5.10 Public Health

This section addresses potential public health impacts related to the Amended Project. These impacts include the potential for increased health risks from the emissions of air contaminants and from airborne pathogens. Related topics are discussed in separate sections of this Amendment Petition. 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 and Section 5.16, Waste Management, respectively. This section presents the methodology and results of a multi-pathway human health risk assessment (HRA) performed to evaluate potential public exposure and impacts associated with airborne emissions from the Project's operation. Exposure routes evaluated in the HRA include inhalation, dermal absorption, and ingestion of soil, water and food products.

Chemical substances released to ambient air that pose potential risks to human health from Project operations include chemical constituents released during brine handling, including steam vent tanks and steam blow lines, byproducts from the combustion of natural gas in the recuperative thermal oxidizer (RTO), byproducts from the combustion of diesel fuel in the emergency diesel fire water pump and electrical generator engines, losses from loading chemical storage tanks, chemical constituents present in the cooling water, and byproducts from chemical treatment for biological growth control in the cooling towers.

For public health, the term "chemical substances" refer to chemical substances in ambient air that are regulated by either the U.S. Environmental Protection Agency (EPA) and/or the State of California. The California Office of Environmental Health Hazard Assessment (OEHHA) and the California Air Resources Board (CARB) use the term "Toxic Air Contaminant" (TAC) and have currently identified 244 chemical substances, including radionuclides, as TACs. The EPA uses the term "Hazardous Air Pollutants" (HAP), and has currently identified 188 substances as HAP, all of which are presently included in California's list of TAC. 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 HAP. TAC emissions from the Project's brine handling operations, RTOs, fire water pump, emergency electrical generator engines, and cooling towers are analyzed for impacts to public health.

On January 24, 2009, the California Air Resources Board (CARB) released new acute reference; inhalation chronic reference; and oral chronic reference exposure levels (as contained in the Hotspot Analysis Reporting Program [HARP] database), for certain compounds potentially of concern to the Amended Project. These include: arsenic, arsenic compounds (inorganic), and mercury. As of this date, the dispersion modeling and associated health risk assessment (HRA) for the Amendment Petition had been completed. The Applicant has discussed this with the contractor, Atmospheric Dynamics, Inc. (ADI) who t prepared both the modeling and the HRA. ADI has indicated that the new HARP criteria for the compounds indicated will not affect the conclusions presented in this section.

5.10.1 Summary of Differences between Amended Project and Original SSU6

There are several major engineering differences between the Amended Project and the original SSU6 project. Compared with the original project, none of these changes will result in more numerous or more significant public health impacts, and in fact, the Amended Project will result in reduced impacts. Because the sources of TAC emissions are essentially the same as those for criteria pollutant emissions for both the Amended Project and the original project, the comparative discussion in the following paragraphs is similar to the comparative discussion at the beginning of Section 5.2, Air Quality.

The affected environment for public health for the Amended Project is essentially the same as the original SSU6 project— the area still is largely agricultural and very lightly populated. The original project emissions were produced by multiple vent tanks, dilution water heaters, and the handling and disposal of solid silica and sulfur filter cake wastes. The Amended Project will not require dilution water heaters or the handling or disposal of large amounts of filter cake. Therefore, fugitive emissions associated with filter cake management will no longer occur. Fugitive dust from filter cake management associated with the original project might have contained heavy metals such as arsenic (a listed TAC), because arsenic is known to be present in the geothermal brine. Additionally, single flash technology eliminates the need for equipment such as crystallizers and clarifiers associated with multiple flash technology which, in turn, greatly reduces the number of tank vents and other emission sources.

The original project proposed LO-CAT plus Sulfurite technology to control hydrogen sulfide (H_2S) in the non-condensable gas (NCG), which would have generated approximately three tons per day of solid sulfur waste that would have required offsite disposal. The Applicant had proposed an activated carbon adsorption system to augment the LO-CAT/Sulfurite system to control benzene and reactive organic gases (ROG) emissions. Regeneration and/or replacement of the activated carbon would have resulted in air emissions from indirect sources from the regeneration process and offsite transportation of spent carbon waste. The LO-CAT system did not control emissions of inorganic TAC such as arsenic or mercury.

The Amended Project plans to install recuperative thermal oxidizers (RTOs) to control H_2S and other constituents of the NCG instead of the LO-CAT/Sulfurite/activated carbon system proposed for the original project. The RTO uses an efficient combustion technology to oxidize the H_2S emissions as well as ROC and benzene in the NCG stream. The H_2S is oxidized to form sulfur dioxide (SO_2) gas, which will be controlled in a wet scrubber downstream of the RTO. Specifically, the SO_2 gas will be neutralized chemically to form water soluble salts, which become dissolved in the scrubber water, and the scrubber blowdown will be injected into the geothermal brine source, helping to preserve the resource. In addition, based on information developed from existing plants operated by the Applicant's affiliates (i.e., performance tests of similar equipment), the RTO followed by the caustic scrubber effectively controls arsenic and mercury emissions. The mechanism is thought to be oxidation of the metals to a form that is soluble in the scrubber solution. In short, the use of the RTO in the Amended Project will yield equivalent level of H_2S and benzene emissions, and substantially lower arsenic and mercury emissions compared to the original project.

The original project proposed a biological oxidation process operated in one cell of the cooling tower to control H_2S emissions in the condensate makeup water. The Amended Project plans to install a chemical oxidation process (referred to as "ChemOx") with a substantially higher control efficiency to control H_2S emissions, resulting in lower H_2S emissions and lower associated public health risks than the original project.

The Applicant is predicting a 70 percent reduction in ammonia emissions from the Amended Project compared to the original project. The reduction in emissions is attributed to the caustic scrubber following the RTO; ammonia in the NCG will be absorbed in the caustic scrubbing solution and will be injected into the subsurface formation with the scrubber blowdown.

The Amended Project will install Tier 4 diesel-fired engines to drive the emergency fire water pump and emergency generators. Tier 4 engines have substantially lower emission rates of criteria pollutants than the Tier 2 engines proposed for the original project, including substantially lower diesel particulate matter (DPM), a listed TAC.

The HRA for the original project concluded that the impacts from air emissions from normal Project operations would not result in significant risks to public health. Because the impact of TAC emissions to public health during normal operation of the Amended Project are generally equivalent to those of determined for the original project, the HRA for the Amended Project also shows those impacts to be less than significant.

However, the HRA for the original project concluded that there would be some short-term, unavoidable significant impacts during commissioning, startup, and shutdown of the original project. The commissioning, startup and shutdown activities associated with the Amended Project are very similar to the original project, and thus will result in similar emissions and associated impacts. Measures to minimize emissions are included in the existing Conditions of Certification (COC) for the original project. The Applicant anticipates that the same COCs will be equally effective controlling emissions from the Amended Project and, therefore, proposes no changes.

5.10.2 LORS Compliance

The LORS relevant to public health that are applicable to the Amended Project are summarized briefly in Table 5.10-1 and discussed in the text following the table. The LORS presented and discussed in this section relate only to public health concerns due to the emissions of TAC. Other Amendment Petition sections discuss LORS related to other public health topics such as air quality, hazardous materials, hazardous waste management, etc.

