5.10 Public Health

This AFC section addresses potential public health issues related to BSEP. These issues include the potential for health impacts due to the emissions of air pollutants; health risks from the emissions of air contaminants; and airborne pathogens. Related topics are discussed in separate sections of the AFC document. Impacts on Federal or State ambient air quality standards due to criteria pollutant emissions from both construction and operation are addressed in Section 5.2, Air Quality, and the potential for exposure to hazardous materials and/or hazardous wastes are addressed in Section 5.6, Hazardous Materials Handling, and Section 5.16, Waste Management, respectively. A discussion of electromagnetic fields (EMF) is provided in Section 5.14, Transmission Line Safety and Nuisance. This section presents the methodology and results of a human health risk assessment (HRA) performed to evaluate potential impacts and public exposure associated with airborne emissions from the Project's operations.

Chemical substances released to ambient air that pose potential risks to human health from Project operations include byproducts from the combustion of natural gas in Project auxiliary boilers, byproducts from the combustion of diesel fuel in the emergency diesel fire water pump, byproducts from chemical treatment for biological growth control in the cooling tower, and breakdown products from the thermal degradation of the heat transfer fluid (HTF). For public health, the term chemical substances refer to chemical substances in ambient air that are regulated by either the EPA and/or the State of California. The California Office of Environmental Health Hazard Assessment (OEHHA) and the California Air Resources Board (ARB) use the term Toxic Air Contaminant (TAC), which currently includes over 244 chemical substances. The EPA uses the term Hazardous Air Pollutants (HAP), and has currently identified 188 substances as HAPs, all of which are presently included in California's list of TACs. The term TAC will be used throughout this section to mean both TAC and HAP, except when specifically addressing a Federal requirement that only applies to HAPs. TAC emissions from the Project's auxiliary boilers, fire water pump, cooling tower, and HTF expansion (ullage) tank are analyzed for impacts to public health.

5.10.1 LORS Compliance

The LORS relevant to public health that are applicable to the BSEP are summarized briefly in Table 5.10-1 and discussed in the text following the table.

5.10.1.1 Federal LORS

National Emission Standards for Hazardous Air Pollutants (NESHAP), 40 CFR Parts 61 and 63

EPA regulations related to hazardous air pollutants (HAPs) will have limited applicability to the BSEP because the Project will not be a major source of HAP emissions. The Project will have emissions of biphenyl and benzene from the HTF, but these emissions are below the major source limits for HAPs. In addition, there are no health risk factors associated with biphenyls even though it is a recognized HAP. These Federal NESHAP regulations have been incorporated by reference in KCAPCD Regulation IV, but are not expected to apply to BSEP.

Table 5.10-1 Summary of LORS Applicable to Public Health

LORS*	Applicability	Where Discussed in AFC
Federal:		
None applicable	Not applicable	Section 5.10.1
State:		
California Health and Safety Code (HSC) Section 41700	Prohibits odors and emissions from causing injury, detriment, nuisance, or annoyance to any considerable number of people.	Section 5.10.1
HSC Sections 44360 to 44366 (Air Toxics "Hot Spots" Information and Assessment Act – AB2588)	Regulates public exposure to toxic air contaminants from existing and new sources.	Sections 5.10.1 and 5.10.3
HSC Sections 25249.5 et seq. (Safe Drinking Water and Toxic Enforcement Act of 1986 -- Proposition 65)	Requires notification related to public exposure to chemicals known to cause cancer or reproductive toxicity.	Section 5.10.1
Title 17 California Code of Regulations (CCR), Section 93115, Airborne Toxic Control Measure (ATCM) for Stationary Compression Ignition Engines	Establishes emission limits and operating limits on stationary compression ignition engines, including emergency fire pump engines.	Sections 5.10.1 and 5.10.3
Title 17 and 26, CCR Section 93103, Subchapter 7.5, Chapter 1, Part III	Regulates hexavalent chromium and chromate substances in cooling towers through notification, concentration limits, and testing record retention.	Section 5.10.1
CEC Staff Cooling Water Management Program Guidelines For Wet and Hybrid Cooling Towers at Power Plants (CEC, 2004)	Provides example of adequate contents of a biocide application and monitoring program designed to control microorganisms, to the maximum extent feasible, within cooling towers using open recirculating water systems.	Sections 5.10.1 and 5.10.4
Local (Kern County Air Pollution Control District (KCAPCD)):		
KCAPCD Rule 419 (Nuisance)	Implements HSC Section 41700 (see above)	Sections 5.10.1 and 5.10.4
KCAPCD Rule 210.9 (Construction and Reconstruction of Stationary Hazardous Pollutant Sources)	New Source Review for Air Toxics implements the Federal NESHAP under 40 CFR Part 63 and also the California ATCM (see above).	Sections 5.10.1 and 5.10.3
* The LORS in this table relate only to public health concerns due to the emissions of TAC and other air contaminants. See other AFC sections for LORS related to other public health topics such as air quality, EMF, hazards, waste streams, etc.		

5.10.1.2 State LORS

HSC Sections 39650 et seq.

These sections of the California HSC establish a broad statewide program of public protection against exposure to TACs determined to be carcinogenic, teratogenic, mutagenic, or otherwise toxic or injurious to humans, including control technology requirements and cumulative impact analysis. The BSEP will meet all applicable measures to control and minimize TAC emissions and, as evidenced by this HRA, will not compromise the public's health.

