5.16 PUBLIC HEALTH

This section evaluates public health and safety issues associated with the 200-megawatt (MW) Bullard Energy Center (BEC), which will be located in the City of Fresno, California. Specifically, information is presented on the methodology and results of a health risk assessment (HRA) that has been conducted to address potential impacts of routine operational BEC emissions of toxic air contaminants on human health in the neighboring areas. Exposure to criteria pollutants, nitrogen dioxide (NO_2), sulfur dioxide (SO_2), carbon dioxide (CO), volatile organic compounds (VOCs), and particulate matter less than 10 micrometers in diameter (PM_{10}), is examined in Section 5.2, Air Quality.

A limited number of hazardous materials will be stored and used during normal operations at the BEC. These are discussed further in Section 5.15, HazMat Handling. Only aqueous ammonia will be stored on site in sufficient quantity to require a hazardous material Off-site Consequence Analysis, which is also discussed in Section 5.15, HazMat Handling. The details of the public health analysis are contained in the following sections:

- Section 5.16.1, Affected Environment, describes the local environment surrounding the project site. Topographical information is provided. Sensitive receptors within a 3-mile radius of the project site are identified in Figure 5.16-1, Sensitive Receptors Within 3 Miles of the Project Site.
- Section 5.16.2, Environmental Consequences, discusses the maximum potential public health consequences of the project and the HRA approach is described. The estimated project emissions of toxic air pollutants are presented, and the potential health impacts of these emissions are evaluated. The results of the HRA show that the maximum incremental off-site cancer risk from the project will be 1.46 in 1 million. This is well below the accepted cancer risk significance threshold for new sources of 10 in 1 million. The results of the assessment also show that the chronic total hazard index (THI) and the acute THI are 0.001 and 0.0071, respectively, which are both well below the significance criteria of 1.0.
- Section 5.16.3, Cumulative Impacts, addresses the cumulative impacts of the project with other nearby sources of toxic air contaminants.
- Section 5.16.4, Mitigation Measures, discusses mitigation measures to minimize the impacts of the project's emissions of toxic air contaminants.
- Section 5.16.5, Laws, Ordinances, Regulations, and Standards (LORS), describes applicable laws, ordinances, regulations, and standards pertaining to the public health aspects of the project.
- Section 5.16.6, Involved Agencies and Agency Contacts, lists the agency contacts consulted while conducting the public HRA.
- Section 5.16.7, Permits Required and Permit Schedule, lists the permits required and provides the permit schedule.
- Section 5.16.8, References, lists the references used to conduct the public HRA.

5.16.1 Affected Environment

The project site is located at 5829 North Golden State Boulevard in the City of Fresno in the San Joaquin Valley. The project site is about 10.5 miles northwest of the Fresno Yosemite International Airport. Land uses adjacent to the project site are predominantly rural, although there are industrial facilities immediately to the northwest and southeast and across Highway 99 to the south and residential developments to the east and northeast beyond North Golden State Boulevard.

The project site is at an elevation of approximately 300 feet above sea level in terrain that is generally flat within 6 miles. Terrain elevations as high as the combustion turbine generator (CTG) stacks are found within about 9.5 miles of the project site and continue to rise beyond that distance into the foothills of the Sierra Nevada Mountains. Topography within a 6- and 10-mile radius of the project site is shown in Figure 5.2-1 of the Air Quality section of this document.

For 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 are of particular concern. The nearest sensitive receptor is a residence approximately 750 feet southeast of the project boundary. All sensitive receptors located within a 3-mile radius of the project are shown in Figure 5.16-1, Sensitive Receptors Within 3 Miles of the Project Site; however, the HRA approach treated all receptors as sensitive receptors. Although a school site is located within one mile of the BEC, the nearest sensitive receptor is the residence. In addition, future school sites would not include a new school within 1 mile of the BEC site.

5.16.2 Environmental Consequences

This section describes the potential public health risks caused by the construction and operation of the project, and the methodology and results of the HRA. Also, uncertainties in the HRA are discussed and other potential health impacts are described.

A potentially significant carcinogenic risk is indicated when the predicted maximum cancer risk is greater than 10 in 1 million. Noncancer risk is typically reported as a total THI, which is a ratio calculated for each target organ. Specifically, the maximum predicted acute or chronic exposure caused by the project is expressed as a fraction of the corresponding maximum acceptable exposure level for a pollutant. The acceptable exposure level is generally the level at (or below) which no adverse health effects are expected. Thus, significant noncancer risk impacts occur when a chronic or acute THI above 1.0 is predicted.

5.16.2.1 Public Health Impact Assessment Approach

The potential human health risks posed by the project's emissions were assessed using procedures consistent with the Office of Environmental Health Hazard Assessment (OEHHA) *Air Toxics Hot Spots Program Risk Assessment Guidelines – The Air Toxics Hot Spots Program Guidance Manual for Preparation of Health Risk Assessments* (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 Sections 44360 *et seq*.). The Hot Spots law established a statewide program for

inventorying emissions of toxic air contaminants from individual facilities, as well as requirements for risk assessment and public notification of potential health risks.