Table 5.10-1 Summary of LORS Applicable to Public Health

LORS	Applicability	Where Discussed in AP
Federal:		
None applicable	Not applicable	--
State:		
California Health and Safety Code (HSC) §§ 39650 - 39675	Establishes a multi-step process to identify TAC, assess potential exposure and health effects, and control their emissions.	Sections 5.10.2 and 5.10.4
HSC § 41700, General Limitations	Prohibits odors and emissions from causing injury, detriment, nuisance, or annoyance to any considerable number of people.	Sections 5.10.2 and 5.2, Air Quality

Table 5.10-1 Summary of LORS Applicable to Public Health

LORS	Applicability	Where Discussed in AP
HSC §§ 44360 to 44366 (Air Toxics "Hot Spots" Information and Assessment Act – AB2588)	Regulates public exposure to TAC from existing and new sources.	Sections 5.10.2 and 5.10.4
HSC §§ 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 5.10.2
California Code of Regulations (CCR), Title 17, § 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 and electrical generator engines.	Section 5.10.2
Title 13 CCR, Article 4.8, Chapter 9, §§ 2449 *et seq*., In-Use Off-Road Diesel-Fueled Fleets	Regulation requires private and government owners of self-propelled, diesel-powered off-road vehicle fleets (e.g., forklifts, loaders, tractors, workover rigs, airport ground support), with a combined fleet power rating of more than 2,501 Hp, to have a written idling policy that is made available to vehicle operators and informs them that idling is limited to five consecutive minutes.	Section 5.10.2
CCR, Title 22, § 60306	This section requires that whenever a cooling system using recycled water in conjunction with an air conditioning facility utilizes a cooling tower or otherwise creates a mist that could come into contact with employees or members of the public, the cooling system will operate a drift eliminator whenever the cooling system is in operation and that chlorine or another biocide will be used to treat the cooling system circulating water to minimize the growth of Legionella and other microorganisms.	Section 5.10.4
California Energy Commission (CEC) Staff Cooling Water Management Program Guidelines For Wet and Hybrid Cooling Towers at Power Plants	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 circulating water systems.	Sections 5.10.2, 5.10.4 and 5.10.6
Local (Imperial County Air Pollution Control District [ICAPCD]):		
ICAPCD Rule 216 – Construction or Reconstruction of Major Stationary Sources that Emit Hazardous Air Pollutants	Requires the applications of Best Available Control Technology for Toxics (T-BACT) to any constructed or reconstructed major source.	Sections 5.10.2 and 5.2, Air Quality
ICAPCD Rule 309 – Air Toxic "Hot Spots" Information and Assessment	Facilities subject to the Air Toxic "Hot Spots" Information and Assessment Act (see HSC §§ 44360 to 44366 above) are subject to an annual fee to recover reasonable anticipated program costs.	Section 5.10.2

Table 5.10-1 Summary of LORS Applicable to Public Health

LORS	Applicability	Where Discussed in AP
ICAPCD Rule 407 – (Nuisance)	Implements HSC §41700 (see above).	Section 5.10.2 and 5.2, Air Quality
ICAPCD Rule 1002 - California ATCMs	Implements the California ATCMs (see above).	Section 5.10.2
ICAPCD Rule 1003 - Hexavalent Chromium Emissions From Cooling Towers	Prohibits the use of hexavalent chromium containing materials in cooling tower water.	Section 5.10.2

5.10.2.1 Federal LORS

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

EPA regulations related to HAP are not applicable to the Amended Project because the Project will not be a major source of HAP emissions. The Federal National Emissions Standards for Hazardous Air Pollutants (NESHAP) regulations have been incorporated by reference in ICAPCD Rule 1001, but do not apply to the Amended Project.

Toxic Chemical Release Inventory Program: Emergency Planning and Community Right-to-Know Act § 313

Under the Emergency Planning and Community Right-to-Know Act, certain facilities and establishments must report toxic releases to the environment if they:

- Manufacture more than 25,000 pounds of a listed chemical per year;
- Process more than 25,000 pounds of a listed chemical per year; and/or
- Use more than 10,000 pounds of a listed chemical per year.

This program is commonly referred to as the Toxic Chemical Release Inventory. As applied to electric utilities, only those facilities in Standard Industrial Classification (SIC) Codes 4911, 4931, and 4939 that combust coal and/or oil for the purpose of generating electricity for distribution in commerce must report under this regulation. The Amended Project falls under SIC Code 4911, which covers establishments engaged in the generation, transmission, and/or distribution of electric energy for sale. However, this is not applicable to the Project because it will not combust coal and/or oil for the purpose of generating electricity for distribution in commerce.

5.10.2.2 State LORS

HSC Section 39650 et seq.

These sections of the HSC establish a broad statewide program of public protection against exposure to TAC determined to be carcinogenic, teratogenic, mutagenic, or otherwise toxic or injurious to humans, including control technology requirements and cumulative impact analysis. The Amended Project 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 41700

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

HSC Sections 44360-44366 – Air Toxic "Hot Spots" Information and Assessment (AB2588)

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

California Safe Drinking Water and Toxic Enforcement Act (Proposition 65),
HSC §§25249.5 *et seq.*; CCR Title 22, Division 2, Part 2, Subdivision 1, Chapter 3 *et seq*.

Proposition 65 requires persons who emit/release certain chemicals that are "known to the State to cause" cancer and reproductive toxicity to provide warning to exposed persons, and prevents certain chemicals that cause cancer and reproductive toxicity from being discharged into sources of drinking water. Certain exemptions apply for chemicals emitted in low quantities or low concentrations if the discharger shoulders the burden of proving that the risks are insignificant. The administering agency for Proposition 65 is the OEHHA, although the program has no reporting requirements, and OEHHA has no inspection or direct oversight responsibilities for individual facilities. The Attorney General and private parties in practice enforce the law.

The Amended Project will use and/or release several chemical substances that contain Proposition 65-listed chemicals. The brine contains several Proposition 65-listed chemical substances that may be emitted during the course of normal facility operations, either through the cooling tower, steam vents, rock muffler, or air pollution control device. In addition, Proposition 65-listed chemical substances may be emitted as combustion byproducts from propane combustion in the air pollution control device, or from diesel fuel combustion in the emergency engines. However, the emission levels of Proposition 65-listed chemicals are not expected to exceed Proposition 65 thresholds for which public notification would be required. The facility operator will provide warnings to employees who may be exposed to listed chemicals by posting warning signs and through safety training, as provided by 8 CCR § 5194.

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

The ATCM for compression ignition (CI) engines specifies operating requirements and exhaust emission standards for stationary CI engines. Although this is an ATCM, it contains emission standards for criteria pollutants. In addition, it requires the use of CARB-specification diesel fuel (15 parts per million by weight [ppmw] sulfur).

To drive the fire water pump, the Applicant will install a new stationary CI engine that will meet the Tier 4 emissions standards for off-road engines and will limit the non-emergency hours of operation to the number of hours necessary to comply with the testing requirements of National Fire Protection Agency (NFPA) 25 "Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems," 2002 edition, as required by the ATCM (CCR §93115.6(a)(4)(A)(1)). The Project will limit the hours of operation of the fire water 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 Project will install six emergency generators. To drive these generators, the Applicant will install new stationary CI engines that will meet the Tier 4 emissions standards for off-road engines and will limit the non-emergency hours of operation to no more than 20 hours per year, and will install a totalizing hour meter on each engine to substantiate compliance with the use limitation. The Project will use only CARB diesel fuel in both the emergency generator and in the fire water pump engines and will retain purchase records and the Material Safety Data Sheet and/or technical data sheet to substantiate compliance with the 15 ppmw fuel sulfur requirement.

HSC § 39666 delegates the enforceability of California ATCM to local air quality agencies, in this case the Imperial County Air Pollution Control District (ICAPCD).

Title 13 CCR, Article 4.8, Chapter 9, §2449 *et seq*., In-Use Off-Road Diesel-Fueled Fleets

Effective March 1, 2009, CARB regulations will require private and government owners of self-propelled, diesel-powered off-road vehicle fleets (e.g., forklifts, loaders, tractors, workover rigs, airport ground support), with a combined fleet power rating of more than 2,501 Hp, to have a written idling policy that is made available to vehicle operators and informs them that idling is limited to five consecutive minutes. The policy must include, at a minimum, the following elements as outlined by the regulation:

- description of idling limitations,
- applicable vehicle list,
- non-compliance reporting contact information,
- regulation language,
- exemptions, and
- description of potential penalties.

There are monetary penalties for not having a written policy. A training program is highly recommended, but not required by the regulation. In addition to the written policy, an initial report that includes applicable vehicles must be submitted. The deadline for large private fleets (>5,000 Hp) and state and federal fleets is

April 1, 2009; for medium fleets (2,501 – 5,000 hp) is June 1, 2009; and for small fleets (0 – 2,500 Hp) is August 1, 2009. Annual updates will be required. Once the initial report is received, CARB will assign Equipment Identification Numbers (EIN) will be assigned by CARB and provide them to the fleet owner. The fleet owner must affix a label with the EIN to the vehicle within 30 days of receipt. Initial and annual update reporting can be completed online using on the Diesel Off-Road On-Line Reporting System (DOORS). This regulation will, among other things, reduce DPM emissions from construction vehicles.

