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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 (IGCC) power generating facility called Hydrogen Energy California (HECA or the "Project") in Kern County, California. The Project will produce electricity while substantially reducing greenhouse gas emissions by capturing carbon dioxide (CO_2) and transporting it for enhanced oil recovery (EOR) and sequestration.

The 315-acre Project Site is located approximately 6.5 miles west of the outermost edge of the city of Bakersfield and 2 miles northwest of the unincorporated community of Tupman in western Kern County, California, as shown in Figure 2-1, Project Vicinity Map. The Project Site is adjacent to an oil producing area known as the Elk Hills Oil Field Unit. The Project Site is currently undeveloped. Existing surface elevations vary from about 445 feet above mean sea level (msl) in the southwest corner to about 310 feet above msl in the northeast corner.

The Project will gasify petroleum coke (or blends of petroleum coke and coal, as needed) to produce hydrogen to fuel a combustion turbine operating in combined cycle mode. The gasification component 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 component will also capture approximately 90 percent of the carbon dioxide from the syngas at steady-state operation, which will be transported and used for EOR and sequestration (storage) in the Elk Hills Oil Field Unit. 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 located in Kern County, California. These Project components are described below.

Major on-site Project components will include, as shown on Figure 2-4, Plot Plan:

- Solids Handling, Gasification, and Gas Treatment
  - Feedstock delivery, handling and storage
  - Gasification
  - Sour shift/gas cooling
  - Mercury removal
  - Acid gas removal
- 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
- Zero liquid discharge
- Carbon dioxide compression
- Wastewater injection wells
- Raw water treatment plant
- Other plant systems

The Project also includes the following off-site facilities, as shown on Figure 2-5, Project Location Map:

- **Electrical Transmission Line** – An electrical transmission line will interconnect the Project to Pacific Gas & Electric's (PG&E) Midway Substation. The interconnection voltage is expected to be 230 kilovolts (kV). The Project is considering two alternative transmission routes, both of which extend from the western edge of the Project Site to the north, and west to the north side of the substation. Transmission Alternative 1 is approximately 9 miles long and Transmission Alternative 2 is approximately 9.5 miles long.
- **Natural Gas Supply** – A natural gas interconnection will be made with either PG&E or Southern California Gas Company natural gas pipelines, both of which are located southeast of the Project Site. The natural gas pipeline will be approximately 7 miles in length. The interconnect will consist of one tap off the existing natural gas line, one meter set, one service pipeline service connection, and a pressure limiting station located on the Project Site.
- **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 18 miles in length. Potable water for drinking and sanitary use will be supplied by West Kern Water District located near the State Route 119 (SR 119)/Tupman Road intersection (southeast of the Project Site). The potable water supply pipeline will be approximately 5.5 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. The Project is considering two alternative pipeline routes. Alternative 1 is approximately 2 miles in length, while Alternative 2 is approximately 2.5 miles in length.

The Project components described above are shown on Figure 2-5, Project Location Map, which depicts the region, the vicinity, the Project Site and its immediate surroundings for Project components.

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

The disturbed acreage associated with the Project is summarized in Table 5.6-1, Project Disturbed Acreage.

Table 5.6-1
Project Disturbed Acreage

Project Component	Temporary Disturbance	Permanent Disturbance
Project Site	315 acres	315 acres
Electrical transmission line	Alternative 1 – 15 acres Alternative 2 – 15 acres	Alternative 1 – 2 acres Alternative 2 – 2 acres
Natural gas line	PG&E – 2 acres Southern California Gas Company – 2 acres	PG&E – previously disturbed Southern California Gas Company – previously disturbed
Water supply line	BVWSD – 15 acres	BVWSD – previously disturbed
CO_2 line	Alternative 1 – 1 acre Alternative 2 – 1 acre	Alternative 1 – previously disturbed Alternative 2 – previously disturbed
Temporary Construction Areas	Included in Project Site	None
Total Project Disturbance	**348 acres**	**317 acres**

Source: HECA Project
Notes:
BVWSD = Buena Vista Water Storage District
CO_2 = carbon dioxide

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 California 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 located near an oil producing area in Kern County, California, as shown in Figure 2-1. It is approximately 2 miles northwest of the community of Tupman. The legal description is as follows: North ½ of Section 22 within Township 30 South, Range 24 East on Kern County Assessor's Parcel Number (APN) 159-180-12.