The HRA was conducted in four steps using the Hotspots Analysis and Reporting Program (HARP):

- Hazard Identification and Emission Quantification
- Exposure Assessment
- Dose-response Assessment
- Risk Characterization

Step 1 – The purpose of this step was to identify whether pollutants emitted from the plant include known or suspected human carcinogens, or have been linked by health effects specialists to other types of adverse health effects. The OEHHA guidelines provide lists of pollutants with potential cancer and noncancer health effects that are potentially emitted by various categories of sources. The pollutants that are listed for the specific types of equipment that will be present at the operational project are presented in Table 5.16-1, Toxicity Values Used to Characterize Health Risks.

TABLE 5.16-1
TOXICITY VALUES USED TO CHARACTERIZE HEALTH RISKS

Compound	Sources of Emissions	Inhalation Cancer Potency Factor $(mg/kg\text{-}day)^{-1}$	Chronic REL ($\mu g/m^3$)	Acute REL ($\mu g/m^3$)
Diesel particulate (PM_{10})	Diesel firewater pump engine	1.1E+00	5.0E+00	--
Ammonia	Gas turbine stacks	--	2.0E+02	3.2E+03
Acetaldehyde	Gas turbine stacks	1.0E-02	9.0E+00	--
Acrolein	Gas turbine stacks	--	6.0E-02	1.9E-01
Benzene	Gas turbine stacks	1.0E-01	6.0E+01	1.3E+03
Ethylbenzene	Gas turbine stacks	--	2.0E+03	--
Formaldehyde	Gas turbine stacks	2.1E-02	3.0E+00	9.4E+01
Hexane	Gas turbine stacks	--	7.0E+03	--
Propylene	Gas turbine stacks	--	3.0E+03	--
Toluene	Gas turbine stacks	--	3.0E+02	3.7E+04
Xylenes	Gas turbine stacks	--	7.0E+02	2.2E+04
PAHs	Gas turbine stacks	3.9E-01	--	--
Naphthalene	Gas turbine stacks	1.2E-01	9.0E+00	--
Arsenic	Cooling tower	1.2E+01	3.0E-02	1.9E-01
Chlorine	Cooling tower	--	2.0E-01	2.1E+02
Chromium	Cooling tower	5.1E+02	2.0E-01	--
Fluoride	Cooling tower	--	1.3E+01	2.4E+02
Manganese	Cooling tower	--	2.0E-01	--
Nickel	Cooling tower	9.1E-01	5.0E-02	6.0E+00

TABLE 5.16-1
TOXICITY VALUES USED TO CHARACTERIZE HEALTH RISKS

Compound	Sources of Emissions	Inhalation Cancer Potency Factor $(mg/kg\text{-}day)^{-1}$	Chronic REL ($\mu g/m^3$)	Acute REL ($\mu g/m^3$)
Sulfate	Cooling tower	--	2.5E+01	1.2E+02
Zinc	Cooling tower	--	3.5E+01	--

Notes:
-- = not applicable
mg/kg-day = milligrams per kilogram per day
PAHs = Polycyclic aromatic hydrocarbons
$\mu g/m^3$ = micrograms per cubic meter
PM_{10}= particulate matter less than 10 micrometers in diameter
REL = reference exposure level

Step 2 – An exposure assessment was conducted to estimate the extent of potential public exposure to the project emissions. Public exposure is evaluated in terms of the predicted short- and long-term ground-level concentrations resulting from project emissions, the pathway(s) of exposure, and the duration of exposure to the emissions. Dispersion modeling was performed using the ISCST3 model within HARP to estimate the ground-level concentrations near the project site. The methods used in the dispersion modeling were consistent with the approach described in Section 5.2, Air Quality, and the modeling protocol that was submitted for the project for review by the California Energy Commission (CEC) and the San Joaquin Valley Unified Air Pollution Control District (SJVAPCD) (URS 2006).

Step 3 – A dose-response assessment was performed using the HARP model to characterize the relationship between pollutant exposure and the potential incidence of an adverse health effect in exposed populations. The dose-response relationship is expressed in terms of potency factors for cancer risk and RELs for acute and chronic noncancer risks. The OEHHA guidelines provide potency factors and RELs for an extensive list of toxic air contaminants. Potency factors and RELs are revised continuously by the OEHHA, and the most recent values were applied in this HRA (Cal-EPA/OEHHA 2005). All exposure pathways available in HARP were included in this analysis, except for drinking water. 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.”

Step 4 – Risk characterization was performed to integrate the health effects and public exposure information and provide quantitative estimates of health risks from project emissions. Risk modeling was performed using HARP to estimate cancer and noncancer health risks for the project. The HARP model uses OEHHA equations and algorithms to calculate health risks, based on input parameters that include emission rates, “unit” ground-level concentrations, and toxicological data.

Detailed descriptions of the model input parameters and results of the HRA are presented later in this section.

5.16.2.2 Construction-Phase Emissions

Due to the relatively short duration of the project's construction phase (i.e., approximately 16 months), significant long-term public health effects are not expected. To ensure worker safety during actual construction, safe work practices will be followed. A detailed analysis of the potential environmental impacts due to criteria pollutant emissions during construction and control of these emissions is discussed in Section 5.2, Air Quality.