Construction of the Amended Project will involve a large number of diesel-fueled off-road vehicles, and thus it is possible that the Project's construction contractor would be subject to this regulation. The Applicant will use a contractual mechanism to ensure that any construction contractor employed for the Project who is subject to this regulation complies with the regulation.

California Code of Regulations (CCR) Section 60306

The California Department of Health Services regulates microbial growth and reduction of the potential for Legionella in the CCR, Title 22, § 60306. The section states, in part, that whenever a cooling system using recycled water in conjunction with an air conditioning facility utilizes a cooling tower or otherwise creates a mist that could come into contact with employees or members of the public, the cooling system will operate a drift eliminator whenever the cooling system is in operation and that chlorine or another biocide will be used to treat the cooling system circulating water to minimize the growth of Legionella and other microorganisms. The Amended Project will comply with this requirement through the use of biocides in the cooling towers and a preventive maintenance program.

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 Amended Project cooling towers as water treatment chemicals during normal operations. Geothermal brine is known to contain chromium, and as a result, condensate may contain small amounts of chromium. However, at the concentrations present in condensate, the concentration of chromium in the circulating water is expected to be negligible.

CEC Staff Cooling Water Management Program Guidelines for Wet and Hybrid Cooling Towers at Power Plants

The Amended Project will develop and implement a cooling tower maintenance plan in accordance with the CEC Cooling Water Management Program Guidelines (CEC, 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.

5.10.2.3 Local LORS

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

Rule 216 – Toxic Air Contaminants New Source Review

T-BACT must be utilized on any constructed or reconstructed major source. A major source of HAP is any stationary source or group of stationary sources within a contiguous area and under common control that emits or has the potential to emit considering controls, in the aggregate, 10 tons per year or more of a single HAP or 25 tons per year or more of any combination of HAP. As shown in Table 5.10-8, the Amended Project will emit less than ten tons per year of HAP, with benzene emissions being the largest HAP emissions of less than two tons per year. (Note that H_2S and ammonia are not HAP.) However, while T-BACT is not required by regulation for Amended Project, the control proposed for the Project (i.e., RTO, ChemOx, Tier 4 engines) would satisfy T-BACT requirements.

Rule 309 – Air Toxic "Hot Spots" Information and Assessment

Facilities subject to the Air Toxic "Hot Spots" Information and Assessment Act are subject to an annual fee to recover the reasonable anticipated costs incurred by the State Air Resources Board, the District, and the State Department of Health Services in implementing and administering the Act (Part 6, Division 26 of the Health and Safety Code, commencing with § 44300). Although the assessments provided in this section indicate that the Amended Project will have insignificant impacts from TAC emissions, the facility may be required to pay fees for future air toxic assessments under this rule.

Rule 407 – Nuisance

Under this local implementation of HSC § 41700 (see above), the ICAPCD 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 the Project's proposed emission controls and operational limits.

Rule 1001 - National Emission Standards for Hazardous Air Pollutants

This ICAPCD rule adopts the Federal NESHAP requirements promulgated under 40 Code of Federal Regulations (CFR) Part 61 by reference. However, as noted above, there is currently no NESHAP that applies to this Project.

Rule 1002 - California Airborne Toxic Control Measures

This rule implements the State regulations. The diesel-fired engines in the emergency fire water pump and generator engines will be subject to these requirements to use engines certified by the EPA and State to comply with the appropriate emission standards, and the Applicant will use ultra-low sulfur diesel fuel, as required.

Rule 1003 - Hexavalent Chromium Emissions From Cooling Towers

The rule limits hexavalent chromium in cooling towers to less than 0.15 milligrams per liter (mg/L), and prohibits the addition of hexavalent chromium materials to the cooling tower water. The Amended Project will not add hexavalent chrome materials to the circulating water in the cooling towers. Chromium is known to be present in the condensate that will be used for makeup water to the cooling towers. Conservatively assuming that all naturally occurring chrome was hexavalent chromium, the chromium content in the cooling

tower derived from the condensate analysis (from an existing geothermal plant operated by the Applicant) would be 1.97 x 10^{-6} milligrams per liter (mg/L), which is significantly below the rule limit.

5.10.2.4 Agency Contacts

The primary agency responsible for public health for the Amended Project is the ICAPCD. 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, Air Quality, and 5.6, Hazardous Materials, respectively.

Table 5.10-2 Administering Agency and Contact Information

Agency Contact	Phone/E-mail	Permits/Issue
Brad Poiriez Air Pollution Control Officer Imperial County Air Pollution Control District 150 S. 9th Street El Centro, CA 92243	(760) 482-4606 bradpoiriez@imperialcounty.net	Implementation of AB2588, review of HRAs, ATCM implementation, air quality permits.

5.10.2.5 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.

5.10.3 Affected Environment

The Project site is located approximately six miles west of Calipatria, California, southwest of the Salton Sea, near Obsidian Butte, at the northern end of the Imperial Valley, at an average elevation of 225 feet below mean sea level. Imperial Valley is a broad flat depression, centered about the Salton Sea, and flanked by mountains on the east (20 miles away) and west (24 miles away).

The Project site is currently used for agriculture, and land uses in the surrounding area include existing geothermal power facilities, agriculture, and wildlife management, including the Sonny Bono Salton Sea National Wildlife Refuge. The closest residential land use to the Project site is located northeast of the site, approximately 0.8 miles away (the Sonny Bono Salton Sea National Wildlife Refuge Headquarters staff housing). The second closest residence is approximately two miles east of the site. There are no hospitals, daycare centers, or other sensitive receptors within three miles of the Project site.

Based on the CARB Community Health Air Pollution Information System (CHAPIS), the nearest industrial facility previously evaluated for health risk impacts due to TAC emissions is located approximately 10 miles north of the Amended Project, two miles east of the Salton Sea. Health risks shown in CHAPIS from this facility and in the general area of the Amended Project are primarily from byproducts of combustion from diesel-fueled CI engines. There has been no ambient monitoring of TAC pollutants on or around the Project site, and no record of any community health studies or concerns.

5.10.4 Environmental Impacts

Potential environmental impacts addressed in this section are limited to human exposure to the emissions of TAC and non-chemical substances of concern (i.e., pathogens) associated with the Project's operation. The methods used to assess potential human health risks are consistent with those identified 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 an HRA under AB2588 and is generally considered the best available reference for conducting human HRAs in California. Additional references include the Health Assessment Document for Diesel Engine Exhaust (EPA, 2002).

The human health risks potentially associated with Project TAC emissions are evaluated in the HRA. No appreciable quantity of TAC is expected to be emitted from the fire water pump or emergency generator diesel fuel tanks, thus emissions from these sources have not been considered for evaluating health risk impacts. Since construction impacts are temporary, no significant impacts to public health are expected to occur from construction, and this HRA does not quantify health risks from construction activities.

5.10.4.1 TAC Emissions

Chemical substances that pose potential risks to human health from Project operations include chemical constituents released during the handling of brine, including steam vent tanks and steam blow lines, byproducts from the combustion of natural gas in the RTO, byproducts from the combustion of diesel fuel in the emergency fire water pump and generator engines, losses from loading chemical storage tanks, chemical constituents present in the cooling water, and byproducts from chemical treatment for biological growth control in the cooling towers. TAC emissions from these activities are summarized in this section. Please note that NOx and CO are listed TAC. NOx and CO emission rates are discussed in detail in Section 5.2, Air Quality, and are not discussed herein. NOx and CO emission rates are included in the HRA modeling.

Power Block Emissions

Within the context of this emission calculation discussion, the term "power block" is used to mean the high pressure (HP) separator, production test unit (PTU) and rock muffler of the Resource Production Facility (RPF), and the steam turbine, condenser, RTO and associated scrubber of the Power Generating Facility (PGF). As such, the Amended Project has three "power blocks". The reason behind this aggregation of units from the RPF and PGF is to simplify the explanation of emissions during startup, shutdown and commissioning of the Project, as these operations have emissions from devices in both the RPF and PGF.

For chemicals released during the handling of brine, TAC emissions are generated from commissioning, startup, shutdown, and normal operation of the Amended Project. TAC emissions from the power block are summarized below. Detailed emission calculations are provided in Appendix E.3.

