.09E-05
Cadmium	7440439	1.10E-03	3.24E-07	2.83E-03
Chromium	7440473	1.40E-03	4.12E-07	3.61E-03
Cobalt	7440484	8.40E-05	2.47E-08	2.16E-04
Copper	7440508	8.50E-04	2.50E-07	2.19E-03
Manganese	7439965	3.80E-04	1.12E-07	9.79E-04
Mercury	7439976	2.60E-04	7.65E-08	6.70E-04
Molybdenum	7439987	1.10E-03	3.24E-07	2.83E-03
Nickel	7440020	2.10E-03	6.18E-07	5.41E-03
Selenium	7782492	2.40E-05	7.06E-09	6.18E-05
Vanadium	7440622	2.30E-03	6.76E-07	5.93E-03
Zinc	7440666	2.90E-02	8.53E-06	7.47E-02

Notes:
1) Emission factors ($lb/10^6$ scf) are from AP-42, Chapter 1.4, Table 1.4-3 and 1.4-4. Factors in lb/10E6 scf were converted to factors in MMBtu/hr by dividing by the design base fuel heating value in Btu/scf..
2) Rectisol Flare Pilot Firing Rate = 0.3 MMBtu/hr
3) Annual Operating Hours = 8760 hr/yr\

Table 5.6-10
Tail Gas Thermal Oxidizer TACs Emission Rates

Compound	CAS #	Emission Factor ($lb/10^6$ scf)	Hourly (lb/hr)	Annual (lb/yr)
Arsenic	7440-38-2	2.00E-04	1.90E-06	1.67E-02
Benzene	71-43-2	2.10E-03	2.00E-05	1.75E-01
Beryllium	7440-41-7	1.20E-05	1.14E-07	1.00E-03
Cadmium	7440-43-9	1.10E-03	1.05E-05	9.18E-02
Chromium	7440-47-3	1.40E-03	1.33E-05	1.17E-01
Cobalt	7440-48-4	8.40E-05	8.00E-07	7.01E-03
Copper	7440-50-8	8.50E-04	8.10E-06	7.09E-02
Formaldehyde	50-00-0	7.50E-02	7.14E-04	6.26E+00
Hexane	110-54-3	1.80E+00	1.71E-02	1.50E+02
Manganese	7439-96-5	3.80E-04	3.62E-06	3.17E-02
Mercury	7439-97-6	2.60E-04	2.48E-06	2.17E-02
Naphthalene	91-20-3	6.10E-04	5.81E-06	5.09E-02
Nickel	7440-02-0	2.10E-03	2.00E-05	1.75E-01
Selenium	7782-49-2	2.40E-05	2.29E-07	2.00E-03
Toluene	108-88-3	3.40E-03	3.24E-05	2.84E-01
Vanadium	7440-62-2	2.30E-03	2.19E-05	1.92E-01
Benzo(a)pyrene	PAH	1.20E-06	1.14E-08	1.00E-04
Benz(a)anthracene	PAH	1.80E-06	1.71E-08	1.50E-04
Benzo(b)fluoranthene	PAH	1.80E-06	1.71E-08	1.50E-04
Chrysene	PAH	1.80E-06	1.71E-08	1.50E-04
Dibenzo(a,h)anthracene	PAH	1.20E-06	1.14E-08	1.00E-04
Indeno(1,2,3-cd)pyrene	PAH	1.80E-06	1.71E-08	1.50E-04
2-Methylnaphthalene	PAH	2.40E-05	2.29E-07	2.00E-03
3-Methylchloranthrene	PAH	1.80E-06	1.71E-08	1.50E-04
7,12-Dimethylbenz(a)anthracene	PAH	1.60E-05	1.52E-07	1.33E-03
Acenaphthene	PAH	1.80E-06	1.71E-08	1.50E-04
Acenaphthylene	PAH	1.80E-06	1.71E-08	1.50E-04
Anthracene	PAH	2.40E-06	2.29E-08	2.00E-04
Benzo(g,h,i)perylene	PAH	1.20E-06	1.14E-08	1.00E-04
Benzo(k)fluoranthene	PAH	1.80E-06	1.71E-08	1.50E-04
Fluoranthene	PAH	3.00E-06	2.86E-08	2.50E-04
Fluorene	PAH	2.80E-06	2.67E-08	2.34E-04
Phenanthrene	PAH	1.70E-05	1.62E-07	1.42E-03
Pyrene	PAH	5.00E-06	4.76E-08	4.17E-04

Source: HECA Project

Notes:
1) Tail Gas Thermal Oxidizer Operating Hours = 8,760 per year (accounting for both process vent and SRU startup)
2) Emission factor source USEPA AP-42 Section 1.4
3) Calculation assumes a typical fuel heating value, ranging from 1,020 to 1,050 Btu/scf.

Btu = British thermal units
CAS = Chemical Abstracts Service Registry Number
USEPA = U.S. Environmental Protection Agency
HHV = higher heating value
PAH = polycyclic aromatic hydrocarbons
scf = standard cubic feet
SRU = sulfur recovery unit
TAC = toxic air contaminant

Table 5.6-11
Carbon Dioxide Vent TACs Emission Rates

Compound	CAS #	Emission Factor (ppm)	Hourly (lb/hr)	Annual (lb/yr)
Hydrogen Sulfide	7783-06-4	10	5.15E+00	2.60E+03
Carbonyl Sulfide	463-58-1	Up to 55	2.82E+01	14.20E+03

Source: HECA Project

Notes:
1) Emission rates based on power plant design and 21 day/yr full venting.
CAS = Chemical Abstracts Service Registry Number
ppm = parts per million
TAC = toxic air contaminant

Table 5.6-12
Emergency Generator TACs Emission Rates

Compound	CAS #	Emission Factor (g/Bhp/hr)	Hourly (lb/hr)	Annual (lb/yr)
Diesel Particulate Matter	DPM	0.03	1.60E-01	8.02E+00

Source: HECA Project

Note:
1) Emergency Generator operating hours = 50 hr/yr per generator.
2) Emissions factor shown is site specific diesel emission rate based on vendor data.
3) Emission rate shown is for individual generator.
Bhp = Brake horsepower
CAS = Chemical Abstracts Service Registry Number
DPM = diesel particulate matter
g = grams
TAC = toxic air contaminant

Table 5.6-13
Fire Water Pump TACs Emission Rates

Compound	CAS #	Emission Factor (g/Bhp/hr)	Hourly (lb/hr)	Annual (lb/yr)
Diesel Particulate Matter	DPM	0.015	1.84E-02	1.84E+00

Source: HECA Project

Note:
1) Fire Water Pump operating hours = 100 hr/yr.
2) Emission factor shown is from Tier 4 requirements.
Bhp = Brake horsepower
CAS = Chemical Abstracts Service Registry Number
DPM = diesel particulate matter
g = gram
TAC = toxic air contaminant

- Cooling Towers (power block, ASU, and gasification) – Hourly emissions were calculated based on the circulation rates, drift fractions, and expected concentrations in parts per million [ppm]) of TACs in cooling water. Annual emission rates were calculated based on 8,322 hours per year.