5.16.2.3 Operational-Phase Emissions

Facility operations were evaluated to determine whether particular substances will be used or generated that may cause adverse health effects if released into the air. The primary sources of potential emissions from facility operations are the two simple-cycle CTGs burning exclusively natural gas fuel, and the ammonia slip-stream from the selective catalytic reduction (SCR) control system used to minimize emissions of oxides of nitrogen (NO_x). Secondary sources of potential emissions from the facility are the emergency diesel firewater pump engine and the evaporative cooling tower. The emergency fire pump will normally be operated only for short periods in testing mode to ensure operability if needed. The cooling tower will employ a high-efficiency drift elimination system to minimize the release of drift droplets containing trace amounts of hazardous substances. The substances emitted from these sources (with associated toxicological information) are shown in Table 5.16-1, Toxicity Values Used to Characterize Health Risks.

Upon the specific recommendations of SJVAPCD staff (SJVAPCD 2006), emission factors for the identified air toxic substances emitted from internal combustion natural gas turbines were obtained from data provided by the Ventura County Air Pollution Control District (VCAPCD 1995). In addition, ammonia slip emissions from the CTG SCR system were calculated based on stack parameters provided by the turbine vendor and a best available control technology (BACT) limit of 10 parts per million, volumetric dry (ppmvd) at 15 percent oxygen (O_2), as described in Section 5.2, Air Quality. Trace levels of inorganic particles are indicated in the analysis of the source water for the cooling tower and low-level emissions of these pollutants would therefore be contained in the particulate matter emitted as drift from the cooling tower. Diesel particulate emissions would result only from the weekly tests of the diesel internal combustion engine used to drive the plant firewater pump.

Annual CTG emissions were estimated by assuming that both CTGs would operate simultaneously under full-load conditions (100 percent load) for 5,000 hours per year, including startups and shutdowns. The cooling tower is also assumed to operate for 5,000 hours per year. CTG stack parameters (i.e., exit temperature and velocity) for the full-load condition were used in the model simulations to assess the hourly and annual ground-level impacts and health risks.

For calculation of both maximum hourly and annual project emission rates, the maximum natural gas consumption rate of 909.7 million British thermal units per hour (MMBtu/hr) high heating value (HHV) per CTG was assumed for all operating hours. To calculate the cooling tower emissions, a water circulating rate of 13,800 gallons per minute with three cycles of concentration was used, and a drift elimination system capable of limiting drift to no more than 0.0005 percent of the circulating water rate, as guaranteed by the equipment vendor. Concentrations of inorganic chemicals in the water were obtained from the local city water

sampling data for the past 25 years. The emergency diesel firewater pump emissions were estimated assuming that this equipment would run at its full rated capacity (160 horsepower [hp]) for 1-hour per week for emergency preparedness. Any hours of actual emergency firewater pump usage were not included.

Emission factors for the CTGs were obtained from the VCAPCD's AB2588 emission factors for internal combustion natural gas turbines (1995). These emission factors are expressed in units of pounds per million cubic feet (lb/MMcf) of natural gas fuel usage, which were divided by the HHV of the natural gas (1024 British thermal unit (Btu)/standard cubic feet [scf]) to arrive at emission factors for individual pollutants in units of pounds per million British thermal unit (lb/MMBtu). These factors were then multiplied by the Btu equivalent of the maximum hourly CTG gas consumption rate to obtain maximum toxic air contaminant emission rates in units of pounds per hour (lb/hr). The emission factors and estimated maximum hourly and annual CTG emissions are summarized in Table 5.16-2, Emission Rates from Operation of Natural-Gas-Fired Combustion Turbines. The emission factors, estimated maximum hourly, and annual cooling tower emissions are summarized in Table 5.16-3, Emission Rates from Operation of Cooling Tower.

TABLE 5.16-2
EMISSION RATES FROM OPERATION OF NATURAL-GAS-FIRED COMBUSTION TURBINES

Chemical Species	Emission Factor (lb/MMBtu)	Emission Factor (lb/MMcf)	Maximum Hourly Emissions per CTG[1] (lb/hr)	Annual Emissions Per CTG[1,2] (lb/yr)
Ammonia	10 ppm[3]	10 ppm[3]	11.9	5.95E+04
Acetaldehyde	3.61E-05	0.037	3.29E-02	1.64E+02
Acrolein	8.79E-06	0.009	8.00E-03	4.00E+01
Benzene	1.10E-05	0.0113	1.00E-02	5.02E+01
Ethylbenzene	1.29E-05	0.0132	1.17E-02	5.86E+01
Formaldehyde	9.18E-05	0.094	8.35E-02	4.18E+02
Hexane	1.71E-03	1.75	1.55E+00	7.77E+03
Propylene	1.03E-03	1.0522	9.35E-01	4.67E+03
Toluene	7.09E-05	0.0726	6.45E-02	3.22E+02
Xylenes	2.82E-05	0.0289	2.57E-02	1.28E+02
PAHs	1.95E-07	0.0002	1.78E-04	8.88E-01
Naphthalene	7.81E-07	0.0008	7.11E-04	3.55E+00

Notes:
1 See Appendix O, Public Health, for detailed emission calculations. Natural gas fuel heat rate assumed at 1,024 Btu/scf.
2 Annual emissions calculations based on 5,000 operating hr/yr for each CTG, including startups, warmups, shutdowns and maintenance operations.
3 Based on estimated ammonia slip from NO_x control (10 ppmvd at 15% oxygen).