Commissioning Emissions

Project commissioning will take place in three phases, with each power block commissioned separately, approximately 10 months apart. Commissioning activities involve the following general steps:

- Production wells have a warm up duration of 12 to 16 hours for the first well, followed by 16 to 24 hours for the next two wells (combined). Steam from well warm-ups vents to the PTU at a rate of 250,000 pounds per hour (lbs/hr) per well.
- Production piping and equipment have a warm up duration of 24 to 32 hours. Steam is vented at a rate of 350,000 lbs/hr to the rock muffler.
- Steam blow has a duration of 16 to 24 hours with steam venting at 750,000 lbs/hr to the rock muffler.
- Turbine and auxiliary loops preheat with a duration of 18 to 24 hours. The total steam flow rate is 350,000 lbs/hr; 50,000 lbs/hr steam flows through the turbine, condenser and RTO, and the balance of 300,000 lbs/hr of steam flows to the rock muffler.
- Turbine load test with a duration of 18 to 24 hours, full steam flow rate of 750,000 lbs/hr through the turbine, condenser and RTO, with no venting of steam directly to atmosphere.
- Turbine performance test has a duration of 18 to 24 hours, with a steam flow rate of 750,000 lbs/hr through the turbine, condenser and RTO, with no venting of steam to atmosphere.

TAC emissions from commissioning activities are attributed to the air contaminants present in the NCG that are released from the brine with the steam phase in the HP separator. The Applicant has detailed information derived from existing operating plants that demonstrate the ratio of NCG to brine, NCG to steam, and the composition of the NCG. This information is used in conjunction with steam flow rates to estimate emissions. Uncontrolled emissions are expected during specific phases of commissioning and are emitted through either the PTU or rock muffler, as described above. Other phases of commissioning will involve venting the NCG through the RTO for emissions control. Commissioning emissions for one power block are shown in Table 5.10-3. Detailed commissioning emission calculations are provided in Appendix E.3.

Table 5.10-3 Commissioning TAC Emissions, One Power Block

Pollutant	Maximum Hourly Emissions (Lbs/hr)	Event Emissions (Lbs/Event)
Lead	2.54E-05	1.83E-03
H_2S	6.66E+01	4.48E+03
NH_3	2.77E+02	2.28E+04
Arsenic	6.46E-03	4.41E-01
Mercury	5.02E-03	3.48E-01
Benzene	2.40E+00	1.60E+02
Toluene	4.85E-02	3.25E+00
Ethylbenzene	4.30E-02	2.88E+00
Xylenes	4.29E-02	2.90E+00
Beryllium	2.39E-05	1.72E-03

Table 5.10-3 Commissioning TAC Emissions, One Power Block

Pollutant	Maximum Hourly Emissions (Lbs/hr)	Event Emissions (Lbs/Event)
Cadmium	4.78E-06	3.44E-04
Total Chromium	4.78E-05	3.44E-03
Copper	2.39E-05	1.72E-03
Manganese	2.39E-05	1.72E-03
Nickel	4.78E-05	3.44E-03
Selenium	1.20E-05	8.61E-04
Total Silica	1.20E-02	8.61E-01
Diesel PM	0.00E+00	0.00E+00
Chloroform	9.48E-03	6.82E-01
Formaldehyde	5.00E-05	3.60E-03
PAH's (excluding naphthalene)	1.18E-06	8.47E-05
Naphthalene	8.82E-07	6.35E-05
Acetaldehyde	1.26E-05	9.11E-04
Acrolein	7.94E-06	5.72E-04
Propylene	2.15E-03	1.55E-01
Hexane	1.85E-05	1.33E-03
	Ci/hr	**Ci/Event**
Radon	1.82E-03	2.07E-01

Operating Emissions

Operating TAC emissions involve the startup, shutdown, and normal operations of the PGF, which includes the operation of the steam turbine with associated emission control equipment and cooling tower. In addition, routine testing and maintenance of the emergency engines is included in normal operations.

Normal Operations

TAC emissions from normal operations are attributed to the air contaminants that are present in the NCG that are released from the brine with the steam phase. The Applicant has detailed information derived from existing operating plants that demonstrate the ratio of NCG to brine, NCG to steam, and the composition of the NCG. This information is used in conjunction with steam flow rates to estimate uncontrolled emissions. Controlled emissions are estimated based on the uncontrolled emission rate and the control efficiency of the

RTO, plus the emissions associated with fuel combustion in the RTO. Normal operating organic TAC emissions associated with NCG from the steam turbine are always controlled; inorganic TAC may or may not be controlled. As noted earlier, the proposed control system will control arsenic and mercury emissions (via oxidation in the RTO and absorption in the scrubber), but is assumed to provide no control for other inorganic TAC, thus ensuring that emissions are not underestimated for other pollutants.

Normal operations are expected to occur approximately 8,760 hours per year, and will involve the operation of all three power blocks at steam flow rates of 750,000 lbs/hr for each power block. Steam is processed through the steam turbine and condenser. NCGs are then processed through the RTO and associated scrubbers (one RTO per power block) for emissions control. Normal operating TAC emissions from the Project vent through the RTO scrubber stack, and include products of combustion from the RTO, plus the byproducts of NCG combustion. Normal operating emissions for one power block are shown in Table 5.10-4. Detailed operating emission calculations are provided in Appendix E.3.

Table 5.10-4 Normal Operating TAC Emissions, One Power Block

Pollutant	Maximum Hourly Emissions (Lbs/hr)	Annual Emissions (Lbs/Year)
Lead	1.5E-06	1.29E-02
H_2S	2.0E+00	1.75E+04
NH_3	1.1E+01	9.46E+04
Arsenic	3.2E-04	2.83E+00
Mercury	5.0E-04	4.40E+00
Benzene	1.2E-01	1.05E+03
Toluene	2.5E-03	2.22E+01
Ethylbenzene	2.2E-03	1.91E+01
Xylenes	2.2E-03	1.95E+01
Beryllium	0.0E+00	0.00E+00
Cadmium	0.0E+00	0.00E+00
Total Chromium	0.0E+00	0.00E+00
Copper	0.0E+00	0.00E+00
Manganese	0.0E+00	0.00E+00
Nickel	0.0E+00	0.00E+00
Selenium	0.0E+00	0.00E+00
Total Silica	0.0E+00	0.00E+00

Table 5.10-4 Normal Operating TAC Emissions, One Power Block

Pollutant	Maximum Hourly Emissions (Lbs/hr)	Annual Emissions (Lbs/Year)
Diesel PM	0.0E+00	0.00E+00
Chloroform	0.0E+00	0.00E+00
Formaldehyde	5.0E-05	4.38E-01
PAH's (excluding naphthalene)	1.2E-06	1.03E-02
Naphthalene	8.8E-07	7.73E-03
Acetaldehyde	1.3E-05	1.11E-01
Acrolein	7.9E-06	6.96E-02
Propylene	2.2E-03	1.88E+01
Hexane	1.9E-05	1.62E-01
	Ci/hr	**Ci/yr**
Radon	1.8E-03	1.59E+01

Startup and Shutdown

Similar to commissioning, emissions from startup and shutdown are attributed to the air contaminants that are present in the NCG that are released from the brine with the steam phase. Uncontrolled emissions are expected during specific phases of startup and shutdown and are emitted through either the PTU or rock muffler. Other phases of startup and shutdown will involve venting the NCG through the RTO for emissions control.

During startup, the following activities are expected to occur:

- Production wells have a warm up duration of 12 to 16 hours for the first well, followed by 16 to 24 hours for the next two wells (combined). Steam from well warm up vents to the PTU at a rate of 250,000 lbs/hr per well.
- Production piping and equipment have a warm up duration of 24 to 32 hours. Steam is vented at a rate of 350,000 lbs/hr to the rock muffler.
- Turbine and auxiliary loops preheat has a duration of 18 to 24 hours. The total steam flow rate is 350,000 lbs/hr; 50,000 lbs/hr steam flows through the turbine, condenser and RTO, and the balance of 300,000 lbs/hr of steam flows to the rock muffler.
- Auxiliary equipment startup has a duration of 8 to 12 hours. A slip stream of steam at a flow rate of 80,000 lbs/hr is directed to the auxiliary equipment which flows to the condenser and RTO, with the balance of the steam flow of 270,000 lbs/hr vented to the rock muffler.