HSC Section 39666

The California HSC delegates the enforceability of California ATCM to local air quality agencies. Airborne toxic control measures have been adopted to reduce emissions of TACs from non-vehicular sources. The goal is to limit the emissions of TAC to the maximum extent possible. The BSEP is not a major source of HAP emissions as can be seen from the discussions in the following sections. The Project will employ a diesel-fueled fire water pump, and an ATCM has been adopted to control diesel particulate matter (DPM) emissions from new stationary compression ignition (CI) engines. The fire water pump at the BSEP will be limited to an annual non-emergency (e.g., testing and maintenance) operating time of 50 hours per year to minimize DPM emissions.

HSC Section 41700

The HSC prohibits the discharge of air pollutants that cause injury, detriment, nuisance, or annoyance to the public. This requirement is implemented through KCAPCD Rule 419.

HSC Sections 44360-44366 – Air Toxic "Hot Spots" Information and Assessment

Under California HSC Sections 44360-44366, the BSEP will file the required TAC emissions information. This filing requirement applies after the start of operations. Assessments provided in this AFC Public Health section indicate that the BSEP will have insignificant impacts from TAC emissions. The administering agency for the Air Toxics "Hot Spots" program is the KCAPCD.

HSC Sections 25249.5 et seq. (Safe Drinking Water and Toxic Enforcement Act of 1986 - Proposition 65)

Under this code, facilities that emit chemicals identified under the Proposition 65 and known to cause cancer or reproductive harm are required to notify the public and provide warnings. Based on the HRA provided in this section, TAC emission rates and resulting cancer risks do not exceed significance thresholds that require Proposition 65 warnings.

Title 17 CCR, Section 93115 Airborne Toxic Control Measure for Stationary Compression Ignition Engines

The California ATCM for compression ignition (CI) engines specifies operating requirements and exhaust emission standards for stationary CI engines. Although this is an air toxic control measure, it contains emission standards for criteria pollutants as well as diesel particulate matter. In addition, it requires the use of ARB diesel fuel (15 ppm sulfur [S] by weight).

Pursuant to §93115.3(n), the requirements of §93115.6(b)(3) [the emission standards] do not apply to in-use emergency fire pump assemblies that are driven directly by stationary diesel-fueled CI engines and only operated the number of hours necessary to comply with the testing requirements of National Fire Protection Act (NFPA) 25 "Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems," 2002 edition.

The facility will limit the hours of operation of the fire pump engine to one hour per week, not to exceed 50 hours per year, as recommended by NFPA 25, and will install a totalizing hour meter to substantiate compliance with the use limitation. The facility will use only ARB diesel fuel in the fire pump engine and retain purchase records and Material Safety Data Sheets (MSDSs) to substantiate compliance with the fuel sulfur requirement.

CCR Titles 17 and 26, Section 93103, Subchapter 7.5, Chapter 1, Part III

These requirements regulate hexavalent chromium and chromate substances in cooling towers. There will be no hexavalent chromium added to the BSEP cooling tower during operations and there is not expected to be hexavalent chromium in the onsite groundwater used for cooling tower makeup water.

CEC Staff Cooling Water Management Program Guidelines for Wet and Hybrid Cooling Towers at Power Plants (CEC, 2004)

The BSEP will develop and implement a cooling tower maintenance plan in accordance with the CEC Cooling Water Management Program Guidelines (2004). The plan will be documented and submitted to the CEC for review and approval prior to commencement of cooling tower operation. The plan will contain a description of the biocide(s) selected and the reasons for their selection, a description of how the biocide is to be administered (continuous or intermittent feed, level of residual concentrations, etc.), detailed description of the microbial testing protocol, response to microbial control following an upset, shutdown, startup, and maintenance procedures, and a description of documents related to maintaining the microbiological control program.

5.10.1.3 Local LORS

KCAPCD has several local rules and regulations that implement its own, as well as Federal and State programs addressing TAC emissions, as described below.

Rule 419 – Nuisance

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

Rule 423 - National Emission Standards for Hazardous Air Pollutants (NESHAP)

This KCAPCD rule adopts the Federal NESHAP requirements promulgated under 40 CFR Parts 61 and 63 by reference. However, as noted above, there are currently no NESHAP that apply to this Project.

Rule 210.9 – Toxic Air Contaminants New Source Review

This rule requires that a HRA be performed if facilities with emissions of TAC have high facility priority score. A detailed HRA is necessary if TAC emissions exceed KCAPCD significance threshold levels. Toxics Best Available Control Technology (T-BACT) must be installed if the HRA shows a cancer risk greater than one-in-one-million. At no time shall the cancer risk exceed ten-in-one-million. Based on the emission estimates described in this report, BSEP is not a high priority facility, and hence modeling is not required for the HRA.

CEQA and Federal Conformity Guidelines

Under CEQA, the KCAPCD is the responsible agency on air quality and related matters within its jurisdiction or impacting on its jurisdiction. The KCAPCD has developed its own CEQA guidelines dated July 1999 for evaluating projects within its jurisdiction. The KCAPCD CEQA Guidelines state the use of the health risk public notification thresholds adopted by the District's Board of Directors for evaluating impact from proposed projects. The KCAPCD's Board adopted significance thresholds for public notification are set at a cancer risk greater than or equal to 10-in-one-million and/or a non-cancerous Hazard Index (HI) greater than or equal to 1.0.