CO = carbon monoxide
lb/hr = pounds per hour
lb/yr = pounds per year
lb/MMBtu= pounds per million British thermal units
lb/MMcf= pounds per million cubic feet
PAH= polycyclic aromatic hydrocarbons
SCR= selective catalytic reduction

TABLE 5.16-3
EMISSION RATES FROM OPERATION OF COOLING TOWER

Chemical Species	Emission Factor (µg/L)	Emission Factor Source	Maximum Hourly Emissions[1] (lb/hr)	Annual Emissions[1,2] (lb/yr)
Arsenic	5	Source water analysis	5.18E-07	2.59E-03
Chlorine	11,000	Source water analysis	1.14E-03	5.70E+00
Chromium	6	Source water analysis	6.22E-07	3.11E-03
Fluoride	200	Source water analysis	2.07E-05	1.04E-01
Manganese	10	Source water analysis	1.04E-06	5.18E-03
Nickel	20	Source water analysis	2.07E-06	1.04E-02
Sulfate	11,000	Source water analysis	1.14E-03	5.70E+00
Zinc	10	Source water analysis	1.04E-06	5.18E-03

Notes:
[1] Total emissions for the three cells of the cooling tower are presented in the table.
[2] Annual emissions based on 5,000 operating hr/yr for the cooling tower and a drift rate of 0.0005%.
See Appendix O, Public Health, for detailed emission calculations.
µg/L = micrograms per liter
lb/hr = pounds per hour
lb/yr = pounds per year

A vendor-guaranteed diesel particulate matter emission factor of 0.15 grams per horsepower-hour was used to estimate emissions from the engine driver for the emergency diesel firewater pump. The estimated maximum hourly and annual emissions from the firewater pump are summarized in Table 5.16-4, Emission Rates from Operation of the Emergency Diesel Firewater Pump Engine.

TABLE 5.16-4
EMISSION RATES FROM OPERATION OF THE EMERGENCY DIESEL FIREWATER PUMP ENGINE

Chemical Species	Emission Factor[1] (g/hp-hr)	Emission Factor Source	Maximum Hourly Emissions[2] (lb/hr)	Annual Emissions[2] (lb/yr)
Diesel particulate (PM_{10})	0.15	Supplied by engine vendor	5.29E-02	2.75E+00

Notes:
[1] Hourly emissions are based on one full hour of test operations.
[2] Annual emissions based on one hour of test operations per week (52 tests per year).
See Appendix O, Public Health, for detailed emission calculations.
g/hp-hr = grams per horsepower hour
lb/hr = pounds per hour
lb/yr = pounds per year
PM_{10} = particulate matter less than 10 micrometers in diameter

5.16.2.4 Model Input Parameters

The HRA was conducted using worst-case emissions (short- and long-term) from all sources of the operational project. Cancer and chronic noncancer health effects were estimated using the

annual CTG, cooling tower, and firewater pump emission estimates in pounds per year. Acute noncancer health effects were estimated using the worst-case maximum hourly emissions for both CTGs, the cooling tower, and the firewater pump in lb/hr. These were used as direct input to the HARP model.

Dispersion modeling was performed using the ISCST3 model in HARP and methods consistent with the approach (e.g., building downwash, meteorological data, etc.) described in Section 5.2, Air Quality, and the modeling protocol submitted for the project (URS 2006). The ISCST3 model uses the CTG, cooling tower, and firewater pump stack parameters to calculate the concentration per unit emissions. HARP then uses this information along with the emission rates (provided in the input file as described above) to calculate ground-level concentrations for each chemical species. Meteorological data for the years 1987-1991 (the same years used in the air quality analysis described in Section 5.2, Air Quality) were used in the HRA. Risk values were modeled for all sensitive receptors within 3 miles of the project and all grid, boundary, and census receptors within 6 miles of the project, to assess potential health effects at all of these locations. Boundary receptors were placed every 82 feet along the property fence line. Grid receptors were spaced every 328 feet out 6 miles from the site in every direction. Any risks calculated by the HARP model at on-site receptor locations were ignored.

Toxicological data, cancer potency factors, and RELs for specific chemicals are built into the California Air Resource Board (CARB) HARP model. The pollutant-specific cancer potency factors and RELs used in the HRA are listed in Table 5.16-1, 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.

5.16.2.5 Calculation of Health Effects

Adverse health effects are expressed as cancer or noncancer health risks. Cancer risk is typically reported as “lifetime cancer risk” which is the maximum estimated increased risk of contracting cancer caused by long-term exposure to a pollutant suspected of being a carcinogen. Cancer risk is calculated by assuming that an individual is exposed continuously to pollutants at the computed long-term average concentration 24 hr/day for a period of 70 years. Although this continuous lifetime exposure is unlikely, the goal of the approach is to produce a worst-case estimate of potential cancer risk. Noncancer risk is typically reported as a “THI” which is calculated for each target organ as a fraction based on the maximum acceptable exposure level to a pollutant. The acceptable exposure level is generally the level at (or below) which no adverse health effects are expected. THI values are calculated for both short- (acute) and long-term (chronic) exposures.