- Full functional trip test with a duration of 6 to 8 hours, venting steam at a flow rate of 350,000 lbs/hr to the rock muffler.
- Steam delivery to the turbine at gradual increase of steam from 350,000 lbs/hr to a full production rate of 750,000 lbs/hr over a period of 4 to 6 hours. Steam vents through the turbine, condenser, and RTO.

During shutdowns the following activities will take place:

- Turbine taken offline, steam vented to rock muffler, gradual flow reduction from 750,000 to 0 lbs/hr over a period of 8 to 12 hours. The procedure is to take one well offline at a time, meaning the first step will reduce the steam flow rate to 500,000 lbs/hr, followed by a reduction to 250,000 lbs/hr and, finally, the third well is taken offline to drop the steam flow down to zero.
- After shutting down all three wells, the pipeline is drained of brine, with no steam or other emissions released to atmosphere.

The Applicant anticipates up to four starts and four stops per year. There may be unplanned "plant trips"[1]; the frequency or duration of those trips cannot be predicted, and TAC emissions from those events are not estimated. Startup and shutdown TAC emissions for one power block are shown in Table 5.10-5. Detailed startup and shutdown emission calculations are provided in Appendix E.3.

[1] A "plant trip" is an unplanned shutdown which requires that the steam turbine be taken offline rapidly. During these events, steam is vented to the rock muffler until the wells can be shutdown in a controlled manner.

Table 5.10-5 Startup and Shutdown TAC Emissions, One Power Block

Pollutant	Cold Start Up			Warm Start Up			Shutdown		
	Maximum Hourly Emissions (Lbs/hr)	TAC Emissions (Lbs/Event)	TAC Emissions (Lb/year)	Maximum Hourly Emissions (Lbs/hr)	TAC Emissions (Lbs/Event)	TAC Emissions (Lb/year)	Maximum Hourly Emissions (Lbs/hr)	TAC Emissions (Lbs/Event)	TAC Emissions (Lb/year)
Lead	2.5E-05	1.1E-03	1.1E-03	2.5E-05	1.0E-04	3.0E-04	0.0E+00	0.0E+00	0.0E+00
H_2S	3.1E+01	3289	3289	6.7E+01	4.1E+02	1.2E+03	5.6E+01	4.0E+02	4.0E+02
NH_3	1.3E+02	16043	16043	2.8E+02	1.9E+03	5.8E+03	2.3E+02	1.7E+03	1.7E+03
Arsenic	3.0E-03	0	0	6.5E-03	4.0E-02	1.2E-01	5.4E-03	3.9E-02	3.9E-02
Mercury	2.3E-03	0	0	5.0E-03	3.1E-02	9.4E-02	4.2E-03	3.0E-02	3.0E-02
Benzene	1.1E+00	117	117	2.4E+00	1.5E+01	4.4E+01	2.0E+00	1.4E+01	1.4E+01
Toluene	2.3E-02	2.37	2	4.8E-02	3.0E-01	8.9E-01	4.0E-02	2.9E-01	2.9E-01
Ethylbenzene	2.0E-02	2.10	2	4.3E-02	2.6E-01	7.9E-01	3.6E-02	2.6E-01	2.6E-01
Xylenes	2.0E-02	2.11	2	4.3E-02	2.6E-01	7.9E-01	3.6E-02	2.6E-01	2.6E-01
Beryllium	2.4E-05	0	0	2.4E-05	9.6E-05	2.9E-04	0.0E+00	0.0E+00	0.0E+00
Cadmium	4.8E-06	0	0	4.8E-06	1.9E-05	5.7E-05	0.0E+00	0.0E+00	0.0E+00
Total Chromium	4.8E-05	0	0	4.8E-05	1.9E-04	5.7E-04	0.0E+00	0.0E+00	0.0E+00
Copper	2.4E-05	0	0	2.4E-05	9.6E-05	2.9E-04	0.0E+00	0.0E+00	0.0E+00
Manganese	2.4E-05	0	0	2.4E-05	9.6E-05	2.9E-04	0.0E+00	0.0E+00	0.0E+00
Nickel	4.8E-05	0	0	4.8E-05	1.9E-04	5.7E-04	0.0E+00	0.0E+00	0.0E+00
Selenium	1.2E-05	0	0	1.2E-05	4.8E-05	1.4E-04	0.0E+00	0.0E+00	0.0E+00
Total Silica	1.2E-02	1	1	1.2E-02	4.8E-02	1.4E-01	0.0E+00	0.0E+00	0.0E+00
Diesel PM	0.0E+00	0	0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Chloroform	9.5E-03	0	0	9.5E-03	3.8E-02	1.1E-01	0.0E+00	0.0E+00	0.0E+00

Table 5.10-5 Startup and Shutdown TAC Emissions, One Power Block

Pollutant	Cold Start Up			Warm Start Up			Shutdown		
	Maximum Hourly Emissions (Lbs/hr)	TAC Emissions (Lbs/Event)	TAC Emissions (Lb/year)	Maximum Hourly Emissions (Lbs/hr)	TAC Emissions (Lbs/Event)	TAC Emissions (Lb/year)	Maximum Hourly Emissions (Lbs/hr)	TAC Emissions (Lbs/Event)	TAC Emissions (Lb/year)
Formaldehyde	5.0E-05	0	0	5.0E-05	2.0E-04	6.0E-04	0.0E+00	0.0E+00	0.0E+00
PAH's (excluding naphthalene)	1.2E-06	0	0	1.2E-06	4.7E-06	1.4E-05	0.0E+00	0.0E+00	0.0E+00
Naphthalene	8.8E-07	0	0	8.8E-07	3.5E-06	1.1E-05	0.0E+00	0.0E+00	0.0E+00
Acetaldehyde	1.3E-05	0	0	1.3E-05	5.1E-05	1.5E-04	0.0E+00	0.0E+00	0.0E+00
Acrolein	7.9E-06	0	0	7.9E-06	3.2E-05	9.5E-05	0.0E+00	0.0E+00	0.0E+00
Propylene	2.2E-03	0	0	2.2E-03	8.6E-03	2.6E-02	0.0E+00	0.0E+00	0.0E+00
Hexane	1.9E-05	0	0	1.9E-05	7.4E-05	2.2E-04	0.0E+00	0.0E+00	0.0E+00
	Ci/hr	**Ci/event**	**Ci/year**	**Ci/hr**	**Ci/event**	**Ci/year**	**Ci/hr**	**Ci/event**	**Ci/year**
Radon	1.8E-03	1.0E-01	1.0E-01	1.8E-03	1.5E-02	4.6E-02	1.5E-03	1.1E-02	1.1E-02

Cooling Towers

The Amended Project will include three 5-cell cooling towers with drift eliminators, one per power block. Total Suspended Particulate (TSP) emissions are calculated based on the maximum water circulation rate and the amount of Total Dissolved Solids/Total Suspended Solids in the water. The reduction due to the drift eliminator is then applied to derive Particulate Matter (PM10) emissions. Inorganic TAC emissions are estimated by speciating the PM10 according to chemical analysis of condensate from a similar geothermal plant operated by the Applicant. Organic TAC emissions are estimated via mass balance – the organic TAC present in the condensate makeup water is assumed to volatilize completely in the cooling tower. H_2S emissions are estimated based on the H_2S concentration in the condensate and the control efficiency of the ChemOx. H_2S remaining after treatment is assumed to volatilize completely. Finally, the cooling tower will be dosed with sodium hypochlorite for control of biological growth. Hypochlorite usage is estimated based on experience with similar applications. Such treatment is known to cause formation of chloroform, a volatile TAC that would be emitted from the cooling tower (Rogozen, 1998). Hourly and annual emissions for one cooling tower are listed in Table 5.10-6. Emissions are based on continuous operation up to 8,760 hours per year. Details of the cooling tower emission calculations are provided in Appendix G.3.