5.10.1.4 Agency Contacts

The primary agency responsible for public health in the vicinity of the BSEP is the KCAPCD. Agencies and agency contacts relevant to public health issues analyzed in this section are provided in Table 5.10-2. Agency contacts for air quality and hazardous materials handling are provided in AFC Sections 5.2 and 5.6 respectively.

Table 5.10-2 Administering Agency and Contact Information

Agency Contact	Phone/E-mail	Permits/Issue
Glen Stephens Kern County APCD 2700 "M" Street, Suite 302 Bakersfield, CA 93301-2370	(661) 862-5250 GlenS@co.kern.ca.us	Implementation of AB2588, review of HRAs

5.10.1.5 Required Permits and Permit Schedule

No permits are specifically required to address the requirements for public health. Instead, the permits required for air quality (see Section 5.2, Air Quality) will restrict the TAC emissions as well as the criteria pollutants.

5.10.2 Affected Environment

The 2,012-acre BSEP plant site is largely vacant and significantly disturbed from past agricultural activities that occurred up to the 1980's. The Project is located in Kern County along the SR-14 corridor, approximately four miles north-northwest of California City's northern boundary, approximately 15 miles north of the Town of Mojave, and approximately 24 miles northeast of Tehachapi.

Population density in the area immediately around the BSEP plant site is sparse and dispersed. Figure 5.10-1 presents the distribution of the population (population density) within a three-mile radius around the plant boundary, which is considered inclusive of the area of potential exposure to TAC. According to the CEC, sensitive receptors are defined as groups of individuals that may be more susceptible to health risks due to TAC exposure and usually include schools, day care facilities, convalescent homes, and hospitals. There are no sensitive receptors within a three-mile radius of the plant site. The only school within a three-mile radius from the plant boundary, located northeast of the BSEP site (Red Rock Elementary), was determined to be no longer be in use based on a site survey. The school does not lie within a three-mile radius of the power block. Four residences were identified within one mile of the BSEP site and for the purposes of this study, they were considered as discrete receptors. The nearest receptors analyzed for this study were located along the plant site boundary, with the closest point located one-third of a mile from the proposed location of the power block.

The Kern County Department of Public Health Services and the KCAPCD were consulted to determine if any public health studies related to respiratory, cancers, or related illnesses were conducted within a six-mile radius of the BSEP site. Representatives of these organizations indicated that they were not aware of any such studies in the area.

5.10.3 Environmental Impacts (Health Risk Assessment)

Potential environmental impacts addressed in this section are limited to human exposure to the emissions of chemical substances of concern associated with the Project's operation. The method used to assess potential human health risks are consistent with those proposed by the Air Toxics Hot Spots Program Guidance Manual for Preparation of Health Risk Assessments (OEHHA, 2003), referred to as the Guidance Manual hereafter. The Guidance Manual describes algorithms, exposure methods, and cancer and non-cancer health values needed to perform a HRA under AB2588 and is generally considered the best available reference for conducting human HRA in California. Additional references include the Health Assessment Document for Diesel Engine Exhaust (EPA, 2002).

A list of all TAC emitted by the Project under normal operating conditions which may cause an adverse public health impact are presented in Table 5.10-3. The human health risks potentially associated with these substances are evaluated in a HRA. No appreciable quantity of TAC is expected to be emitted from the solar field or the fire water pump diesel fuel tank.

Air Quality impacts from construction of the BSEP are discussed in Section 5.2, Air Quality. Project contributions to the background data are minimal. Since the BSEP site is far from population centers and because construction impacts are temporary, no significant impacts to public health are expected to occur during construction.

Table 5.10-3 Chemical Substances Potentially Emitted from the BSEP

Benzene Biphenyl Chloroform Dichlorobenzene Diesel Particulate Matter Formaldehyde Hexane Naphthalene Phenol	Polycyclic aromatic hydrocarbons (PAHs) Benzo(a)anthracene Benzo(a)pyrene [B(a)P] Benzo(b)fluoranthene Benzo(k)fluoranthene Chrysene Dibenz(a,h)anthracene Indeno(1,2,3-cd)pyrene 7, 12-DimethylBenz(a)anthracene Toluene

5.10.3.1 Risk Definitions and Significance

Cancer Risk

Cancer risk is the probability or chance of contracting cancer over a human life span, which is assumed to be 70 years. Carcinogens are not assumed to have a threshold below which there would be no human health impact. In other words, any exposure to a carcinogen is assumed to have some probability of causing cancer; the lower the exposure, the lower the cancer risk (i.e., a linear, no-threshold model). In assessing public health impacts, cancer risk is the expected incremental increase in cancer cases based on an equally exposed population of individuals, typically expressed as cases per million individuals.

State and local regulations have developed cancer risk levels above which a project is considered to have a potential significant impact on public health. California's AB2588 Air Toxic Hot Spots Program and California's Proposition 65, for example, have developed a significance level for incremental cancer risk of 10-in-one-million as the public notification level for TAC emissions from existing sources.