Both cancer and noncancer risk estimates provided in this HRA represent incremental risks (i.e., risks due to project sources only) and do not include potential health risks posed by existing background concentrations. This approach is consistent with the significance criteria used to evaluate predicted impacts, which are also based on the incremental contributions to risk by project sources. The HARP model performs all of the necessary calculations to estimate the potential lifetime cancer risk and THI resulting from project emissions.

5.16.2.6 Health Effects Significance Criteria

Various state and local agencies use different significance criteria for cancer and noncancer health effects. For carcinogenic health effects, an exposure to a new emissions source is normally considered potentially significant when the predicted incremental lifetime cancer risk of the source exceeds 10 in 1 million (10×10^{-6}). For non-carcinogenic health effects (chronic or acute), an exposure that affects each target organ is considered potentially significant when the THI exceeds a value of one.

5.16.2.7 Estimated Lifetime Cancer Risk

Based on the risk assessment methodology described in the foregoing subsections, the maximum incremental cancer risk resulting from project emissions was estimated to be 1.46 in 1 million. The maximum cancer risk was located about 328 feet east of the project site boundary (receptor located at Universal Transverse Mercator (UTM) North American Datum [NAD] 83 coordinates 241602 m East, 4,078,919 m North), as shown in Figure 5.16-2, Incremental Lifetime Cancer Risk. The sensitive receptor with the highest predicted cancer risk is the nearest residence located approximately 1,312 feet east of the facility boundary (241,878 m East, 4,078,875 m North); the maximum incremental cancer risk at this location was estimated to be 0.148 in 1 million. Table 5.16-5, Estimated Cancer Risk and Acute and Chronic Total Hazard Indices, presents the results of the HRA for the project operations for cancer, chronic, and acute health risks. All HARP model files, along with all air quality modeling files, are provided electronically on a digital versatile disc (DVD) that is supplied separately with this application.

TABLE 5.16-5
ESTIMATED CANCER RISK AND ACUTE AND CHRONIC TOTAL HAZARD INDICES

Location	Cancer Risk	Chronic Hazard Index	Acute Risk Hazard Index
Point of maximum impact	1.46 excess risk in 1 million	0.0010 total hazard index	0.0071 total hazard index
Nearest resident/sensitive receptor	0.148 excess risk in 1 million	0.0005 total hazard index	0.0070 total hazard index

The estimated cancer risk at all locations is well below the significance criteria of 10 in 1 million. Thus, it is concluded that the project's emissions will not pose a significant cancer risk to any populations potentially exposed to these emissions.

5.16.2.8 Estimated Chronic and Acute Total Hazard Indices

The maximum chronic THI resulting from project emissions was estimated to be 0.0010. The location of the maximum estimated chronic THI is approximately 328 feet east of the site (the receptor is located at UTM coordinates of 241,602 m East, 4,078,919 m North), the same receptor for which the maximum cancer risk was predicted (see Section 5.16.2.7, Estimated Lifetime Cancer Risk). The sensitive receptor with the predicted highest impact is a residence located approximately 4 miles southeast of the facility (at 246,424 m East, 4,074,913 m North); the maximum chronic THI at this receptor was estimated to be 0.00048.

The maximum acute THI resulting from the project was estimated to be 0.0071 approximately 0.6 mile southwest of the site (UTM coordinates 240,802 m East, 4,079,919 m North). The sensitive receptor with the highest predicted acute THI impact is a residence located approximately 0.6 mile northeast of the site (at 241,937 m East, 4,080,015 m North); the maximum acute THI at this location was estimated to be 0.0070. Table 5.16-5, Estimated Cancer Risk and Acute and Chronic Total Hazard Indices, presents the detailed noncancer results of the HRA for the project operations.

The estimated chronic and acute THIs are both well below the significance criterion of one. Thus, it is concluded that the project's emissions will not pose a significant noncancer health risk to any populations potentially exposed to these emissions.

5.16.2.9 Uncertainty in the Public Health Impact Assessment

Sources of uncertainty in 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 designed to provide sufficient health protection to avoid underestimation of risk to the public. Some sources of uncertainty applicable to this HRA are discussed below.

The CTG emission rates of individual toxic air contaminants were derived using vendor data for ammonia slip and from emission factors (VCAPCD 1995) for the other air toxics. Both the short- and long-term CTG emissions were developed assuming both CTGs would operate at the maximum load for the maximum number of annual operating hours requested in this application. Under actual operating conditions, the CTGs may operate less and the average loads will be lower than 100 percent of capacity. Consequently, the emissions used for this HRA are likely to be higher than those that would occur under normal operation of the project.

The dispersion models used in HRAs contain assumptions that tend to lead toward over-prediction of ground-level contaminant 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 to receptors, none of the material was assumed to be converted or removed through chemical reaction or lost at the ground surface through reaction, gravitational settling, or turbulent impaction. In reality, these mechanisms work to reduce the level of pollutants remaining in the atmosphere during plume travel.