Table 5.10-6 Maximum Hourly and Annual Cooling Tower TAC Emissions, One Cooling Tower

Pollutant	Maximum Hourly Emissions (Lbs/hr)	Annual Emissions (Lbs/Year)
Lead	2.4E-05	0.2094
H_2S	1.3E+00	11,671
NH_3	6.1E+01	536,242
Arsenic	1.4E-04	1.2147
Mercury	1.2E-06	0.0105
Benzene	3.5E-04	3.0892
Toluene	1.7E-04	1.4572
Ethylbenzene	1.7E-04	1.4572
Xylenes	3.3E-04	2.9144
Beryllium	2.4E-05	0.2094
Cadmium	4.8E-06	0.0419
Total Chromium	4.8E-05	0.4189
Copper	2.4E-05	0.2094
Manganese	2.4E-05	0.2094
Nickel	4.8E-05	0.4189
Selenium	1.2E-05	0.1047

Table 5.10-6 Maximum Hourly and Annual Cooling Tower TAC Emissions, One Cooling Tower

Pollutant	Maximum Hourly Emissions (Lbs/hr)	Annual Emissions (Lbs/Year)
Total Silica	1.2E-02	104.7195
Diesel PM	0.0E+00	0.0000
Chloroform	9.5E-03	83.0284
Formaldehyde	0.0E+00	0.0000
PAH's (excluding naphthalene)	0.0E+00	0.0000
Naphthalene	0.0E+00	0.0000
Acetaldehyde	0.0E+00	0.0000
Acrolein	0.0E+00	0.0000
Propylene	0.0E+00	0.0000
Hexane	0.0E+00	0.0000
	Ci/hr	**Ci/year**
Radon	1.0E-05	0.0889

Emergency Diesel Generator and Fire-Water Pump Engines

The Amended Project will operate three 1.5-megawatt (MW) 2,200 horsepower [Hp]) diesel-fueled emergency generator engines, three 1.0-MW (1,500 Hp) emergency generator engines, and one 200-Hp fire water pump engine. The six emergency generator engines will be operated up to 20 hours per year each for maintenance and testing and the emergency fire water pump engine up to 50 hours per year. The diesel engines will emit DPM, a California-listed TAC (CARB, 2006). DPM emissions are assumed to be equal to fine particulate matter (PM10) emissions. The PM10 emission factor was set equal to the 0.15 gallons/horsepower per hour limit specified in 17 CCR § 93115 for Tier 4 engines (CARB, 2004a). Hourly and annual DPM emissions for emergency engine testing and maintenance operation are shown in Table 5.10-7. DPM emissions from emergency operation of the engines are not estimated.

Table 5.10-7 Emergency Engine DPM Emissions

Pollutant	Emissions – One Engine		Project Total (Three Engines)
	(lb/hr)	(tpy)	(tpy)
1.5 MW Emergency Generator Engine	0.242	4.85	15
1.0 MW Emergency Generator Engine	0.363	7.25	22
200-Hp Emergency Fire Water Pump Engine	0.006	0.322	0.322

Details of the emergency diesel generator and fire water pump engines emission calculations are provided in Appendix E.3.

Hydrochloric Acid Storage Tanks

Because hydrochloric acid (HCl) is acutely toxic, and does not exhibit chronic or cancerous toxicity, only the short-term (i.e., one-hour) emissions need to be quantified for the HRA. Maximum short-term HCl emissions will occur when concentrated HCl is loaded into storage tanks. Maximum hourly emissions are estimated assuming loading of one delivery tanker truck per hour into storage tanks. Emissions of HCl from loading operations are estimated using EPA AP-42 emission calculation methodology for loading loses (EPA, 2000). The maximum one-hour HCl emission rate is 18.2 pounds per hour.

Summary of Emissions

Total TAC emissions from the Amended Project are shown in Table 5.10-8 below. Annual emissions include four startups, four shutdowns and 8,760 hours of normal operations of the steam turbine and RTO, 8,760 hours per year of cooling tower operation, 20 hours of operation each for the emergency generator engines and 50 hours per year of operation of the fire water pump engine.

Table 5.10-8 Amended Project TAC Emissions

Pollutant	Maximum Hourly Emissions (Lbs/hr)	Annual TAC Emissions (Lbs/Year)
Lead	7.61E-05	0.68
H_2S	2.00E+02	102,292
NH_3	8.32E+02	1,963,162
Arsenic	1.94E-02	13.57
Mercury	1.51E-02	14.34
Benzene	7.19E+00	3,683
Toluene	1.45E-01	81.54

Table 5.10-8 Amended Project TAC Emissions

Pollutant	Maximum Hourly Emissions (Lbs/hr)	Annual TAC Emissions (Lbs/Year)
Ethylbenzene	1.29E-01	70.99
Xylenes	1.29E-01	76.76
Beryllium	7.17E-05	0.63
Cadmium	1.43E-05	0.13
Total Chromium	1.43E-04	1.26
Copper	7.17E-05	0.63
Manganese	7.17E-05	0.63
Nickel	1.43E-04	1.26
Selenium	3.59E-05	0.32
Total Silica	3.59E-02	316.10
Diesel PM	1.82E+00	36.62
Chloroform	2.84E-02	250.62
Formaldehyde	1.50E-04	1.32
PAH's (excluding naphthalene) 5	3.53E-06	0.03
Naphthalene	2.65E-06	0.02
Acetaldehyde	3.79E-05	0.33
Acrolein	2.38E-05	0.21
Propylene	6.45E-03	56.85
Hexane	5.56E-05	0.49
Hydrochloric acid	1.82E+01	217.90
	Ci/hr	**Ci/year**
Radon	5.47E-03	48.41

5.10.4.2 Impact Assessment (HRA)

A multi-pathway HRA was conducted for normal operating emissions from the Amended Project. This section presents the HRA approach, descriptions of the models and assumptions used, and HRA conclusions.

Risk Definitions and Significance Criteria

Cancer Risk

Cancer risk is the probability or chance of contracting cancer over a human life span, which is assumed to be 70 years (EPA, 2005). 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 excess cancer cases per million exposed 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. The ICAPCD'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 chronic or acute Hazard Index (HI) greater than or equal to 1.0 (ICAPCD, 2006).

Non-Cancer Health Hazard

Non-cancer health effects are characterized as 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 HI, which is the calculated exposure to a contaminant divided by its REL. HIs for those pollutants affecting the same target organ are typically summed, with the resulting totals expressed as HIs for each organ system.

Chronic toxicity is defined as adverse health effects from prolonged chemical exposure. Chronic exposure is one which occurs over a period exceeding 12 percent of a 70-year lifetime. 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 less than or equal to one hour. For most chemicals, the exposure required to produce acute effects is higher than levels required for chronic effects because 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.

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 by the OEHHA in the Consolidated Table of OEHHA/ARB Approved Risk Assessment Health Values (OEHHA, 2008).

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 DPM emissions, the risk assessment methodology used was consistent with that employed by the CARB in the document entitled: "Risk Reduction Plan to Reduce Particulate Matter Emissions from Diesel-Fueled Engines and Vehicles" (CARB, 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 CARB Scientific Review Panel (SRP) derived a best-estimate of the cancer unit risk factor as 300 excess cancer cases per million people breathing one $\mu g/m^3$ 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 the California Environmental Quality Act (CEQA). However, most air districts in California have adopted local significance thresholds for health risks in their policy guidance to project proponents. Under CEQA, the ICAPCD is the responsible agency on air quality and related matters within its jurisdiction or impacting its jurisdiction. The ICAPCD has developed its own air quality CEQA guidelines dated November 2007 for evaluating projects within its jurisdiction. The ICAPCD 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 ICAPCD'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 chronic or acute HI greater than or equal to 1.0 (ICAPCD, 2007).

Health Risk Assessment Approach

The HRA contains three quantitative determinations: emission estimation, air dispersion analysis, and health risk characterization. As discussed above, source emissions of TAC from the Project were estimated based on quantification methods specific to facility operations and EPA-approved emission factors and calculation methods. Exposure calculations were performed using EPA- and CEC-approved air dispersion modeling analysis to predict ground-level air concentrations. Results of the air modeling exposure predictions were then applied to the emission estimates and, along with the respective cancer health risk factors and chronic and acute non-cancer RELs for each TAC, a health risk characterization was performed that quantified individual health risks associated with predicted levels of exposure.