Non-Cancer Risk

Non-cancer health effects can be either chronic or acute. In determining potential non-cancer health risks from TAC emissions, it is assumed that there is a dose of the chemical of concern below which there would be no impact on human health. The air concentration corresponding to this dose is called the reference exposure level (REL). Non-cancer health risks are measured in terms of a hazard index (HI), which is the calculated exposure of each contaminant divided by its REL. HIs for those pollutants affecting the same target organ are typically summed, with the resulting totals expressed as hazard indices for each organ system.

Similar to cancer risk, non-cancer impacts also have determined significance thresholds based on the estimated HI for the project. RELs used in the HI calculations were those published in the California Air Pollution Control Officers Association (CAPCOA) AB2588 Risk Assessment Guidelines (CAPCOA, 1993), as updated in August 2003 by the OEHHA in the *Consolidated Table of OEHHA/ARB Approved Risk Assessment Health Values* (OEHHA, 2003).

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

Acute toxicity is defined as adverse health effects caused by a short-term chemical exposure of no more than 24 hours. For most chemicals, the multi-pathway exposure required to produce acute effects is higher than levels required to cause chronic effects because the of the shorter exposure period. Because acute toxicity is predominantly manifested in the upper respiratory system at threshold exposures, all hazard indices are typically summed to calculate the total acute HI.

State and local regulations have developed chronic and acute risk levels above which a project is considered to have a potential significant impact on public health. For health risk, a chronic or acute HI exceeding 1.0 is considered significant.

Diesel Particulate Risk

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

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

California Environmental Quality Act Significance Criteria for Health Impacts

California has not established State-wide significance thresholds for cancer and non-cancer health risk impacts under CEQA. However, most air districts in California have adopted local significance thresholds for health risks in their policy guidance to project proponents. The KCAPCD CEQA Guidelines (amended July 1999) state the use of the health risk public notification thresholds adopted by the District's Board of Directors for evaluating impact from proposed projects. The adopted significance thresholds for public notification are those recommended by CAPCOA and are set at a cancer risk greater than or equal to 10 cases in one million and a chronic or acute HI equal to or greater than 1.0.

5.10.3.2 Health Risk Assessment Approach

Source emissions of TAC from the Project were estimated based on EPA emission factors and quantification methods for facility operations. A screening level methodology was adopted to prioritize the risk of the facility based on the recommended "facility prioritization method" proposed by the CAPCOA Air Toxics Hot Spots Program. Facility scores are calculated for both carcinogenic and non-carcinogenic effects, and the highest of the two scores determines the ranking of the facility as high priority (highest score is greater than or equal to 10), intermediate priority (highest score is between one and 10), and low priority (highest score is less than one). A low facility score screens out the possibility for a facility to have a maximum individual cancer risk, or an acute or chronic non-cancer risk above the significance thresholds. Air contaminant inhalation would be the dominant pathway for public exposure to chemical substances released by the Project and is considered the most conservative pathway for estimating health risk.

Health Risk Factors

Chemical substance were evaluated in this analysis using health values that have been approved by the OEHHA and the ARB for use in facility HRAs conducted for the AB2588 Air Toxics Hot Spots Program (OEHHA, 2003). The chemical substances of concern that are addressed in this HRA are listed in Table 5.10-4, along with their respective published OEHHA health effect values. The table lists the OEHHA-adopted inhalation and oral cancer slope factors, non-cancer acute RELs, and inhalation and oral non-cancer chronic RELs. The cancer potency factors and RELs used are consistent with the current values as determined by OEHHA.

Toxic Air Contaminant Emissions

Emission sources of chemical substances of concern that may be associated with the BSEP facility include the auxiliary boilers, emergency diesel fire water pump and the cooling tower. No appreciable quantities of TAC are expected to be emitted from operation of the solar field array or the emergency fire water pump fuel tank. Detailed calculations in support of air toxic emissions discussed below are provided in Appendix E.2, Air Emissions Calculations.

The Project will not be a major source of Federal HAP emissions. The emissions inventory shows total Federal HAP emissions of 0.30 tons per year (tpy). The primary contributor to the total HAP emissions is benzene with emissions of 0.17 tpy (~57 percent) followed by chloroform with 0.07 tpy (~23 percent). Hexane (0.05 tpy) contributes to 17 percent of the total emissions. Regulatory major source thresholds are 10 tpy for any single HAP and 25 tpy for total HAP emissions. The BSEP therefore accounts for only up to two percent of the major source thresholds for single and total HAP emissions. The total HAP emissions from the Project are summarized in Appendix E.2.

Auxiliary Boilers. The BSEP plant will operate two natural gas-fired auxiliary boilers that will be used to reduce the facility's start-up time and to prevent the HTF from freezing. Emissions from these units were calculated based on operating conditions that represent the maximum emissions profile (being permitted) for the BSEP facility. The emissions from each boiler were based on assumed maximum annual operations of 1,000 hours. Table 5.10-5 summarizes TAC potentially emitted from the natural gas-fired auxiliary boilers. For HRA purposes, benzo(a)pyrene or B(a)P was used as the surrogate carcinogen for all PAH emissions, in accordance with OEHHA guidance (OEHHA, 2003). Since the surrogate for total PAH is the most or nearly-the-most potent carcinogens in the class, use of this cancer potency factor with total emissions will tend to overestimate the predicted theoretical risk.