The exposure characteristics assessed in the HRA included the assumption that all receptors (including residents) were continuously exposed to the emissions from the CTGs, cooling tower, and firewater pump at the same location for 24 hours/day, 365 days/year, for 70 years. It is extremely unlikely that any resident would actually be subject to such continued, long-term exposure. This conservative exposure assumption tends to cause risks to be over-estimated by the HRA methods used in this analysis.

The toxicity data used in the HRA contain uncertainties resulting from 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 among humans is expected to be much greater than in laboratory animals. With all of the uncertainty in the

assumptions used to extrapolate toxicity data, significant measures are taken to ensure that there is sufficient health protection built into the health effects criteria used in assessments such as this one.

The conservatism introduced at each step in the HRA to compensate for all of these sources of uncertainty is compounded in the predicted health risks. Therefore, the actual risks resulting from exposure to emissions from the project are expected to be well below the values presented in this analysis.

5.16.2.10 Criteria Pollutants

Emissions of the criteria pollutants (NO_2, CO, SO_2, and PM_{10}) from the project were modeled and an evaluation of their impacts on air quality is presented in Section 5.2, Air Quality. The federal and state National Ambient Air Quality Standards (NAAQS) specify allowable levels of specific air pollutants that should not be exceeded in order to protect the public health. The results presented in Section 5.2, Air Quality, show that the project will not cause or significantly contribute to exceedances of any state or federal Ambient Air Quality Standards (AAQS). Thus, no significant adverse health effects are anticipated to result from the project's criteria pollutant emissions.

5.16.3 Cumulative Impacts

CEC requirements specify that an analysis must be conducted to determine the cumulative impacts of the project and other projects within a 6-mile radius that have received construction permits but are not yet operational or that are in the permitting process or can be expected to do so in the near future. Information requests have been made to SJVAPCD to obtain data on new projects planned within 6 miles from the site. The resulting list of projects will be submitted to CEC for final determination of which new projects, if any, need to be evaluated by cumulative modeling. If an additional HRA is required to include nearby sources, it will be submitted as an addendum to this application at a later date.

5.16.4 Mitigation Measures

The criteria pollutant emissions from the project will be mitigated by the use of BACT and through emissions offsets. A complete discussion of these measures is included in Section 5.2, Air Quality. The toxic pollutant emissions from the CTGs will also be mitigated by the exclusive use of natural gas fuel. In addition, pollution control technologies employed to control criteria pollutants, specifically the CO oxidation catalysts on the CTGs and the SCR system, will also have the effect of significantly reducing organic toxic air contaminants, including those listed in Table 5.16-1, Toxicity Values Used to Characterize Health Risks.

Emissions of toxic pollutants from the cooling tower are small due to the use of BACT to reduce the drift and owing to the low concentrations of toxic inorganic chemicals in the water (see Table 5.16-3, Emission Rates from Operation of Cooling Tower).

Emissions of toxic pollutants from the emergency diesel firewater pump are negligibly small (Table 5.16-4, Emission Rates from Operation of the Emergency Diesel Fire Water Pump Engine) due to the limitation on operations to just a few hours per year.

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 5.16.2.6, Health Effects Significance Criteria. Therefore, no further mitigation of emissions from the project is required to protect public health.

5.16.5 Laws, Ordinances, Regulations, and Standards

The relevant LORS that have been established to protect public health are identified in Table 5.16-6, Summary of Compliance with Public Health LORS. This table also summarizes the agencies that are principally responsible for public health, as well as the general category(ies) of public health concerns regulated by each of these agencies. The conformity of the project to each of the LORS applicable to public health is also presented in this table, as well as references to the locations in this document where each relevant issue is addressed. Points of contact with the primary agencies responsible for public health are identified in Section 5.16.6, Involved Agencies and Agency Contacts.

TABLE 5.16-6
SUMMARY OF COMPLIANCE WITH PUBLIC HEALTH LORS

Authority	Administering Agency	Requirement	Bullard Energy Center Project Compliance
CAA	USEPA CARB SJVAPCD	Protect public from unhealthful exposure from air pollutants.	Based on the results of the risk assessment, air toxics do not exceed acceptable levels (5.16, Public Health). Emissions of criteria pollutants will be minimized by applying BACT to the facility. Increases in emissions of nonattainment pollutants and their precursors will be fully offset (Section 4, Alternatives).
California Public Resource Code § 25523(a); 20 CCR § 1752.5, 2300-2309, and Division 2 Chapter 5, Article 1, Appendix B, Part(1)	CEC	Assure protection of environmental quality; requires quantitative HRA.	The HRA in 5.16, Public Health, of this application satisfies this requirement.
California CAA, TAC Program, H&SC § 39650, *et seq.*	SJVAPCD with CARB oversight	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 HRA (Section 5.16, Public Health), and has performed a BACT assessment (Section 5.2, Air Quality).
H&SC, Part 6, § 44300 *et seq*. (Air Toxics "Hot Spots")	SJVAPCD with CARB/ OEHHA oversight	Regulates public exposure to air toxics. Requires inventory of TACs and HRA.	The HRA presented in Section 5.16, Public Health, of this application satisfies this requirement.
H&SC § 41700	SJVAPCD with CARB oversight	Prohibits emissions in quantities that adversely affect public health, other businesses or property.	Section 5.2, Air Quality, and the HRA (Section 5.16, Public Health) presented in this application satisfy this requirement.