- Gasifier Refractory Heaters– Three gasifiers are present at the site. Under normal operating conditions, only one gasifier will be in warming mode at any given time, as required. Hourly emission rates were calculated using the standard cubic feet of natural gas each heater requires per hour based on its gasifier design. Annual emission rates were calculated based on 1,800 hours per year.

- Auxiliary Boiler – Hourly emission rates were calculated based on the required standard cubic feet of natural gas required per hour based on boiler design. Annual emission rates were calculated based on 2,190 hours per year.

- Gasification Flare – Hourly emissions were calculated based on the hourly heat input rate required for pilot flame operation and the heat content of fuels flared; contributions of both were accounted for in the hourly rates. Annual emission rates were calculated assuming 8,760 hours per year of pilot operation and approximately 101 hours per year of flaring events. This scenario represents the maximum allowable firing scenario.

- SRU Flare – Hourly emissions were calculated based on the hourly heat input rate required for pilot flame operation and the heat content required for assist gas; contributions of both were accounted for in the hourly rates. Annual emission rates were calculated assuming 8,760 hours per year of pilot operation and approximately 6 hours per year of flaring events.

- Rectisol Flare – TACs would be emitted from the flare pilot only. Emissions were calculated based on the hourly heat input rate required for pilot flame operation. Annual emission rates were calculated assuming 8,760 hours per year of pilot operation.

- Tail Gas Thermal Oxidizer – Hourly emission rates were calculated based on the standard cubic feet of natural gas required per hour based on oxidizer design. Annual emission rates were calculated based on 8,760 hours per year.

- Carbon Dioxide Vent – Hourly emission rates were calculated based on maximum hourly flow (by mass) of the vent and the concentration of TACs in the vent stream. This carbon dioxide vent is used during start up and emergency upset conditions, which are, by definition, unplanned and difficult to predict. While the carbon dioxide centrifugal compressor and other injection equipment have historically been very reliable, as a worst-case scenario, annual emission rates were calculated based on 504 hours of venting per year (21 days).

- Diesel Generator – Hourly emission rates were calculated based on the horsepower rating of the generator and the manufacturer-specified particulate emission rate. Annual emissions were calculated based on 50 hours per year of operation for each of two generators.

- Fire Pump Engine – Hourly emission rates were calculated based on the horsepower rating of the generator and the Tier 4 Standard requirements for equipment manufactured in 2014. Annual emissions were calculated based on 100 operating hours per year.

These emission parameter combinations for the numerous turbine operating cases were determined from the turbine screening modeling described in Section 5.1, Air Quality, to produce the highest ground-level impacts outside the Project Site and Controlled Area boundary. This parameter combination ensures that impacts from the HRA will not be underestimated for any operating condition.

SJVAPCD Rule 2520 requires adherence to federally-mandated operating permits. As such, it is important to designate whether the project is a major source of HAPs or not. Under the Clean Air Act, §112, a major source is defined as one that emits 10 tons per year or more of any HAP, or 25 tons per year or more of any combination of HAPs. The Project is not a major source of HAPs, as determined by the list of federal HAPs and the Project's total annual HAP emissions. Appendix N, Public Health and Safety, provides a summary of the annual HAP emissions. All HARP and AERMOD model files are provided electronically on a DVD that is supplied separately with this Revised Application for Certification (AFC).

Mobile Sources

Operational on-site truck trip emissions were incorporated in the dispersion modeling, as discussed in Section 5.1.2.2.2, using EMFAC2007 emission factors, which include particulate matter from heavy diesel trucks. Emission factors from year 2040 were used in the health risk assessment. The inclusion of on-site trucks in the modeling was not discussed in the modeling protocol submitted for the Project to CEC, USEPA, and SJVAPCD (URS 2009). A comment on the protocol by a CEC analyst requested that the trucks be included.

For evaluation of health risks, the Project must not result in an increased probability of cancer greater than 10 in one million from a 70-year exposure to carcinogens. Over a 70-year period, from 2015 to 2085, truck emissions will decrease based on engine and fuel improvements, as regulated by the CARB. Representative emission factors for this 70-year period, therefore, would be from the median calendar year, or 2050. However, EMFAC2007 factors only project to calendar year 2040, so these factors were used for the health risk assessment modeling of trucks. Table 5.6-14 summarizes the EMFAC2007 gram-per-mile factors from the model output and pound-per-hour and pound-per-year rates used in the HARP.

5.6.2.4 Model Input Parameters

The HRA was conducted using the hourly and annual emissions listed for each source identified in Tables 5.6-2 through 5.6-14. Cancer and chronic non-cancer health effects were evaluated using the HARP model with estimated annual average emission rates, and acute non-cancer health effects were analyzed based on maximum hourly emission rates.

Dispersion modeling was performed using the AERMOD model and methods consistent with the approach described in Section 5.1, Air Quality (e.g., building downwash and meteorological input data), and the modeling protocol submitted for review to CEC and SJVAPCD (URS 2009).