Table 5.10-4 Risk Assessment Health Values for Substances of Potential Concern

Compound	Inhalation Unit Risk Factor $(\mu g/m^3)^{-1}$	Cancer Risk		Non-cancer Effects	
		Inhalation Cancer Potency Factor $(mg/kg\text{-}day)^{-1}$	Oral Slope Factor $(\mu g/m^3)^{-1}$	Chronic Inhalation REL $(\mu g/m^3)$	Acute Inhalation REL $(\mu g/m^3)$
Benzene	2.90E-05	1.0E-01	--	6.0E+01	1.3E+03
Biphenyl[1]	--	--	--	--	--
Chloroform	5.3E-06	1.9E-02	--	3.0E+02	1.5E+02
Dichlorobenzene	1.1E-05	4.0E-02	--	8.00E+02	--
Diesel Particulate Matter	--	1.1E+00	--	5.0 E+00	--
Formaldehyde	6.00E-06	2.1E-02	--	3.0E+00	9.4E+01
Hexane	--	--	--	7.0E+03	--
Naphthalene	3.40E-05	1.2E-01	3.4E-05	9.0E+00	--
PAHs					
Benzo(a)anthracene	1.1E-04	3.9E-01	1.2E+00	--	--
Benzo(a)pyrene [B(a)P]	1.10E-03	3.9E+00	1.2E+01	--	--
Benzo(b)fluoranthene	1.1E-04	3.9E-01	1.2E+00	--	--
Benzo(k)fluoranthene	1.1E-04	3.9E-01	1.2E+00	--	--
Chrysene	1.1E-05	3.9E-02	1.2E-01	--	--
Dibenz(a,h)anthracene	1.2E-03	4.1E+00	4.1E+00	--	--
Indeno(1,2,3-cd) pyrene	1.1E-04	3.9E-01	1.2E+00	--	--
7,12-Dimethylbenz(a)anthracene	7.1E-02	5.9E-06	2.1E-02	3.5E+01	2.0E+04
Phenol	--	--	--	2.0E+02	5.8E+03
Toluene	--	--	--	3.0E+02	3.7E+04

[1] Although biphenyl is a recognized TAC, it does not have quantified risk factors.

Source: OEHHA, 2003; updated 2005

Table 5.10-5 Toxic Air Contaminant Emissions for Auxiliary Boilers

Toxic Air Contaminant	Emission Factor [1] (lb/MMscf)	Maximum Hourly Emissions (lb/hr)		Annual Emissions (lb/yr)	
		Boiler (Each)	Boiler (Total)	Boiler (Each)	Boiler (Total)
Benzene	2.10E-03	6.00E-05	1.20E-04	6.00E-02	1.20E-01
Dichlorobenzene	1.20E-03	3.43E-05	6.86E-05	3.43E-02	6.86E-02
Formaldehyde	7.50E-02	2.14E-03	4.29E-03	2.14E+00	4.29E+00
Hexane	1.80E+00	5.14E-02	1.03E-01	5.14E+01	1.03E+02
Naphthalene	6.10E-04	1.74E-05	3.49E-05	1.74E-02	3.49E-02
PAH[2]					
7,12-Dimethylbenz(a)anthracene	1.60E-05	4.57E-07	9.14E-07	4.57E-04	9.14E-04
Benz(a)anthracene	1.80E-06	5.14E-08	1.03E-07	5.14E-05	1.03E-04
Benzo(a)pyrene	1.20E-06	3.43E-08	6.86E-08	3.43E-05	6.86E-05
Benzo(b)fluoranthene	1.80E-06	5.14E-08	1.03E-07	5.14E-05	1.03E-04
Benzo(k)fluoranthene	1.80E-06	5.14E-08	1.03E-07	5.14E-05	1.03E-04
Chrysene	1.80E-06	5.14E-08	1.03E-07	5.14E-05	1.03E-04
Dibenzo(a,h)anthracene	1.20E-06	3.43E-08	6.86E-08	3.43E-05	6.86E-05
Indeno(1,2,3-cd)pyrene	1.80E-06	5.14E-08	1.03E-07	5.14E-05	1.03E-04
Toluene	3.40E-03	9.71E-05	1.94E-04	9.71E-02	1.94E-01

[1] AP-42 Emission Natural Gas Combustion Emission Factors (Table 1.4-3)

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

Emergency Fire Water Pump. One diesel-fueled fire water pump, with a capacity of 3,000 gallons per minute, delivers water to the fire protection water piping network. Emissions from this unit were quantified for routine testing and maintenance operation only (see Table 5.10-6), and these activities will be limited to no more than 50 hours per year. A limit on the hours of operation is one way to meet the Airborne Toxic Control Measures (ATCM) standards for the fire water pump. TAC emissions were characterized as aggregate particulate emissions from diesel-fired engines (OEHHA, 2003). Hourly emissions of DPM from the fire water pump engine were determined to be 0.10 pounds per hour and total annual emissions of DPM from the fire water pump engine were estimated to be 4.96 pounds, based on the limit of 50 hours per year for non-emergency operations.