TABLE 5.16-6
SUMMARY OF COMPLIANCE WITH PUBLIC HEALTH LORS

Authority	Administering Agency	Requirement	Bullard Energy Center Project Compliance
Integrated Air Toxic Program	SJVAPCD	Integrates all state and federal TAC requirements, primarily "Hot Spots" and California Airborne Toxic Control Measures (ATCM).	Section 5.16, Public Health and Section 5.2, Air Quality presented in this application satisfy this requirement.
SJVAPCD Rule 3110	SJVAPCD	Requires annual fees for the Air Toxic "Hot Spots" (AB2588).	The HRA presented in 5.16, Public Health, of this application and the payment of fess to SJVAPCD satisfy these requirements.
SJVAPCD Rule 4102	SJVAPCD	No source shall cause injury, detriment, nuisance or annoyance to the public, which could endanger their comfort, repose, health and safety, or property.	Section 5.2, Air Quality, and the HRA (5.16, Public Health and Safety) presented in this application satisfy this requirement.

Notes:
BACT = best available control technology
CAA =Clean Air Act
CARB = California Air Resources Board
CEC = California Energy Commission
HRA = health risk assessment
OEHHA = Office of Environmental Health Hazard Assessment
RMP = risk management plan
SJVAPCD = San Joaquin Valley Air Pollution Control District
TAC = toxic air contaminant
TBACT = toxic best available control technology
USEPA = United States Environmental Protection Agency

5.16.6 Involved Agencies and Agency Contacts

Agency contacts regarding public health assessment of the project are as listed in Table 5.16-7, Agency Contacts for Public Health Assessment.

TABLE 5.16-7
AGENCY CONTACTS FOR PUBLIC HEALTH ASSESSMENT

Agency	Contact/Title	Telephone
California Energy Commission	Keith Golden Air Quality 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	Ester Davila refer to Air Permitting Specialist 1990 East Gettysburg Avenue Fresno, CA 93726-0244	559-230-6000

5.16.7 Permits Required and Permit Schedule

The Permit to Operate (PTO) to be issued by the SJVAPCD and the CEC's Final Decision Document on this application will serve as the principal approvals required to ensure that the project's impacts to public health will be within acceptable levels. Award of the Authority to Construct (ATC) permit is expected to occur at approximately the same time as the Final Decision is issued by CEC.

5.16.8 References

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

——. 2003. *Air Toxics Hot Spots Program Risk Assessment Guidelines – The Air Toxics Hot Spots Program Guidance Manual for EPA Preparation of Health Risk Assessments*.

——. 2003. *Air Toxics Hot Spots Risk Assessment Guidelines, Part II: Technical Support Document for the Determination of Noncancer Chronic Reference Exposure Levels*.

——. 2005. *Air Toxics Hot Spots Risk Assessment Guidelines, Part II: Technical Support Document for Describing Available Cancer Potency Factors*.

San Joaquin Valley Air Pollution Control District (SJVAPCD. 2006. Telephone conversation between modeling specialist Esther Davila of SJVAPCD and Julie Mitchell of URS Corporation, June 15, 2006.

URS Corporation. 2006. *Modeling Protocol for the Bullard Energy Center*. Prepared by URS on behalf of Bullard Energy Center LLC for submittal to the San Joaquin Valley Air Pollution Control District and the California Energy Commission. August 15, 2006.

Ventura County Air Pollution Control District. 1995. *Ventura County Air Pollution Control District AB2588 Emission Factors*.

Adequacy Issue: Adequate ____ Inadequate ____

DATA ADEQUACY WORKSHEET

Revision No. ____ 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 5.16		
Appendix B (g) (9) (A)	A list of all toxic substances emitted by the project under normal operating conditions, which may cause an adverse public health impact as a result of acute, chronic, or sub-chronic exposure and to which members of the public may be exposed. This list should include, at a minimum, any pollutants emitted by the project that are listed pursuant to Health and Safety Code § 25249.8.	- Table 5.16-1		
Appendix B (g) (9) (B)	A protocol describing the analysis which the applicant will conduct to determine the extent of potential public exposure to substances identified in subsection (g)(9)(A) resulting from normal facility operation. The analysis itself can be submitted after the AFC is complete.	- Section 5.16.2.1		
Appendix B (g) (9) (C)	A map at a scale of 1:24,000, showing all terrain areas exceeding the elevation of the stack within a 10 mile radius of the facility.	- Figure 5.16-1		
Appendix B (g) (9) (D)	A map at a scale of 1:24,000, showing the distribution of population and sensitive receptors within the area exposed to the substances identified in subsection (g)(9)(A).	- Figure 5.16-1		