Table 5.6-14
EMFAC2007 Heavy Truck Emission Factors and AERMOD Emission Rates

Pollutant	Emission Factors from EMFAC			
	Onsite Petcoke and Coal Trucks		Onsite Gasifier Solids Handling Trucks	
	Running (g/mi)	Idling (g/hr)	Running (g/mi)	Idling (g/hr)
PM_{10}	1.09	1.12	1.47	1.12
	Emission Rates for HARP			
	Onsite Petcoke and Coal Trucks		Onsite Gasifier Solids Handling Trucks	
PM_{10}	Running	Idling	Running	Idling
24-hour (lb/hr)	3.1e-3	5.6e-4	2.3e-4	5.4e-5
Annual (lb/yr)	6.2	1.1	3.3e-1	6.5e-2

Notes:
g/mi = grams per mile (factor)
g/hr = grams per hour (factor)
lb/hr = pound per hour (factor)
lb/yr = pound per year (factor)
PM_{10} = particulate matter with an aerodynamic diameter of 10 microns or less.

The AERMOD model is run with unit emission rates (1 gram per second emissions) for each source to calculate the concentration of TACs per unit emission rate from each source. HARP then uses this information along with the estimated source emission rates for specific TAC compounds (as described above) to calculate ground-level concentrations for each chemical species.

Meteorological data for the years 2000, 2001, 2002, 2004, and 2005 (the same years used in the air quality modeling analysis described in Section 5.1) were used in the HRA. Risk values were modeled for the sensitive receptor within 3 miles of the Project Site, receptors at the Tule Elk State Natural Reserve (1,700 feet east of the Project Site), receptors at the Buena Vista Lakebed (6 miles southeast of the Project Site), and at all grid and census receptors within 6 miles (10 km) of the site.

Figure 5.6-2, Receptors of Interest in the Vicinity of the Project Site, shows the locations of the Tule Elk State Natural Reserve and the Buena Vista Lakebed. These locations were included in the analysis at the request of the SJVAPCD. The same grid and refined receptors used in the air quality modeling were used in the HRA (see Section 5.1 for more details). The grid receptors extend 10 km in all directions from the Project boundary, including receptors spaced every 25 meters along the site Project Site and Controlled Area line and out to 100 meters. To be certain that the maximum potential risks resulting from Project emissions will 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 5.6-1, Summary of all Operational TACs and Toxicity Values Used to Characterize Health Risks. 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.

5.6.2.5 Calculation of Health Effects

Adverse health effects are expressed in terms of cancer or non-cancer health risks. Cancer risk is typically reported as "lifetime cancer risk," which is the estimated maximum increase in the 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 highly unlikely, the goal of the approach is to produce a conservative worst-case estimate of potential cancer risk.

Non-cancer risk is typically reported as a THI. The THI is calculated for each target organ as a fraction of the maximum acceptable exposure level or REL for an individual pollutant. The REL is generally the level at (or below) which no adverse health effects are expected. The THIs are calculated for both short-term (acute) and long-term (chronic) exposures to non-carcinogenic substances by adding the ratios of predicted concentrations to RELs for all pollutants.

Both cancer and non-cancer risk estimates produced by the HRA represent incremental risks (i.e., risks due to the modeled 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 non-cancer THIs due to the Project's TAC emissions.

5.6.2.6 Health Effects Significance Criteria

Various state and local agencies provide different significance criteria for cancer and non-cancer health effects. For the Project, the SJVAPCD *Guidelines for Assessing and Mitigating Air Quality Impacts* (January 2002) provide the significance criteria for potential cancer and non-cancer health effects due to Project-related emissions. For carcinogenic health effects, an exposure is considered significant when the predicted increase in lifetime cancer risk exceeds 10 in 1 million ($10 \times 10\text{-}^{6}$). For non-carcinogenic acute and chronic health effects, an exposure that affects each target organ is considered significant when the corresponding THI exceeds a value of 1.0.

5.6.2.7 Estimated Lifetime Cancer Risk

Table 5.6-15, Estimated Cancer Risk and Acute and Chronic Non-cancer THI Due to Project TAC Emissions, presents the detailed cancer risk results of the HRA for Project operations.

Table 5.6-15
Estimated Cancer Risk and Acute and Chronic Non-cancer THI
Due to Project TAC Emissions

Location	Cancer Risk	Chronic Hazard Index	Acute Hazard Index
Point of maximum impact	3.01 excess risk in 1 million	0.262 total hazard index	0.0288 total hazard index
Peak risk at a sensitive receptor (Elk Hills Elementary School)	0.43 excess risk in 1 million	0.036 total hazard index	0.0025 total hazard index
Peak risk at nearest residence	0.70 excess risk in 1 million	0.050 total hazard index	0.0050 total hazard index

Source: HECA Project

The maximum incremental cancer risk resulting from Project emissions was estimated to be 3.01 in 1 million, at a location on the southeastern Project Site and Controlled Area boundary (receptor at 283,960 meters east, 3,911650,650 meters north[2]). The peak cancer risk predicted at a sensitive receptor was 0.43 in 1 million, at the Elk Hills Elementary School, 1.5 miles southeast of the Project Site and Controlled Area boundary (285,878 meters east, 3,908,605 meters north). The peak cancer risk predicted at the nearest residence to the northwest of the Project Site (282,480 meters east, 3,913,177 meters north) is 0.70 in one million.

The estimated cancer risks at all locations are well below the significance criterion of 10 in 1 million. Thus, the Project emissions are expected to pose a less-than-significant increase in terms of carcinogenic health risk.

5.6.2.8 Estimated Chronic and Acute Total Hazard Indices

Table 5.6-15 above, Estimated Cancer Risk and Acute and Chronic Non-cancer THI Due to Project TAC Emissions, presented the detailed non-cancer results of the HRA for the Project operations without the carbon dioxide vent operating. Table 5.6-16 presents the detailed non-cancer results of the HRA for the project operations with the carbon dioxide vent operating.

The maximum chronic THI resulting from Project's operational emissions was estimated to be 0.262 at a location on the southeastern Project Site and Controlled Area boundary (283,960 meters east, 3,911650,650 meters north) – the same location as the predicted cancer risk maximum. The maximum predicted chronic THI at the Elk Hills Elementary School sensitive receptor was 0.036 (285,878 meters east, 3,908,605 meters north). DEGADIS results added to these two locations will increase the maximum chronic THI to 0.275 and the predicted chronic THI at the Elk Hills Elementary School to 0.039. The maximum chronic THI at the nearest residence is 0.068.