The land uses within a 3-mile radius of the site are the unincorporated community of Tupman, with residences and a school approximately 1.3 miles to the southeast, the Tule Elk Reserve and agricultural land to the northeast, and open space in all other directions (see Section 5.4, Land Use, for a detailed analysis of surrounding land uses).

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 to health risks from a chemical exposure: schools (public and private), day care facilities, convalescent homes, parks, and hospitals. There is only one sensitive receptor within 3 miles of the Project: Elk Hills elementary school, located 1.3 miles to the southeast. 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 3 miles of the Project Site, shows the location of this sensitive receptor; however, the HRA approach treats all receptors as sensitive receptors. The closest residential neighborhood is in the unincorporated community of Tupman, approximately 2 miles southeast of the Project boundary, but there is a single residence approximately 0.5 mile northeast of the 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 power plant 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" (US 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, there is still substantial work 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 California's rate.

Recent data from the California Department of Public Health, 2007 County Profiles, using data 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.

Kern County is endemic to *Coccidioides immites*, a fungus that lives in the soils in southwestern U.S. and northwestern Mexico. The tiny spores become wind-borne and inhaled into the lungs where it 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), and 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 (Janadu 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 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. Whereas, 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 or not 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 5.6-2, Summary of all Operational TACs and Toxicity Values Used to Characterize Health Risks. The sources emitting the TACs listed in Table 5.6-2 are summarized below, immediately following 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. 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 2008).

Third, a dose-response assessment was performed in HARP incorporating 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 5.6-2, Summary of all 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, as there are no bodies of water near the 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.

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 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. 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.

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. DEGADIS was run to calculate hydrogen sulfide impacts at this location. The DEGADIS 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 property boundary, and DEGADIS was run to calculate hydrogen sulfide impacts at this location as well. The DEGADIS chronic hydrogen sulfide impact was then added to the HARP maximum impact.

To complete the analysis, DEGADIS modeled the location of maximum hydrogen sulfide ground level concentration at a point along the eastern corner of the northern property boundary. HARP modeled the chronic and acute health effects for all other toxic compounds at this maximum DEGADIS location, and the chronic and acute risks from DEGADIS and HARP were added together at this point.

Carbonyl sulfide 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 carbonyl sulfide.

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

Table 5.6-2
Summary of all 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
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

Table 5.6-2
Summary of all 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 $(mg/kg\text{-}day)^{-1}$
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	--
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	--
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

Table 5.6-2
Summary of all 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 $(mg/kg\text{-}day)^{-1}$
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
Phenanathrene	PAH	--	--	--
Pyrene	PAH	--	--	--

Source: HECA Project
Notes:
1) Data from California Air Resources Board (2008)
2) No REL established or unknown
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

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

- HRSG Combustion Turbine (GE 7FB)
- Auxiliary CTG (GE LMS100® PA)
- Power Block Cooling Towers

Gasification Block

- Gasifier Refractory Heaters
- Auxiliary Boiler
- Ground Flare
- Elevated Flare
- Tail Gas Thermal Oxidizer
- ASU and Gasification Cooling Towers
- Carbon Dioxide Vent

Ancillary Equipment

- Diesel Generator
- Fire Pump Engine

5.6.2.2 Construction Phase Emissions

Due to the relatively short duration of Project 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

Operation of the power plant will emit TACs that can cause adverse health effects upon their release to the air. A summary of all 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 5.6-2, Summary of all Operational TACs and Toxicity Values Used to Characterize Health Risks.

Tables 5.6-3 – 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.