Adequacy Issue: Adequate ____ Inadequate ____

DATA ADEQUACY WORKSHEET

Revision No. ____ 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 (h) (1) (A)	Tables which identify laws, regulations, ordinances, standards, adopted local, regional, state, and federal land use plans, and permits applicable to the proposed project, and a discussion of the applicability of 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;	- Table 5.16-6		
Appendix B (h) (1) (B)	Tables which identify each agency with jurisdiction to issue applicable permits 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.	- Table 5.16-7		
Appendix B (h) (2)	A discussion of the conformity of the project with the requirements listed in subsection (h)(1)(A).	- Section 5.16-5		
Appendix B (h) (3)	The name, title, phone number, and address, if known, of an official within each agency who will serve as a contact person for the agency.	- Table 5.16-7		
Appendix B (h) (4)	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 5.16.7		

Sensitive Receptors within 3 Miles of the Project Site

Bullard Energy Center

URS

FIGURE 5.16-1

0 1000 2000 3000 4000 Feet

SCALE: 1" = 2000' (1:24,000)

N

SOURCES:
USGS (7.5 quads: Herndon 1978, Fresno North 1981);
Duke Energy (site plan); ESRI.

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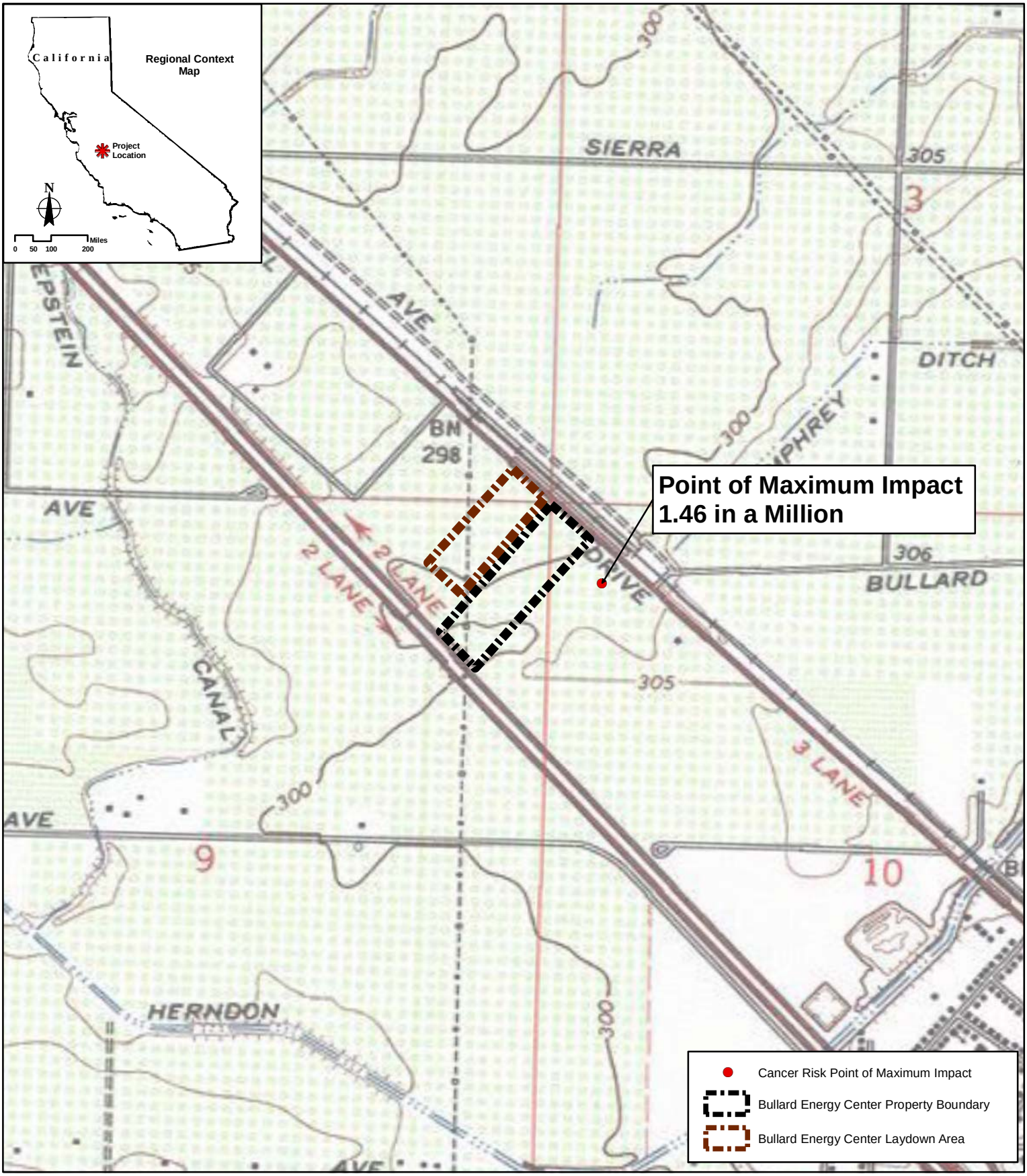

G:\gis\projects\1577\28906905\mxd\bullard_cancer_risk_fig5.16-2.mxd

0 250 500 1,000 Feet
SCALE: 1" = 1000'

N

SOURCES:
USGS (7.5 quad: Herndon 1978);
Duke Energy (site plan); ESRI.

Incremental Lifetime Cancer Risk

Bullard Energy Center

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FIGURE 5.16-2