[2] Coordinates are provided in accordance with the Universal Transverse Mercator and North American Datum, 1927, Zone 11.

Table 5.6-16
Estimated Cancer Risk and Acute and Chronic Non-cancer THI Due to Project TAC Emissions with Carbon Dioxide Vent Operating

Location	Cancer Risk	Chronic Hazard Index	Acute Hazard Index
Point of maximum impact	3.01 excess risk in 1 million	0.275275 total hazard index	0.8610 total hazard index
Peak risk at a sensitive receptor (Elk Hills Elementary School)	0.43 excess risk in 1 million	0.39039 total hazard index	0.1206 total hazard index
Peak risk at nearest residence	0.70 excess risk in 1 million	0.068 total hazard index	0.6658 total hazard index

Source: HECA Project

The maximum acute THI resulting from Project emissions was estimated to be 0.0288 at a location approximately 4.7 kilometers southwest of the Project Site and Controlled Area boundary (280,000 meters east, 3,9070,000 meters north). The maximum acute THI at the Elk Hills Elementary School sensitive receptor was estimated to be 0.0025 (285,878 meters east, 3,908,605 meters north). DEGADIS results added to these will increase the maximum acute THI to 0.8610 (282,356 meters east, 3,912,749 meters north) and the predicted acute THI at the Elk Hills Elementary School to 0.1206. The maximum acute THI at the nearest residence is 0.6658.

The estimated chronic THIs are well below the significance criterion of 1. The estimated acute THIs are below the significance criterion of 1. Thus, the Project emissions of non-carcinogenic TACs will not be expected to pose a significant risk.

Figure 5.6-3, Locations of Maximum Health Risks, shows the locations of the maximum health risks.

5.6.2.9 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 and the procedures and assumptions used to ensure health-protective results are discussed below.

The turbine emission rates were derived using vendor data regarding ammonia slip rates and emission factors from CATEF and AP-42 for the other air toxics. Both the short and long term turbine emissions estimates were developed assuming that all turbines will operate continuously at the same time and at the maximum fuel energy input rate. Under actual operating conditions, the turbines will typically operate fewer hours per year and at lower loads. Consequently, the emissions used for this HRA are likely to be higher than what would be experienced under normal power plant operation.

Dispersion models approved for regulatory applications contain assumptions that lead to over prediction of 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 by means of chemical reactions or losses at the ground surface due to reactions, 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 will 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 will actually experience such exposure to the maximum predicted concentrations of TACs over this period. The conservative exposure assumption leads to over predicted risk estimates in the HRA modeling.

The toxicity data used in the HRA contain uncertainties due to the extrapolation of health effects 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 intraspecies variability is expected to be much greater among humans 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.

5.6.2.10 Criteria Pollutants

The dispersion of the Project's emissions of criteria pollutants (nitrogen dioxide, carbon monoxide, sulfur dioxide, and particulate matter with an aerodynamic diameter of 10 and 2.5 microns or less [PM_{10} and $PM_{2.5}$]) was modeled, and an evaluation of their impacts on air quality is presented in Section 5.1, Air Quality. The federal and state AAQS set limits on the allowable levels of air pollutants in the ambient air necessary to protect public health. The results of the air quality analysis show that the Project will not cause a violation of any state or federal AAQS and will not significantly contribute to existing violations of federal standards. Therefore, no significant adverse health effects are anticipated to result from the Project's criteria pollutant emissions.

5.6.3 Cumulative Impact Analysis

A cumulative HRA is not presented in this AFC. There are no major sources of HAPs nearby the Project Site and none are known to be proposed or under development.

5.6.4 Mitigation Measures

Strict controls for fugitive dust during construction will mitigate the potential for Valley Fever by reducing the amount of airborne dust particles potentially containing the spores. The criteria pollutant emissions from the Project will be mitigated by the use of Best Available Control Technology (BACT) and through emissions offsets. These measures are described in Section 5.1, Air Quality. In addition, pollution control technologies employed to control criteria pollutants (for example, the oxidation catalysts on the turbines and the high efficiency drift eliminators on the cooling towers) will further reduce emissions of TACs listed in Table 5.6-1, Summary of all Operational TACs and Toxicity Values Used to Characterize Health Risks. These measures satisfy the SJVAPCD requirements for toxics (TBACT).

The HRA presented in the foregoing subsections shows that the health effects impacts of the Project will be well below the significance thresholds identified in Section 5.6.2.6, Health Effects Significance Criteria. Therefore, no further mitigation of emissions from the Project is required to protect public health.

5.6.5 Laws, Ordinances, Regulations, and Standards

The Project will be constructed and operated in accordance with all laws, ordinances, regulations, and standards (LORS) applicable to protecting public health. This section briefly discusses the identified LORS. Table 5.6-17, Summary of LORS – Public Health, provides a summary of the requirements of the applicable LORS, the agencies that are principally responsible for public health, and the locations in this document where each of these issues is addressed.

5.6.5.1 Federal

The federal Clean Air Act of 1970, 42 USC 7401 *et seq*., as amended in 1977 and 1990, requires that the public be protected from unhealthful exposure to air pollutants. Based on the results of the risk assessment, health risks due to Project emissions of air toxics will not exceed acceptable levels. Emissions of criteria pollutants will be minimized by applying BACT to the facility. Increases in emissions of criteria pollutants will be fully offset.

5.6.5.2 State

California Public Resource Code § 25523(a); 20 CCR § 1752.5, 2300-2309, and Division 2 Chapter 5, Article 1, Appendix B, Part (1), requires that protection of environmental quality be ensured and that a quantitative HRA be performed. The HRA discussed in this section of the AFC satisfies this requirement.

The California Clean Air Act, TAC Program, HSC § 39650, *et seq*. requires quantification of TAC emissions, use of BACT, and preparation of an HRA. The Project will not cause unsafe exposure to TACs based on results of the HRA discussed in this section of the AFC, and a BACT assessment for the Project has been performed (see Section 5.1, Air Quality).