Table 5.6-3
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 system generator
TAC = toxic air contaminant
lb/hr = pounds per hour
lb/yr = pounds per year

Table 5.6-4
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 Aux 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 3.4-1.

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 5.6-5
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 5.6-6
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
Phenanathrene	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 fuel heating value, Btu/scf, HHV 1,050
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.

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

Table 5.6-7
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
Phenanathrene	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 fuel heating value, Btu/scf, HHV 1,050

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

Table 5.6-8
Ground 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 Chpt. 1.4 (for metals) and Ventura County Air Pollution Control District AB2588 (for non-metals).
3) Calculation assumes fuel heating value, Btu/scf, HHV 1,050

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
Elevated 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 gasifier startup and shutdown with assist gas.

2) Emission factors based on AP-42 Chpt. 1.4 (for metals) and Ventura County Air Pollution Control District AB2588 (for non-metals).

3) Calculation assumes fuel heating value, Btu/scf, HHV 1,050

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

Table 5.6-10
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
Phenanathrene	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 (accounting for both process vent and SRU startup)
2) Emission factor source USEPA AP-42 Section 1.4
3) Calculation assumes fuel heating value, Btu/scf, HHV 1,05

Btu = British thermal units
CAS = Chemical Abstracts Service Registry Number
USEPA = US 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

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

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 mature operating conditions firing syngas. 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.
- Cooling Towers (power block, ASU, and gasification) – Hourly emissions were calculated based on the circulation rates, drift fractions and expected concentrations parts per million [ppm]) of TACs in cooling water. Annual emission rates were calculated based on 8,322 hours per year.
- Gasifier Refractory Heaters– There are three gasifiers 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 based on the required standard cubic feet of natural gas required per hour based on 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.
- Ground 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.
- Elevated 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.
- Tail Gas Thermal Oxidizer – Hourly emission rates were calculated based on the required 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. 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 horse power rating of the generator and the manufacturer-specified particulate emission rate. Annual emissions were calculated based on 50 hours per year operation for each of two generators.
- Fire Pump Engine – Hourly emission rates were calculated based on the horse power 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. 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 or not the project is a major source of HAPs or not. Under the Clean Air Act, §112, a major source is defined as a source 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 Application for Certification (AFC).

5.6.2.4 Model Input Parameters

The HRA was conducted using the hourly and annual emissions listed for each source in Tables 5.6-3 through 5.6-13. 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 2008). 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 Reserve (2,000 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, Other Receptors in the Vicinity of the Project Site, shows the location of the Tule Elk Reserve receptors and the Buena Vista Lakebed receptors which were included 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 property 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 5.6-2, 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 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 (10×10^{-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 5.6-14, 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 5.6-14
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	2.99 excess risk in 1 million	0.032 total hazard index	0.053 total hazard index
Peak risk at a sensitive receptor (Elk Hills Elementary School)	0.48 excess risk in 1 million	0.0049 total hazard index	0.0044 total hazard index

Source: HECA Project

The maximum incremental cancer risk resulting from Project emissions was estimated to be 2.99 in 1 million, at a location on the southern property boundary (receptor located at 283,473 meters east, 3,908,774 meters north[1]). The peak cancer risk predicted at a sensitive receptor was 0.48 in 1 million, at the Elk Hills Elementary School, approximately 1.5 miles southeast of the Project (285,959 meters east, 3,908,409 meters north).

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 5.6-14, Estimated Cancer Risk and Acute and Chronic Non-cancer THI Due to Project TAC Emissions, presents the detailed non-cancer results of the HRA for the Project operations without the Carbon Dioxide Vent operating. Table 5.6-15 presents the detailed non-cancer results of the HRA for the project operations with the Carbon Dioxide Vent operating.