The Amended Project HRA was performed using the Hotspots Analysis and Reporting Program (HARP) software package (Version 1.4) developed by CARB for conducting HRAs in California under the AB2588. The HARP modeling system is a comprehensive health risk assessment tool that contains air emissions, dispersion and risk analysis modules. The HRA is a multi-pathway risk analysis. Air contaminant inhalation

and plant ingestion are the dominant pathways for public exposure to chemical substances released by the Amended Project. In addition, combustion byproducts produced in the natural gas-fired RTO, as well as secondary emissions of inorganic TAC in cooling tower drift potentially emitted by the Project cooling tower, are considered multi-pathway TAC. Therefore, the multi-pathway assessment also includes an evaluation of soil ingestion, dermal absorption, and mother's milk ingestion. The inhalation pathway would be the dominant pathway for public exposure to chemical substances released by the Amended Project and is expected to represent the majority of the predicted risk.

Health Risk Factors

Chemical substances were evaluated in this analysis using health values that have been approved by OEHHA and CARB for use in HRAs conducted for the AB2588 Air Toxics Hot Spots Program. The chemical substances of concern that are addressed in this HRA are listed in Table 5.10-9, 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.

Table 5.10-9 CEHHA / CARB Approved Risk Assessment Health Values

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 $(mg/kg\text{-}day)^{-1}$	Chronic Inhalation REL $(\mu g/m^3)$	Acute Inhalation REL $(\mu g/m^3)$
Acetaldehyde	2.7E-06	1.0E-02	---	1.4E+02	4.7E+02
Acrolein	---	---	---	3.5E-01	2.5E+00
Ammonia	---	---	---	2.0E+02	3.2E+03
Arsenic and compounds (inorganic)	3.3E-03	1.2E+01	1.5E+00	.1.5E-02	2.0E-01[b]
Benzene	2.9E-05	1.0E-01	---	6.0E+01	1.3E+03[c]
Beryllium and compounds	2.4E-03	8.4E+00	---	7.0E-03	---
Cadmium and compounds	4.2E-03	1.5E+01	---	2.0E-02	---
Carbon Monoxide	---	---	---		2.3E+04
Chloroform	5.3E-06	1.9E-02	---	3.0E+02	1.5E+02[d]
Chromium (as Cr^{+6})	1.5E-01	5.1E+02	---	2.0E-01	---
Copper and compounds	---	---	---	---	1.0E+02
Diesel PM	3.0E-04	1.1E+00	---	5.0E+00	---
Ethylbenzene	2.5E-06	8.7E-03	---	2.0E+03	---
Formaldehyde	6.0E-06	2.1E-02	---	9.0E+00	5.5E+01
n-Hexane	---	---	---	7.0E+03	---

Table 5.10-9 CEHHA / CARB Approved Risk Assessment Health Values

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 $(mg/kg\text{-}day)^{-1}$	Chronic Inhalation REL $(\mu g/m^3)$	Acute Inhalation REL $(\mu g/m^3)$
Hydrochloric Acid	---	---	---	9.0E+00	2.1E+03
Hydrogen Sulfide	---[a]	---	---	1.0E+01	4.2E+01
Lead and compounds (inorganic)[e]	1.2E-05	4.2E-02	8.5E-03	---	---
Manganese and compounds	---	---	---	2.0E-01	---
Mercury and compounds (inorganic)	---	---	---	3.0E-02	6.0E-01
Nickel and compounds	2.6E-04	9.1E-01	---	5.0E-02	6.0E+00
Nitrogen Dioxide	---	---	---	---	4.7E+02
Propylene	---	---	---	3.0E+03	---
Selenium and compounds	---	---	---	2.0E+01	---
Silica (crystalline, respirable)	---	---	---	3.0E+00	---
Sulfur Dioxide	6.6E+02	---	---	---	---
Toluene	---	---	---	3.0E+02	3.7E+04
Xylenes	---	---	---	7.0E+02	2.2E+04
Poly Aromatic Hydrocarbons (PAHs)					
Benz(a)anthracene	1.10E-04	3.90E+00	1.20E+00	---	---
Benzo(a)pyrene	1.10E-03	3.90E+00	1.20E+01	---	---
Benzo(b)fluoranthene	1.10E-04	3.90E-01	1.10E+00	---	---
Benzo(j)fluoranthene	1.10E-04	3.90E-01	1.10E+00	---	---
Benzo(k)fluoranthene	1.10E-04	3.90E-01	1.10E+00	---	---
Crysene	1.10E-05	3.90E-02	1.20E-01	---	---
Dibenz(a,h)acridine	1.10E-04	3.90E-01	1.20E+00	---	---
Dibenz(a,h)anthracene	1.20E-03	4.10E+00	4.10E+00	---	---
Dibenz(a,j)acridine	1.10E-04	3.90E-01	1.20E+00	---	---
Dibenzo(a,e)pyrene	1.10E-03	3.90E+00	1.20E+01	---	---
Dibenzo(a,h)pyrene	1.10E-02	3.90E+01	1.20E+02	---	---
Dibenzo(a,i)pyrene	1.10E-02	3.90E+01	1.20E+02	---	---

Table 5.10-9 CEHHA / CARB Approved Risk Assessment Health Values

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 $(mg/kg\text{-}day)^{-1}$	Chronic Inhalation REL $(\mu g/m^3)$	Acute Inhalation REL $(\mu g/m^3)$
Dibenzo(a,l)pyrene	1.10E-02	3.90E+01	1.20E+02	---	---
7H-Dibenzo(c,g)carbazole	1.10E-03	3.90E+00	1.20E+01	---	---
7,12-Dimethylbenz(a)anthracene	7.10E-02	2.50E+02	2.50E+02	---	---
1,6-Dinitropyrene	1.10E-02	3.90E+01	1.20E+02	---	---
1,8-Dinitropyrene	1.10E-03	3.90E+00	1.20E+01	---	---
Indeno(1,2,3-c,d)pyrene	6.30E-03	2.20E+01	2.20E+01	---	---
3-Methylcholanthrene	1.10E-03	3.90E+00	1.20E+01	---	---
5-Methylchrysene	1.10E-03	1.20E-01	---	---	---
Naphthalene	3.40E-05	1.20E-01	---	9.00E+00	---
5-Nitroacenaphthene	3.70E-05	1.30E-01	1.20E-01	---	---
6-Nitrochrysene	1.10E-02	3.90E+01	1.20E+02	---	---
2-Nitrofluorene	1.10E-05	3.90E-02	1.20E-01	---	---
1-Nitropyrene	1.10E-04	3.90E-01	1.20E+00	---	---
4-Nitropyrene	1.10E-04	3.90E-01	1.20E+00	---	---

a. "---" denotes that the pollutant is not have a risk value assigned.

b. Averaging period is 4 hours.

c. Averaging period is 6 hours.

d. Averaging period is 7 hours.

e. Inorganic Lead was identified by CARB as a TAC in April 1997. Since information on non-cancer health effects show no identified threshold, no REL has been developed.

Source: Consolidated Table of OEHHA/ARB Approved Risk Assessment Health Values (OEHHA, 2008).

Dispersion Modeling Methodology

Concentrations of TAC in ambient air resulting from potential TAC emissions were estimated using the CEC-approved HARP software package. HARP is the preferred tool for conducting multi-pathway health risk assessment in California. The methods and requirements used to conduct the air dispersion modeling analysis in HARP for estimating concentrations of TAC are described below.

Air Dispersion Model. The dispersion analysis utilized in HARP is derived from the AERMOD modeling system (version 07026, with the associated meteorological and receptor processing programs AERMET and AERMAP versions 06341) developed by EPA, which estimates both short-term and long-term average

ambient concentrations at receptor locations to produce exposure estimates. AERMOD accounts for site-specific terrain, meteorological conditions, and emissions parameters such as stack exit velocities and temperatures in order to estimate ambient concentrations. The AERMOD dispersion results are adapted for use in HARP using the HARP On-Ramp program. The Building Profile Input Program for PRIME (BPIP-PRIME version 04274) was used for determining building dimensions for downwash calculations in the models. Additional details regarding the application of AERMOD to the Amended Project are provided in Section 5.2, Air Quality, and Appendix E.3.