Table 5.6-17
Summary of LORS – Public Health

Authority	Administering Agency	Requirement	AFC Section(s)
Federal			
Clean Air Act (CAA)	USEPA CARB SJVAPCD	Protect public from unhealthful exposure to air pollutants.	5.6, 5.1
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	Ensure protection of environmental quality; requires quantitative HRA.	5.6.
California Clean Air Act, TAC Program, H&SC § 39650, et seq.	SJVAPCD with CARB oversight	Requires quantification of TAC emissions, use of BACT, and preparation of an HRA.	5.6, 5.1
H&SC, Part 6, § 44300 et seq. (Air Toxics "Hot Spots")	SJVAPCD with CARB/OEHHA oversight	Requires inventorying of TACs and HRA, as well as public notification of predicted health risks.	5.6.2.1
H&SC § 41700	SJVAPCD with CARB oversight	Prohibits emissions in quantities that adversely affect public health, other businesses, or property.	5.1
Local			
SJVAPCD Rule 2520, Section 2.1	SJVAPCD	Requires Federally Mandated Operating Permit for major sources of air toxics	The Project will not be a major source of HAPs, thus this regulation does not apply.
SJVAPCD Rule 2550	SJVAPCD	Requires use of TBACT for major HAP sources to achieve MACT.	5.6
SJVAPCD Rule 4102, Section 4.1 and Policy APR 1905	SJVAPCD	Requires sources to not discharge air toxics detrimental to public health and prepare a HRA.	5.6

Notes:

AFC = Application for Certification
BACT = Best Available Control Technology
CARB = California Air Resources Board
CCR = California Code of Regulations
CEC = California Energy Commission
H&SC = Health and Safety Code
HAP = hazardous air pollutant
HRA = Health Risk Assessment
LORS = laws, ordinances, regulations, and standards
MACT = Maximum Available Control Technology
OEHHA = Office of Environmental Health Hazard Assessment
SJVAPCD = San Joaquin Valley Air Pollution Control District
TAC = toxic air contaminant
TBACT = Toxic Best Available Control Technology
USEPA = U.S. Environmental Protection Agency

California Health and Safety Code, Part 6, § 44300 *et seq*. (Air Toxics "Hot Spots") requires inventorying of TACs and HRA, as well as public notification of predicted health risks. The HRA discussed in this section of the AFC satisfies this requirement.

California Health and Safety Code § 41700 prohibits emissions in quantities that adversely affect public health, other businesses, or property. Section 5.1, Air Quality, and the HRA discussed in this section of the AFC satisfy this requirement.

5.6.5.3 Local

SJVAPCD Rule 2550 requires use of TBACT for major HAP sources to achieve maximum available control technology. The Project will not be a major source of HAPs. Therefore, this regulation does not apply.

SJVAPCD Rule 4102, Section 4.1 requires an HRA to estimate the maximum potential public exposure and health risk for purpose of approving the permit to operate and issuing public notice if necessary. The HRA discussed in this section of the AFC satisfies this requirement.

5.6.6 Involved Agencies and Agency Contacts

Agencies likely to be involved in the Project are shown in Table 5.6-18, Involved Agencies and Agency Contacts.

Table 5.6-18
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
San Joaquin Valley Air Pollution Control District	Leland Villalvazo Supervising Air Quality Specialist 1990 E. Gettysburg Avenue Fresno, CA 93726	(559) 230-5881

5.6.7 Permits Required and Permit Schedule

The Authority to Construct permitting process that would otherwise apply is superseded in the case of CEC power plant licensing projects by the Determination of Compliance process, which is its functional equivalent. The CEC's final decision on this AFC will serve as the principal

approval required to ensure that the Project's impacts to public health will be within acceptable levels. However, a Permit to Operate will be awarded after SJVAPCD confirmation that the Project has been constructed to operate as described in the permit application(s).

5.6.8 References

Cal/EPA/OEHHA (California Environmental Protection Agency and Office of Environmental Health Hazard Assessment), 1999. Air Toxics Hot Spots Program 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), 2000. Air Toxics Hot Spots Program Risk Assessment Guidelines, Part III: 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), 2003. Air Toxics Hot Spots Program Risk Assessment Guidelines: The Air Toxics Hot Spots Program Guidance Manual for Preparation of Health Risk Assessments. August.

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

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.

CDPH (California Department of Public Health), 2007. 2007 County Profiles, REF at http://ww2.cdph.ca.gov/programs/OHIR/Documents/kern.xls.

Chung, V., 2008. Personal Communication, California Department of Environmental Health. June 6, 2008

Cocker, D., 2002. Mira Loma Air Quality Study; The Center for Environmental Research and Technology at UC Riverside (CE-CERT).

Jinadu, B.A. M.D., M.P.H., 2003. *Kern County Department of Public Health: Health Status Report – 2003*. http://www.co.kern.ca.us/health/epivital.asp

Jinadu, B.A., M.D., M.P.H., 1995. Valley Fever Task Force Report on the Control of *Coccidioides Imitis* REF at http://www.co.kern.ca.us/health/publications.asp

Kern County Department of Public Health, 2003. Health Status Report – 2003. http://www.co.kern.ca.us/health/epivital.asp.

OEHHA/CARB (Office of Environmental Health Hazard Assessment and California Air Resources Board), 2008. Consolidated Table of OEHHA/ARB Approved Risk Assessment Health Values. http://www.arb.ca.gov/toxics/healthval/healthval.htm.