Table 5.6-15
Estimated Cancer Risk and Acute and Chronic Non-cancer THI Due to HECA TAC Emissions When Carbon Dioxide Vent Operating

Location	Cancer Risk	Chronic Hazard Index	Acute Hazard Index
Point of maximum impact	2.99 excess risk in 1 million	0.053 total hazard index	0.9797 total hazard index
Peak risk at a sensitive receptor (Elk Hills Elementary School)	0.48 excess risk in 1 million	0.0279 total hazard index	0.3477 total hazard index

Source: HECA Project

The maximum chronic THI resulting from Project's operational emissions was estimated to be 0.032 at a location on the southern property boundary (283,437 meters east, 3,908,774 meters

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

north) – the same location as the predicted cancer risk maximum. The maximum predicted chronic THI at the Elk Hills Elementary School sensitive receptor was 0.0049 (285,959 meters east, 3,908,409 meters north). DEGADIS results added to these two locations will increase the maximum chronic THI to 0.053 and the predicted chronic THI at the Elk Hills Elementary School to 0.0279.

The maximum acute THI resulting from Project emissions was estimated to be 0.053 at a location approximately 3.6 kilometers southwest of the Project (281,500 meters east, 3,906,500 meters north). The maximum acute THI at the Elk Hills Elementary School sensitive receptor was estimated to be 0.0044 (285,959 meters east, 3,908,409 meters north). DEGADIS results added to these two locations will increase the maximum acute THI to 0.9797 and the predicted acute THI at the Elk Hills Elementary School to 0.3477.