Table 5.10-6 Toxic Air Contaminant Emissions for Emergency Internal Combustion Engine

Toxic Air Contaminant	Emission Factor [1] (g/bhp-hr)	Maximum Hourly Emissions (lb/hr)	Annual Emissions (lb/yr)
Diesel Particulate Matter	0.15	0.10	4.96
[1] AP-42 Emission Factors for Diesel Engines (Table 3.3-2)			

Cooling Tower. The BSEP proposes to use a wet cooling tower for power plant cooling. Water for cooling tower makeup will be supplied from onsite groundwater wells. Very low levels of toxic metals and organics were identified in the onsite groundwater (Section 5.17, Water Resources, Table 5.17-7). However, the cooling tower will be source for chloroform emissions from the application of sodium hypochlorite as a biocide for cooling tower maintenance. The chloroform emissions were estimated for an annual cooling tower operation of 5,840 hours and a biocide usage of 2,865 gallons per month (see Table 5.10-7).

Table 5.10-7 Toxic Air Contaminant Emissions for Cooling Tower

Toxic Air Contaminant	Emission Factor [1] (lb chloroform/lb chlorine)	Maximum Hourly Emissions (lb/hr)	Annual Emissions (lb/yr)
Chloroform	0.0034	0.024	138.8
[1] Rogozen, M. B., et al., 1988			

HTF Expansion Tank Vent and Waste Loadout. The total uncontrolled emissions from the HTF expansion tank (also known as an ullage tank) vents were estimated based on data provided by an existing solar plant (Kramer Junction SEGS), extrapolated to account for HTF system size. Controlled emissions were calculated based on the use of two carbon adsorption canisters in series, each with a control efficiency of 95 percent, for an overall control efficiency of 99.5 percent. The emissions from waste loadout were calculated for an assumed twelve waste hauls per year. The total TAC emissions from the waste loadout were calculated as 99.99 percent of the total emissions for benzene, and 0.01 percent of the total emissions for biphenyl. Phenol emissions were considered negligible. The same ratios are assumed for the HTF expansion tank vent. Biphenyl is a TAC but has not been assigned risk factors to allow calculation of the health risk impacts and hence was not included in the HRA study (Table 5.10-8).

Table 5.10-8 Toxic Air Contaminant Emissions for Ullage Vent and Waste Loadout

Toxic Air Contaminant	Maximum Hourly Emissions (lb/hr)		Annual Emissions (lb/yr)	
	Ullage Vent	Waste Loadout	Ullage Vent	Waste Loadout
Benzene[1]	2.33E-01	7.07E+00	1.70E+02	1.70E+02
Biphenyl[2]	2.33E-05	7.07E-04	1.70E-02	1.02E-02
[1]From Tanks 4.09, benzene is 99.99% of total emissions from waste loadout. The same ratio is assumed for the ullage drain vessel vent. [2]Biphenyl emissions calculated are insignificant.				

Risk Characterization

The BSEP HRA evaluated the facility for cancer risk and non-cancer health hazards. The health risk methodology is based on the "Air Toxics Hot Spots Program Risk Assessment Guidance Manual for Preparation of Health Risk Assessments published by the California Environmental Protection Agency (CalEPA) and OEHHA, August 2003. The facility prioritization score is the least complex and most health-conservative method of risk characterization. The procedure is based on the Emissions and Potency Procedure recommended by the Facility Prioritization Guidelines of the AB 2588 Risk Assessment Committee of CAPCOA (CAPCOA, 1990). The method considers the emission rate of the pollutant, its potency, and the receptor proximity to calculate facility risk and assumes no dispersion or dilution. The method also assumes that the pollutants are emitted from a single point nearest to the property boundary. The significance of the prioritization scores lies in its conservative estimates. A refined risk analysis is required only if the highly conservative prioritization score indicates a significant risk.

Facility prioritization scores are determined for carcinogenic effects and non-carcinogenic effects. The score for the carcinogenic effects from the TAC emitted by the BSEP is calculated as the sum of the annual emissions of each substance multiplied by the unit risk factor, a receptor proximity adjustment factor (RP) and a normalization factor. The unit risk factors published by OEHHA are measures of the cancer potency of the pollutant, i.e., the estimated probability that a person will contract cancer as a result of the inhalation of a concentration of 1 ug/m^3 of the TAC continuously over a period of 70 years. The receptor proximity adjustment factor was obtained from the CAPCOA Air Toxics Hot Spots Program – Facility Prioritization Guidelines (CAPCOA 1990). For the BSEP, the nearest receptor is the facility boundary which is one-third of a mile from the emission source (approximately 530 meters) and hence a RP adjustment factor of 0.011 for receptor distance between 500 and 1000 meters was used. The normalization factor is a constant used to bring the carcinogenic and non-carcinogenic scores to a common scale for evaluation.

Non-carcinogenic effects can be due to acute and chronic exposure and both the effects are used in the facility prioritization. The score for the non-carcinogenic effects from the TACs is calculated as the sum of hourly emissions for each substance divided by the RELs and multiplied by the receptor proximity adjustment and a normalization factor. RELs, published by OEHHA, indicate the potential non-cancer health effects and are the concentration level (ug/m^3) or dose (mg/kg-day) at which no adverse health effects are anticipated. The receptor adjustment factor is the same as the one discussed in the carcinogenic effects. The non-carcinogenic scores for each pollutant are calculated for both the effects separately, and the highest scores of the pollutants are summed to get the total facility score. The acute effects are calculated using the maximum hourly emissions and the chronic effects are calculated using the average hourly emissions. Table 5.10-9 presents the scores for the carcinogenic and non-carcinogenic effects.