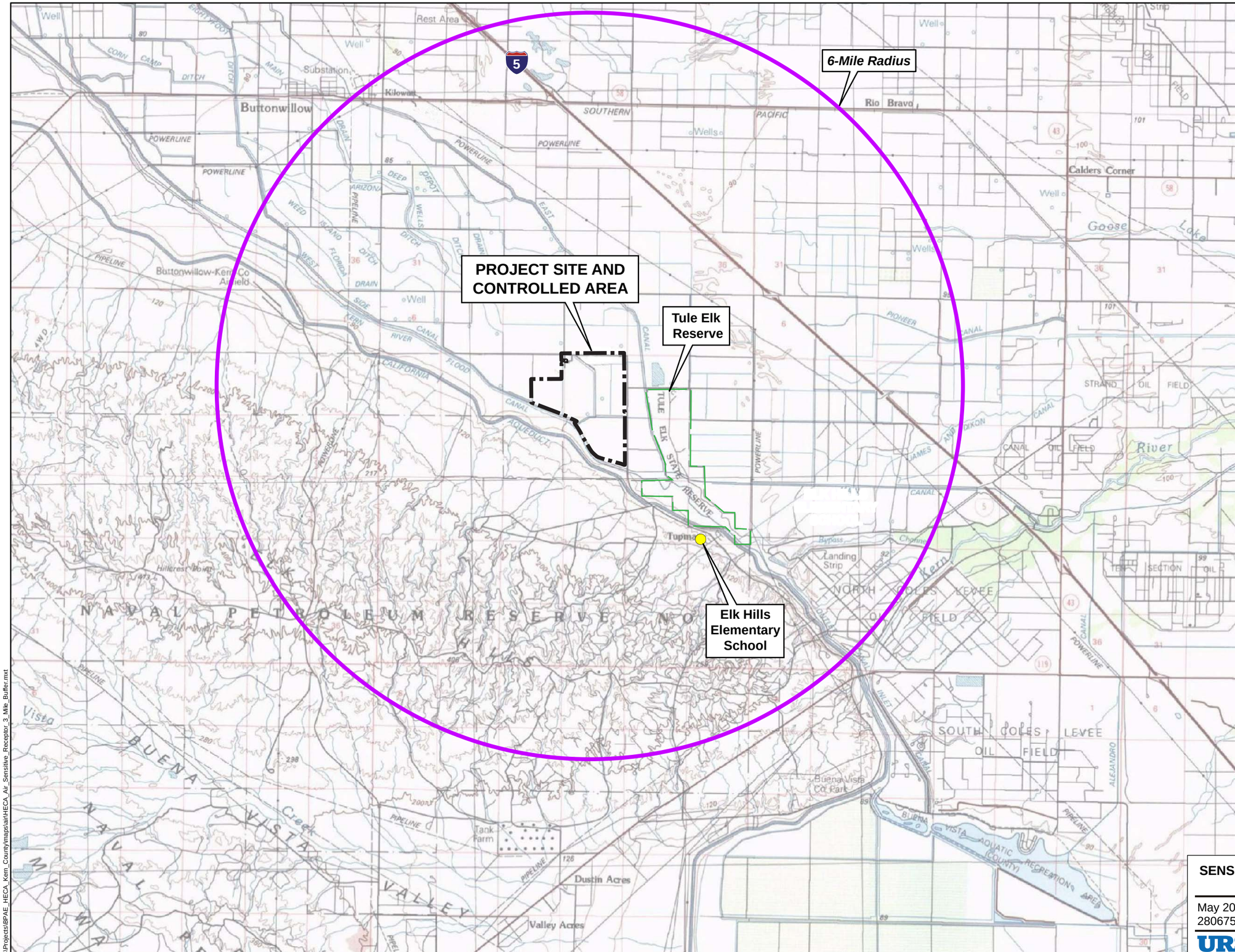
SJVAPCD (San Joaquin Valley Air Pollution Control District), 2002. Guidelines for Assessing and Mitigating Air Quality Impacts. January.

U.S. Department of Energy, National Energy Technology Laboratory, Major Environmental Aspects of Gasification-based Power Generation Technologies, Final Report, December 2002.

U.S. Department of Health and Human Services, 2000. Healthy People 2010: Understanding and Improving Health. 2nd ed. Washington, DC: U.S. Government Printing Office, November 2000.

USEPA (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, 2009. Air Quality Modeling Protocol for the Hydrogen Energy California (HECA) Project. Prepared by URS for San Joaquin Valley Air Pollution Control District, California Energy Commission, U.S. Environmental Protection Agency Region IX, U.S. Forest Service and National Park Service.



LEGEND

- Project Site and Controlled Area
- 6-Mile Radius
- Sensitive Receptor

N

0 0.75 1.5 3
Scale in Miles

Sources:
USGS (30'x60' quads: Taft 1982). Created using TOPO!, ©2006 National Geographic Maps, All Rights Reserved.
Sensitive Receptor (Appendix M).

Note:
The Taft, CA Quad (1982) has been edited to reflect current condition.

SENSITIVE RECEPTORS LOCATED WITHIN 6 MILES OF THE PROJECT SITE

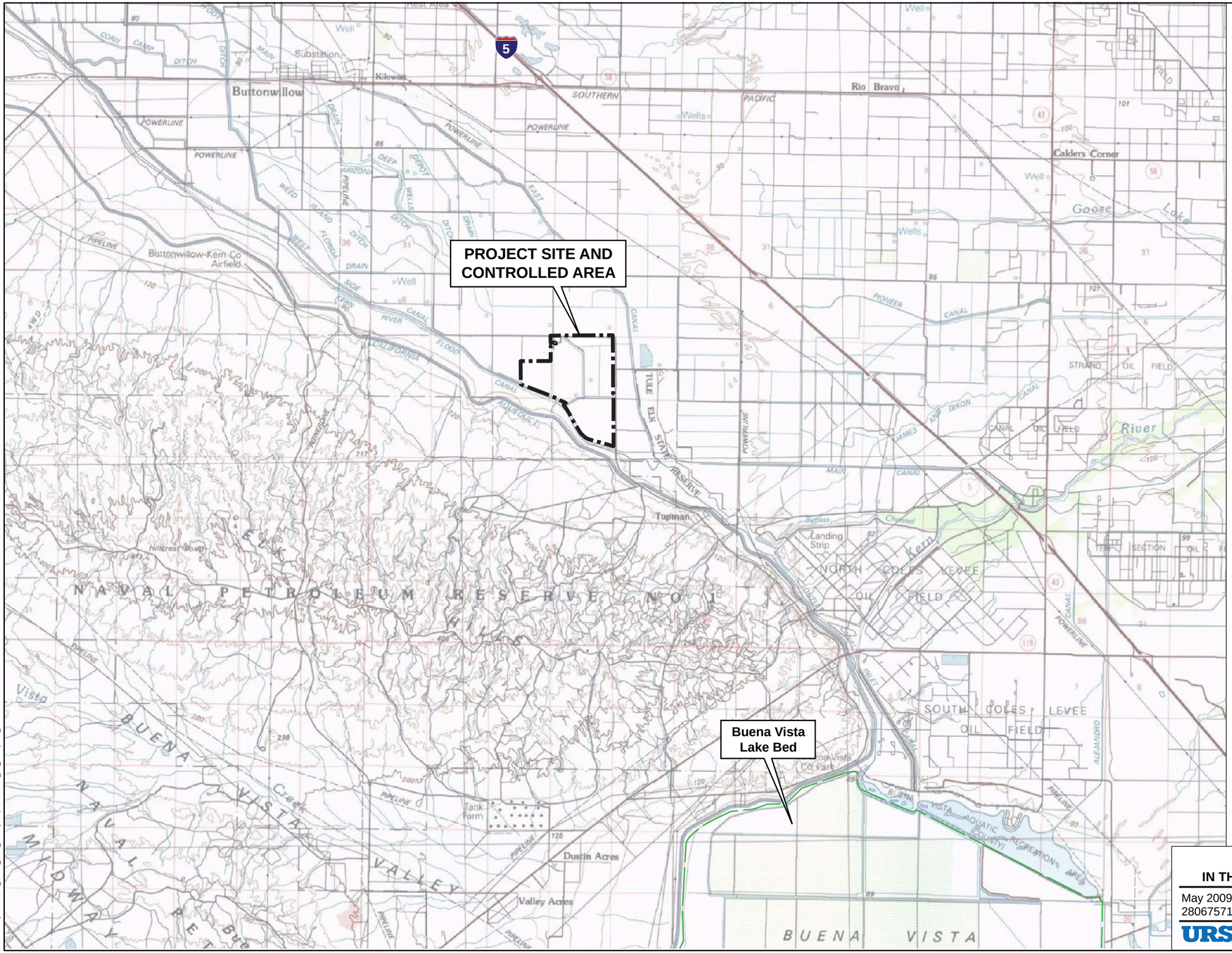
May 2009 — Hydrogen Energy California (HECA)
28067571 — Kern County, California