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 California Air Toxics Emission Factor (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 overprediction 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 overpredicted 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

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 5.6-2, 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 5.6-16, 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.

Table 5.6-16
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

Table 5.6-16
Summary of LORS – Public Health

Authority	Administering Agency	Requirement	AFC Section(s)
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

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).

California Health & 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 & 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 5.6-17, Involved Agencies and Agency Contacts.

Table 5.6-17
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 following 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.

California Air Resources Board (CARB). 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.

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 & 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.

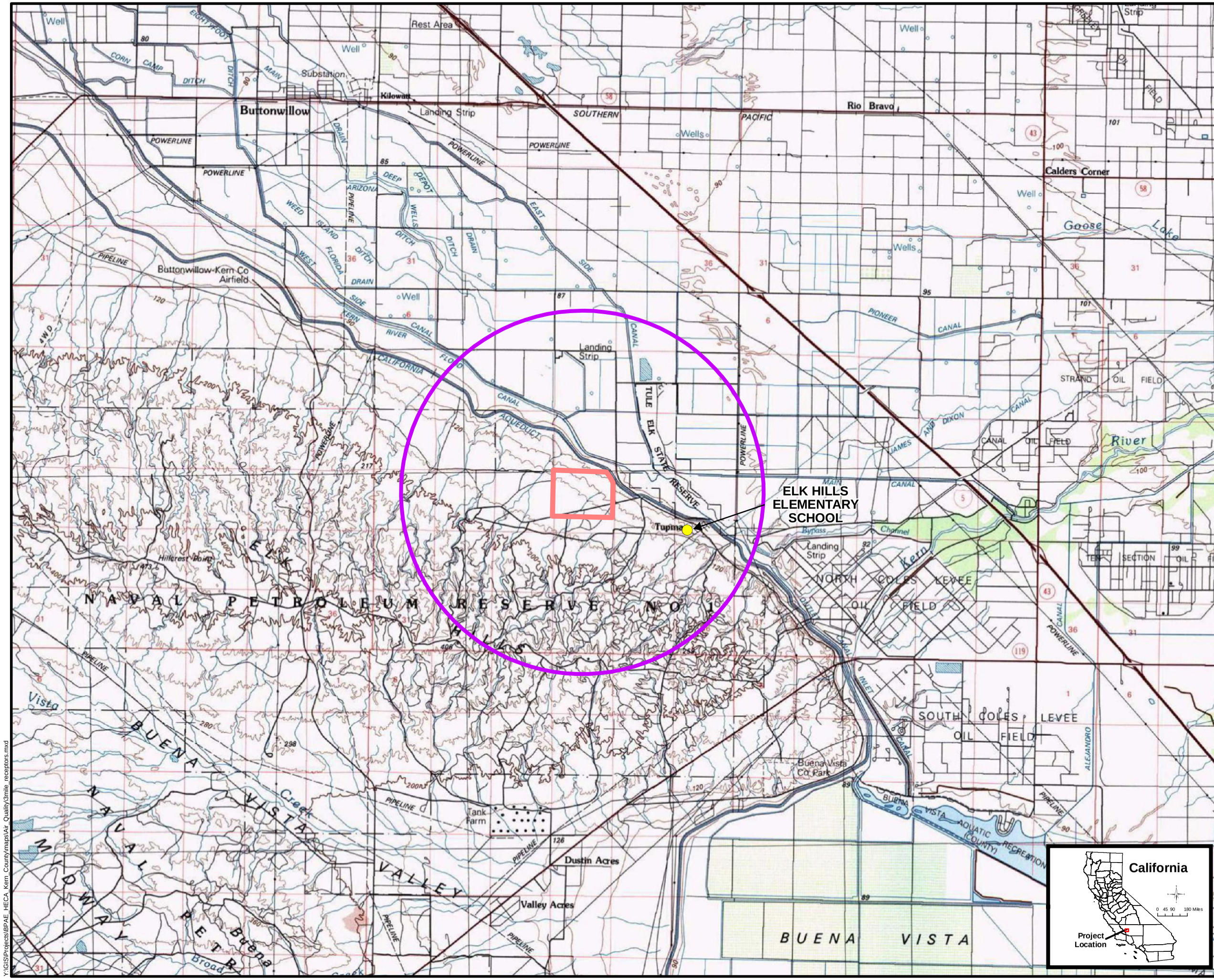
SJVAPCD (San Joaquin Valley Air Pollution Control District). 2002. Guidelines for Assessing and Mitigating Air Quality Impacts. January.