Table 5.10-9 Toxic Air Contaminant Prioritization Scores

Toxic Air Contaminant	CAS Number	Prioritization Scores		
		Cancer[1]	Non-Cancer	
			Chronic[2]	Acute[3]
Benzene	71-43-2	1.68E-01	1.07E-02	9.27E-02
Chloroform	67-66-3	1.38E-02	8.72E-04	2.61E-03
Dichlorobenzene	106-46-7	1.41E-05	1.61E-07	--
Diesel Particulate Matter	9901	2.78E-02	1.87E-03	
Formaldehyde	50-00-0	4.81E-04	2.69E-03	7.52E-04
Hexane	110-54-3	--	2.77E-05	--
Naphthalene	91-20-3	2.22E-05	7.30E-06	--
Toluene	108-88-3	--	1.22E-06	8.66E-08
Total PAH	50-32-8	3.22E-05	--	--
Total Scores[4]		**0.23**	**0.10**	
Facility Score[5]		**0.23**		

[1] Prioritization scores for cancer risk are calculated by multiplying the annual emission in pounds/year, the Unit Risk Factor, a Normalization Factor of 1.70E+03 and a Receptor Proximity Factor of 0.011 for the nearest receptor at 530 meters.

[2] Prioritization scores for chronic non-cancer risk are calculated by dividing the average annual emissions in pounds/year with the acceptable exposure level, and multiplying the result with a Normalization Factor of 1.50E+03 and a Receptor Proximity Factor of 0.011 for the nearest receptor at 530 meters.

[3] Prioritization scores for acute non-cancer risk are calculated similar to chronic scores, except for the use of maximum hourly emissions in pounds/hour.

[4] Total carcinogenic score is obtained by summing the individual pollutant scores. Total non-carcinogenic score is obtained by summing the maximum of the chronic and acute scores for each pollutant.

[5] Facility score is highest of the carcinogenic and non-carcinogenic scores.

5.10.3.3 Risk Assessment Analytical Uncertainties

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

Exposure Assessment

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

Toxicity Assessment

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

Diesel Particulate Unit Risk Factor

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

5.10.3.4 Risk Assessment Results

The HRA using the Facility Prioritization Score method determined the total Project score for carcinogenic effects as 0.23 and for non-carcinogenic effects as 0.10. As shown in Table 5.10-9, the total facility score for the Project is the higher of the two scores, which is 0.23. Facilities are ranked as high priority (Category A) if the highest score is greater than or equal to 10; intermediate priority (Category B) if the highest score is greater than or equal to one but less than 10; and low category (Category C) if the highest score is less than 1.0. Based on the results from the analysis, the total facility score is less than 1.0, thereby categorizing the BSEP as a low priority facility with minimum receptor impacts, as the threshold is based on a conservative quantification approach. Thus, the BSEP will not have a carcinogenic or non-carcinogenic risk above the significance thresholds adopted by KCAPCD.

5.10.3.5 Non-Chemical Substances of Potential Concern

Cooling tower maintenance will help to prevent and reduce the chances of any growth or emissions of biological nature (e.g., mold and bacteria). To control bacteria levels in cooling water, the BSEP will ensure that the potential for bacterial growth is kept to a minimum by establishing and implementing a cooling tower biocide use, biofilm prevention, and a monitoring program. The details of a cooling tower management plan are discussed in Section 5.10.4.

5.10.3.6 Cumulative Impacts

An analysis of the cumulative impacts of the Project with other projects within a six-mile radius is required by the CEC. Two projects were identified: the Pine Tree Wind Development Project within six miles and a transmission project that starts 1.5 miles from the BSEP site and heads south (and therefore most of the activities are not within six miles of the BSEP site). The Pine Tree Wind Project EIR showed insignificant public health impacts, as would be expected for a wind turbine project. The transmission project would also not be expected to have any TAC emissions. The Kern County Annual AB2588 Air Toxics Report dated April 2007, concluded that no facility in KCAPCD exceeded the cancer risk of 10 in one million or a hazard index of 1.0, i.e., no facilities in the KCAPCD were categorized as high priority.

In 1998, the OEHHA listed DPM, a primary combustion product from diesel engines, as a TAC, based on its potential to cause cancer, premature deaths, and other health problems. According to ARB and EPA, mobile source emissions account for much of the sources of cancer risk associated with TAC. According to EPA estimates, mobile sources (car, truck, and bus) of TAC account for as much as half of all cancers attributed to outdoor sources of TAC (EPA, 1994). More recent research from ARB illustrates that health risks from DPM are highest in areas of concentrated emissions, such as near ports, rail yards, freeways, or warehouse distribution centers (ARB, 2004). Additionally, the MATES-III study showed that mobile sources (e.g., cars, trucks, trains, ships, and aircraft) in the South Coast Air Basin represent the greatest contributors to the estimated cancer risks (about 84 percent) (SCAQMD, 2008).

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

Impacts from TAC emissions from stationary and mobile sources tend to decrease with distance from the source. Given the relatively large distances from the BSEP site to any population centroids or individual receptors, and the low level of TAC impacts produced by the Project, the likelihood of significant cumulative air toxic impacts is very low. In addition, ongoing Federal and State diesel motor vehicle emission reduction programs are in place and projected to create significant reductions in DPM emissions, and corresponding health impacts in the region. Combined, these factors will ensure that the Project's potential health impact will not be cumulatively considerable.