URS

FIGURE 5.6-1

G:\Projects\BPAE_HECA_Kern_County\maps\air\HECA_Air_Sensitive_Receptor_3_Mile_Buffer.mxt

5/21/09 vsa..T:\HECA\GRAPHICS\5.06 Pub Health\5.6-1_Air_Sensitve_Receptor_6_Mile_Buffer_052109.ai



LEGEND

Project Site and Controlled Area

Sensitive Receptor

N

0 0.75 1.5 3

Scale in Miles

Sources:
USGS (30'x0' quads: Taft 1982). Created using TOPO!, ©2006 National Geographic Maps, All Rights Reserved.

Note:
The Taft, CA Quad (1982) has been edited to reflect current condition.

RECEPTOR OF INTEREST IN THE VICINITY OF THE PROJECT SITE

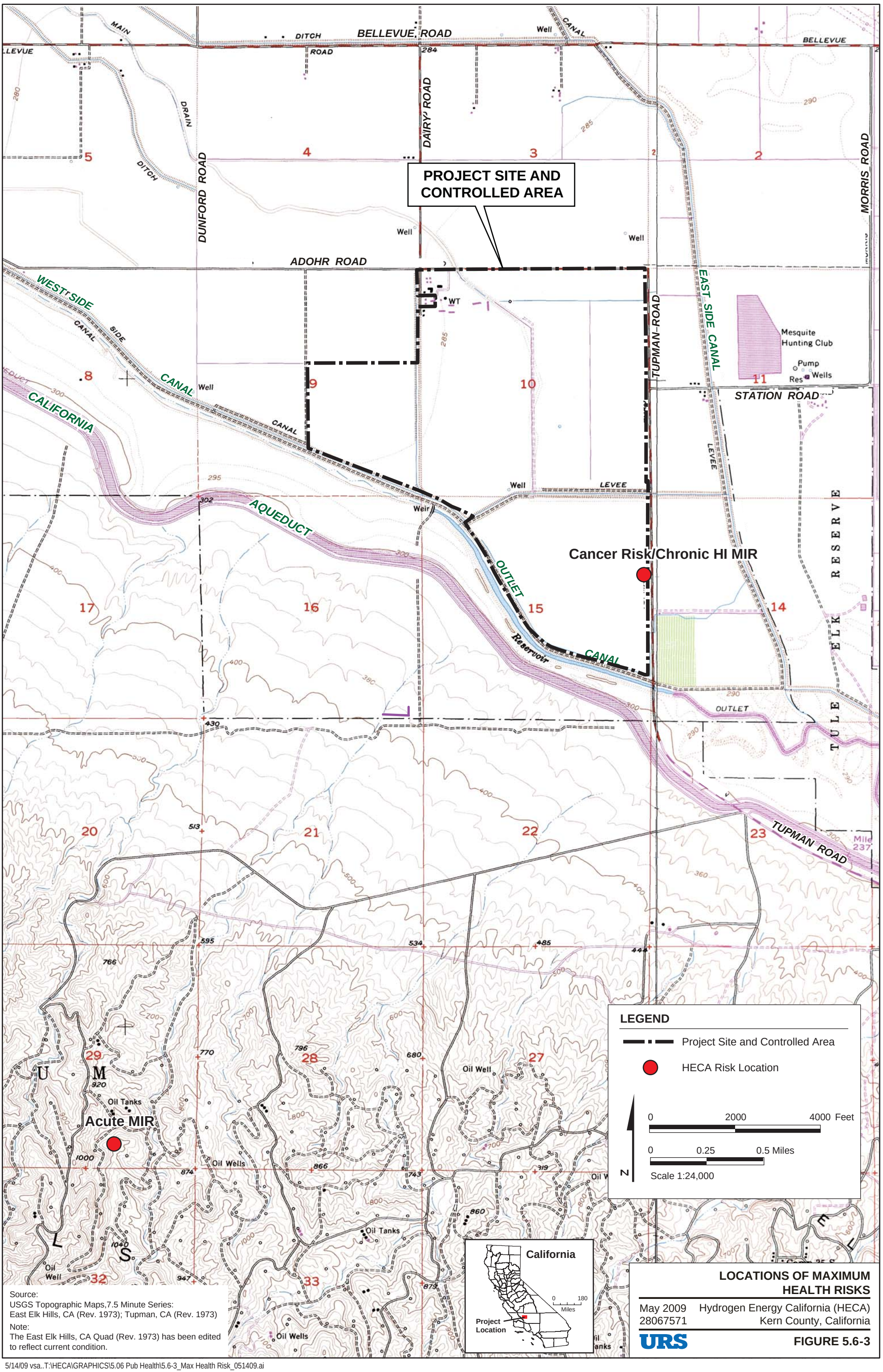
May 2009 Hydrogen Energy California (HECA)
28067571 Kern County, California