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. 2008. 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.



Sensitive Receptor

3-mile Buffer

Property Boundary

0 8,000 16,000 Feet

Sources:
USGS using TOPO!, ©2006 National Geographic Maps, All Rights Reserved.

Sensitive Receptor Located within 3 Miles of the Project Site

Hydrogen Energy California (HECA)

FIGURE 5.6-1

URS

Created July, 2008

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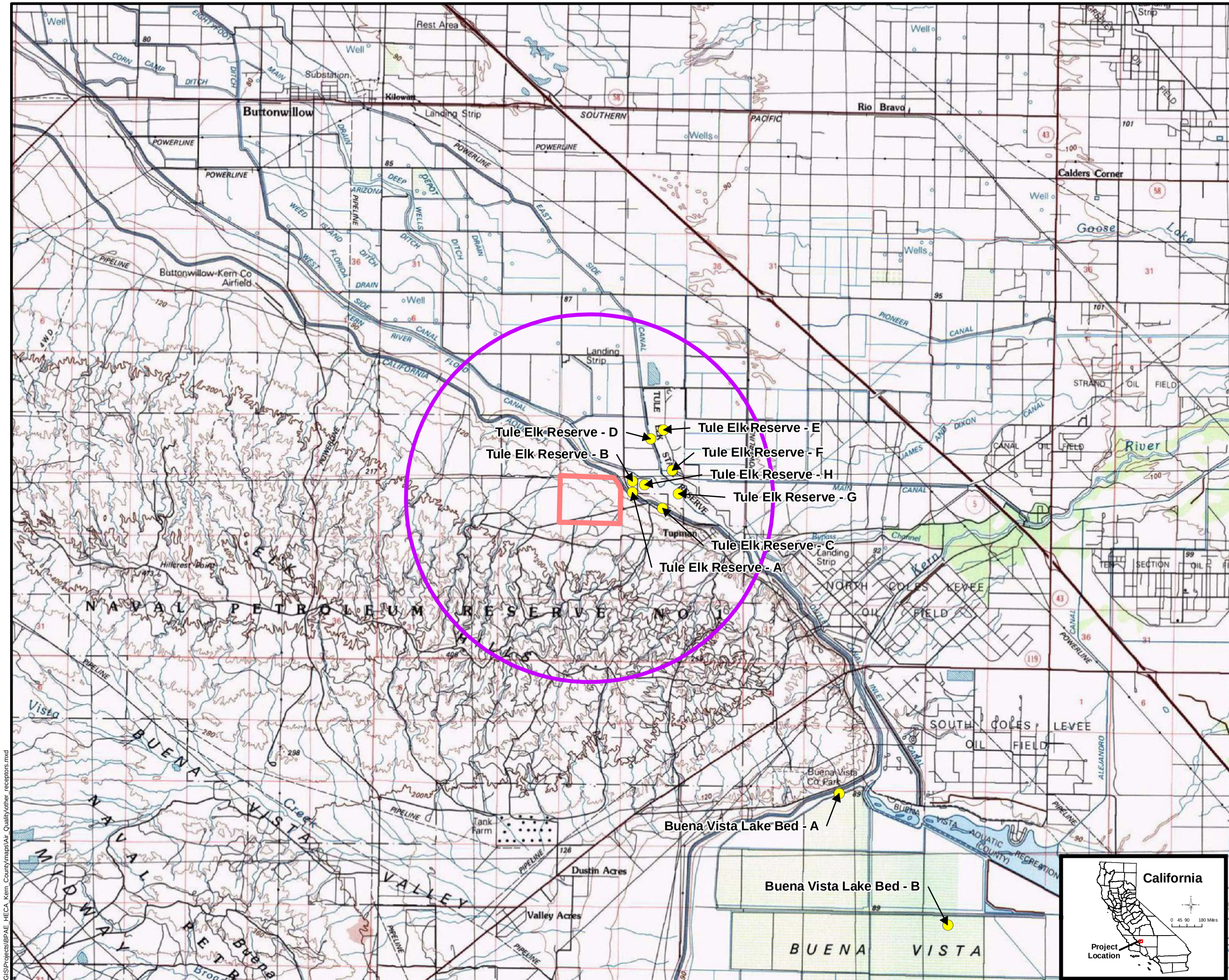

Receptor Location
3-mile Buffer
Property Boundary

0 8,000 16,000 Feet

Sources:
USGS using TOPO!, ©2006 National Geographic Maps, All Rights Reserved.

Other Receptors In the Vicinity of the Project Site

Hydrogen Energy California (HECA)