5.10.4 Mitigation Measures

Emissions of criteria pollutants will be minimized by applying BACT to the emission sources, which will include the use of natural gas as fuel in the auxiliary boilers and low-sulfur diesel fuel in the fire water pump engine. These measures also effectively minimize TAC emissions. Power generation with solar energy will also result in lower health risks per unit of energy generated when compared to conventional fossil-fueled power projects. As demonstrated in the HRA presented in this section, no significant public health impact is expected from the operation of the BSEP. Therefore, no TAC emission mitigation beyond that proposed for air quality is needed to protect public health.

Although impacts are expected to be minimal, the measure listed below will be implemented to further mitigate any potential adverse impacts to public health from the cooling tower recirculation water.

PH-1 The BSEP will develop and implement a Cooling Tower Management Plan in accordance with the CEC Cooling Water Management Program Guidelines (CEC 2004). The Program will be documented and submitted to the CEC for review and approval prior to commencement of cooling tower operation. The plan will contain the following protocols:

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

5.10.5 References

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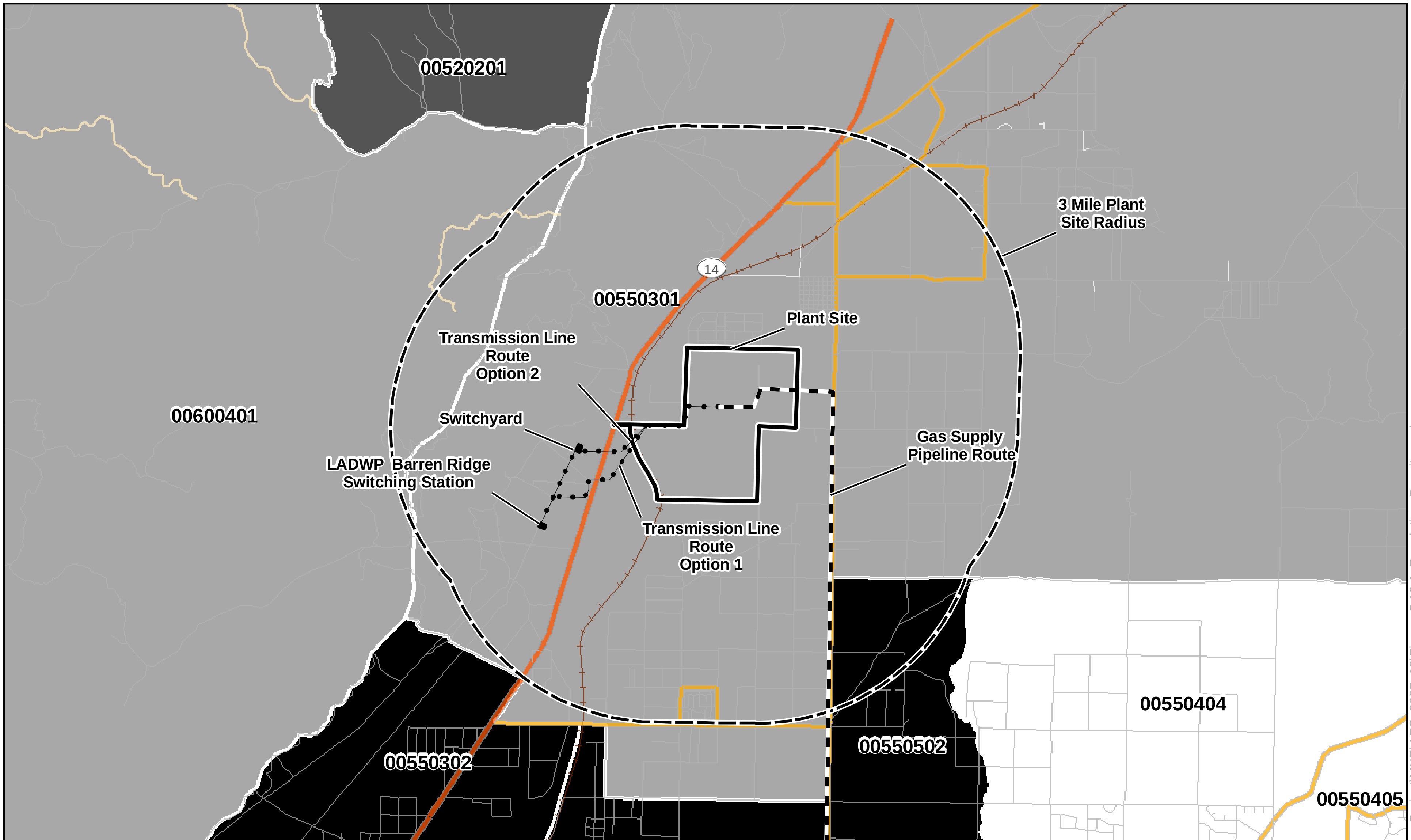

Map Location

Legend

- Plant Site
- Transmission Line Route Options
- Gas Supply Pipeline
- 3 Mile Plant Site Radius

Population per square mile

- 0.0
- 1-2
- 2-5
- 5-37

1:120,000

0 1 2 3 4 Miles

N W E S

Beacon Solar Energy Project

Figure 5.10-1
Population Density
3 Mile Radius of Plant Site

Source: WorleyParsons 2007; ESRI 2007

Beacon Solar

ENSR | AECOM

Project: 10056-014
Date: March 2008