URS

FIGURE 5.6-2

Y:\GIS\Projects\BPAE_HECA_Kern_County\maps\air\HECA_Air_Receptors_Interest.mxt

5/14/09 vsa..T:\HECA\GRAPHICS\5.06 Pub Health\5.6-2_Air_Receptors_Interest_051409.ai



Source:
USGS Topographic Maps,7.5 Minute Series:
East Elk Hills, CA (Rev. 1973); Tupman, CA (Rev. 1973)
Note:
The East Elk Hills, CA Quad (Rev. 1973) has been edited to reflect current condition.

LOCATIONS OF MAXIMUM HEALTH RISKS

May 2009 Hydrogen Energy California (HECA)
28067571 Kern County, California

URS

FIGURE 5.6-3

5/14/09 vsa..T:\HECA\GRAPHICS\5.06 Pub Health\5.6-3_Max Health Risk_051409.ai

Adequacy Issue: Adequate ____ Inadequate ____

DATA ADEQUACY WORKSHEET

Revision No. 0 Date ____

Technical Area: **Public Health** Project: ____ Technical Staff: ____

Project Manager: ____ Docket: ____ Technical Senior: ____

Siting Regulations	Information	AFC Page Number And Section Number	Adequate Yes Or No	Information Required To Make AFC Conform With Regulations
Appendix B (g) (1)	...provide a discussion of the existing site conditions, the expected direct, indirect and cumulative impacts due to the construction, operation and maintenance of the project, the measures proposed to mitigate adverse environmental impacts of the project, the effectiveness of the proposed measures, and any monitoring plans proposed to verify the effectiveness of the mitigation.	Section 5.6.1, p. 5.6-3 Section 5.6.2, p. 5.6-5 Section 5.6.3, p. 5.6-29 Section 5.6.4, p. 5.6-29		
Appendix B (g) (9) (A)	An assessment of the potential risk to human health from the project's hazardous air emissions using the Air Resources Board Hotspots Analysis and Reporting Program (HARP) (HSC §§44360-44366) or its successor and Approved Risk Assessment Health Values. These values should include the cancer potency values and noncancer reference exposure levels approved by the Office of Environmental Health Hazard Assessment (OEHHA Guidelines, Cal-EPA 2005).	Section 5.6.2.1, p. 5.6-5 Section 5.6.2.5, p. 5.6-25 Section 5.6.2.6, p. 5.6-25 Section 5.6.2.7, p. 5.6-26 Section 5.6.2.8, p. 5.6-26		
Appendix B (g) (9) (B)	A listing of the input data and output results, in both electronic and print formats, used to prepare the HARP health risk assessment.	Section 5.6.2.1, p. 5.6-5 Appendix N		
Appendix B (g) (9) (C)	Identification of available health studies through the local public health department concerning the potentially affected population(s) within a 6-mile radius of the proposed power plant site related to respiratory illnesses, cancers or related diseases.	Section 5.6.1, p. 5.6-3 Section 5.6.2.1, p. 5.6-5		
Appendix B (g) (9) (D)	A map showing sensitive receptors within the area exposed to the substances identified in subsection (g)(9)(A).	Figure 5.6-1		

Adequacy Issue: Adequate ____ Inadequate ____

DATA ADEQUACY WORKSHEET

Revision No. 0 Date ____

Technical Area: **Public Health** Project: ____ Technical Staff: ____

Project Manager: ____ Docket: ____ Technical Senior: ____

Siting Regulations	Information	AFC Page Number And Section Number	Adequate Yes Or No	Information Required To Make AFC Conform With Regulations
Appendix B (g) (9) (E)	For purposes of this section, the following definitions apply:			
Appendix B (g) (9) (E) (i)	A sensitive receptor refers to 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;	Section 5.6.1, p. 5.6-3		
Appendix B (g) (9) (E) (ii)	An acute exposure is one which occurs over a time period of less than or equal to 1 hour; and	Section 5.6.2.4, p. 5.6-24		
Appendix B (g) (9) (E) (iii)	A chronic exposure is one which is greater than twelve (12) percent of a lifetime of 70 years.	Section 5.6.2.5, p. 5.6-25		
Appendix B (i) (1) (A)	Tables which identify laws, regulations, ordinances, standards, adopted local, regional, state, and federal land use plans, leases, and permits applicable to the proposed project, and a discussion of the applicability of, and conformance with each. The table or matrix shall explicitly reference pages in the application wherein conformance, with each law or standard during both construction and operation of the facility is discussed; and	Section 5.6.5, p. 5.6-29 Table 5.6-17, p. 5.6-29		
Appendix B (i) (1) (B)	Tables which identify each agency with jurisdiction to issue applicable permits, leases, and approvals or to enforce identified laws, regulations, standards, and adopted local, regional, state and federal land use plans, and agencies which would have permit approval or enforcement authority, but for the exclusive authority of the commission to certify sites and related facilities.	Section 5.6.6, p. 5.6-29 Table 5.6-18, p. 5.6-31		

Adequacy Issue: Adequate ____ Inadequate ____

DATA ADEQUACY WORKSHEET

Revision No. 0 Date ____

Technical Area: **Public Health** Project: ____ Technical Staff: ____

Project Manager: ____ Docket: ____ Technical Senior: ____

Siting Regulations	Information	AFC Page Number And Section Number	Adequate Yes Or No	Information Required To Make AFC Conform With Regulations
Appendix B (i) (2)	The name, title, phone number, address (required), and email address (if known), of an official who was contacted within each agency, and also provide the name of the official who will serve as a contact person for Commission staff.	Section 5.6.6, p. 5.6-31 Table 5.6-18, p. 5.6-31		
Appendix B (i) (3)	A schedule indicating when permits outside the authority of the commission will be obtained and the steps the applicant has taken or plans to take to obtain such permits.	Section 5.6.7, p. 5.6-32		