FIGURE 5.6-2

URS

Created July, 2008

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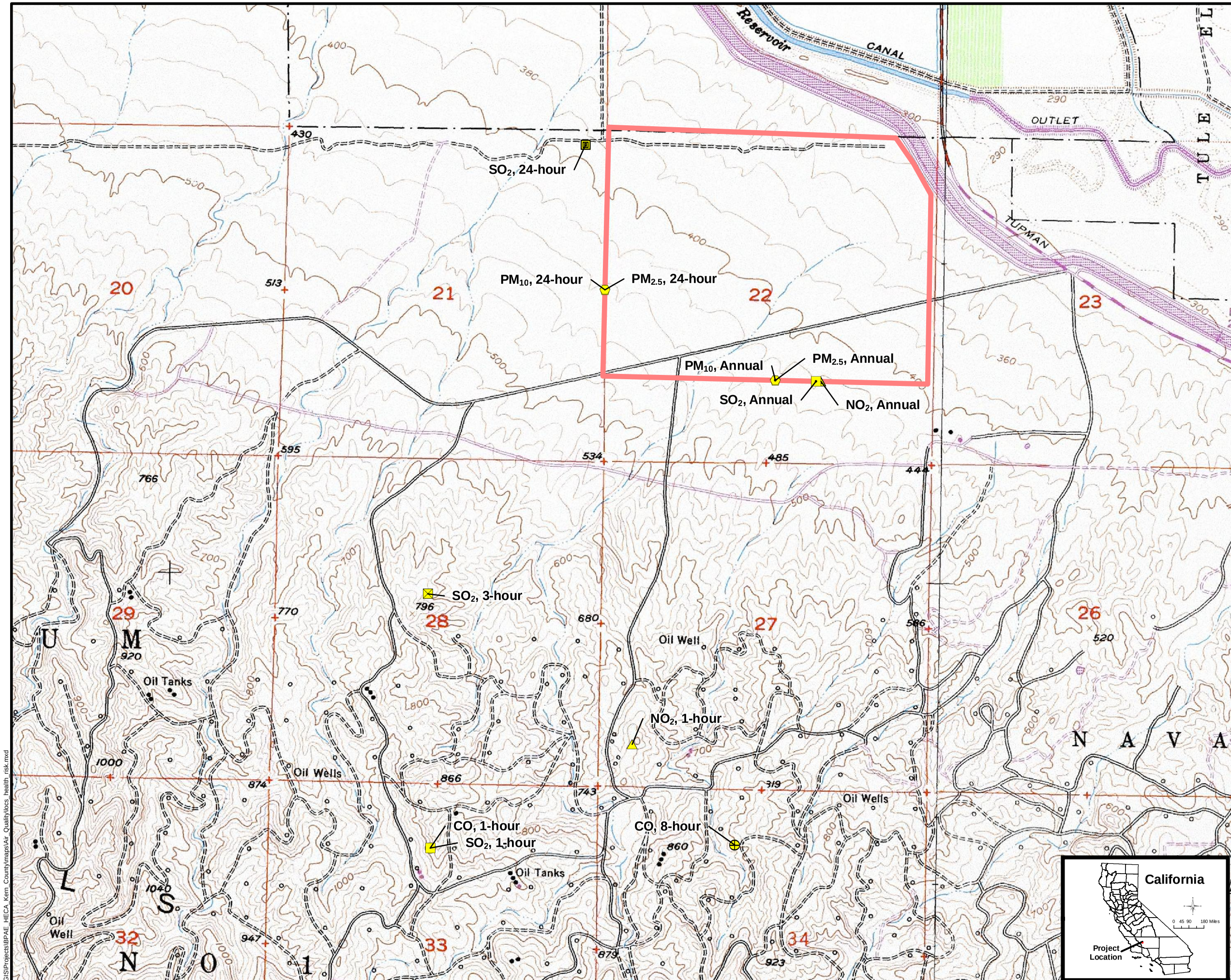

Property Boundary

Maximum Level of Predicted Ground Level Pollutant Concentrations

- CO, 1-hour
- CO, 8-hour
- NO_2, 1-hour
- NO_2, Annual
- PM_{10}, 24-hour
- PM_{10}, Annual
- $PM_{2.5}$, 24-hour
- $PM_{2.5}$, Annual
- SO_2, 1-hour
- SO_2, 24-hour
- SO_2, 3-hour
- SO_2, Annual

0 1,500 3,000 Feet

Sources:
USGS using TOPO!, ©2006 National Geographic Maps, All Rights Reserved.

Locations of Maximum Health Risks

Hydrogen Energy California (HECA)

FIGURE 5.6-3

URS

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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		
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		
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.	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 six-mile radius of the proposed power plant site related to respiratory illnesses, cancers or related diseases.	Section 5.6.2.1		
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		
Appendix B (g) (9) (E)	For purposes of this section, the following definitions apply:	____	____	____

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) (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		
Appendix B (g) (9) (E) (ii)	An acute exposure is one which occurs over a time period of less than or equal to one (1) hour; and	Section 5.6.2.4		
Appendix B (g) (9) (E) (iii)	A chronic exposure is one which is greater than twelve (12) percent of a lifetime of seventy (70) years.	Section 5.6.2.5		
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, Table 5.6-14		
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, Table 5.6-15		

Adequacy Issue: Adequate ____ Inadequate ____

DATA ADEQUACY WORKSHEET

Revision No. 0 Date ____

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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		
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		