Meteorological Data. The Applicant used the five year period of 2002 through 2006[2] of meteorological data collected at the Imperial County Airport, which is located approximately 22 miles south of the Project site, and believes use of this data satisfies the criteria for use as "onsite data". The meteorological data collected at Imperial County Airport accurately represents meteorological conditions at the Project site because there are no terrain or other steering mechanisms that significantly affected the meteorology at the Project site. In particular, the surface roughness, height and length of the large-scale terrain features is consistent throughout the area, and plays a large role in the affect on the horizontal and vertical wind patterns. There is no slope aspect in the vicinity of the Project site that would reasonably affect the wind direction or speed. The mesoscale features at both the Project site and the Imperial County Airport site are similar.

Meteorological data were used in two ways. First, a long-term record of meteorological data defines the overall climate of a region. Second, hourly meteorological observations of certain parameters were used to define the area's dispersion characteristics. These data were used in the air dispersion models described above for defining the Project's impact on air quality.

Modeled Source Release Parameters. Sources of TAC emissions from operation of the Project were modeled as point sources with release parameters consistent with those used for modeling air quality impact analysis of criteria pollutants. A detailed discussion of modeled source release parameters including stack height and stack diameter, exhaust gas temperature, exit velocity, and a calculated volumetric flow rate for each emission source is provided in Section 5.2, Air Quality and Appendix E.3.

Building Downwash. Stack locations and heights and building locations and dimensions were input to BPIP-PRIME. The first part of BPIP-PRIME determined and reported on whether a stack is being subjected to wake effects from one or more structures. The second part calculates direction-dependent "equivalent building dimensions" if a stack was being influenced by structure wake effects. The BPIP-PRIME output was formatted for use in AERMOD input files.

Terrain. An analysis was performed to determine if the "urban" option should be used. This analysis used the procedures of Auer and included drawing a three-kilometer radius around the project site (Auer, 1978). Within this region, land use was classified as either rural or urban. Over 95 percent of the land use within three kilometers of the project site was identified as rural. Therefore, the urban option was not used in the modeling analysis.

[2] Data recovery for 2007 was poor, so 2002 through 2006 was used instead of the most recent five year period.

As part of the AERMET input requirements, Albedo, Bowen Ratio, and Surface Roughness were classified. The AERSURFACE program was used to generate the surface characteristics for use in AERMET as specified in EPA's January 2008 AERMOD Guidance Document and AERSURFACE User's Guide using default settings where appropriate. AERSURFACE was executed for two sectors (Sector 1 = 110º-355º and Sector 2 = 355º-110º) to define surface roughness.

Receptors. Sensitive receptors, locations where a sensitive population such as children, elderly, or the infirmed may be exposed to TAC from the Project, were identified and modeled within a three-mile radius of the Project. A network of residential and occupational receptors was also developed to identify the locations of the maximum exposed individual at an existing residential receptor (MEIR), and the maximum exposed individual at an existing occupational worker receptor (MEIW). Individual receptors identified and modeled in the study included residences, workplaces, schools, medical facilities, daycares, and elderly care centers. The receptors were identified using GoogleEarth, SwitchBoard Digital Directory, Yahoo Yellow Pages, and community elements contained in geographic information system software packages. Figure 5.10-1 shows the residential, worker, and sensitive receptor locations within a three-mile radius of the project. A list of these receptors is provided in Appendix L.1.

Risk Characterization. The HRA evaluated the potential cancer risk and non-cancer health hazards from Amended Project TAC emissions. The health risk methodology is based on the OEHHA Guidance Manual (OEHHA, 2003).

The evaluation of potential non-cancer health effects from inhalation exposure to short-term and long-term airborne TAC concentrations was performed by comparing modeled concentrations at the MEIR and MEIW with RELs. In accordance with the HARP model requirements and OEHHA AB2588 risk assessment guidelines, a non-cancer health hazard assessment was conducted using the maximum one-hour and annual TAC emission rates, along with the OEHHA health risk values, to determine predicted health risks due to potential TAC exposure.

Carcinogenic risks and potential chronic and acute non-cancer health effects were assessed using the dispersion modeling described above and numerical values of toxicity provided by OEHHA. Cancer risk evaluated potential health impacts from inhalation, skin contact, and oral pathways as required by OEHHA guidelines. Additionally, this assessment included highly-conservative assumptions such as a 70-year exposure duration for residential receptors and a 40-year exposure duration for commercial/industrial receptors. An additional conservative assumption for worker exposure point estimate was the use of the OEHHA-defined 95th percentile breathing rate of 393 liters of air per kilogram per day (OEHHA, 2005).

The following HARP modeling options were used for the risk analysis to estimate cancer and non-cancer impacts at the MEIR and the MEIW.

- 70-year Resident Cancer Risk – Derived (Adjusted) Method
- 9-year (Child Resident) Cancer Risk – Derived (OEHHA) Method
- Worker Cancer Risk – Point Estimate
- Chronic Hazard Index – Derived (OEHHA) Method
- Acute Hazard Index – Simple Acute HI

The Derived (OEHHA) risk analysis method uses the high end-point estimates of exposure for the two dominant (driving) exposure pathways, while the remaining exposure pathways use average point estimates. The Derived (Adjusted) method is similar to the Derived (OEHHA) method but uses the breathing rate at the 80th percentile of exposure rather than the high end-point estimate when the inhalation pathway is one of the dominant exposure pathways. The cancer risk estimates using the Derived equations/methods are based on a 70-year exposure. The point-estimate analysis uses a single value rather than a distribution of values in the dose equation for each exposure pathway. Simple acute risk method is a conservative approach where the maximum concentrations from each emission source are superimposed to impact receptors at the same time, irrespective of wind direction and/ or atmospheric stability and is a health-protective approach to assess acute impacts. The environmental pathways that were analyzed consist of all pathways recommended for a refined HRA. Exposure pathways that were enabled include homegrown produce (default: 15 percent), dermal absorption, soil ingestion, and mother's milk. For the cancer and chronic HI impacts at the MEIW, the HARP modeling option "modeled gas-liquid chromatography and default exposure assumptions" was used.

Exposure Assumptions. The chief exposure assumption is one of continuous exposure to the TAC concentrations produced by continuous emissions at the maximum emission rates over a 70-year period at each receptor location. The actual risks are not expected to be any higher than the predicted risks and are likely to be substantially lower. The cancer risk for an inhaled TAC is estimated by multiplying the exposure concentration by the breathing rate multiplied by the inhalation cancer potency factor, using the appropriate units. The averaging time for the cancer risk estimate is usually 70 years, which is used to represent a lifetime exposure.

Risk Assessment Analytical Uncertainties

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

Emissions

There are inherent uncertainties in the emission calculation methods used to estimate emissions from the processing of geothermal brine. The concentrations of contaminants in and properties of the geothermal resource are known to vary geographically. The data used in the emission estimates may vary somewhat from the concentrations and properties encountered at the Project site. There may also be some reduction of the organic TAC emissions due to the use of the ChemOx process on the condensate, which was not accounted for in the emission calculations. Therefore, the emission estimates have uncertainties but, where possible, are used in a manner that tends to over-estimate exposures and corresponding risks resulting from those emissions. Finally, TAC emissions are based on an assumption of operating at full load for all emission units (except diesel engines) for 8,760 hours per year. It is unlikely that all equipment would operate full time under these conditions, thus emissions are likely to be overestimated.

Air Dispersion Modeling

In general, EPA-dispersion models such as AERMOD (used in this HRA) are designed to over-predict concentrations rather than under-predict. For example, the model algorithms assume chemical emissions are not transformed in the atmosphere into other chemical compounds (e.g., photochemical reactions). For certain pollutants, conversion may occur quickly enough to reduce concentrations substantially.

Exposure Assessment

Important uncertainties related to exposure include the identification of exposed populations and their exposure characteristics. The choice of a "residential" MEI 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. Further, the predicted plant operating life is only 30 years, making continuous exposure to Project emissions for 70 years an improbability.

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 chemical toxicity factors (e.g., unit risk factors and RELs), used in the Project HRA, are biased toward over-estimating risk. The amount of the bias is unknown, but could be substantial.

DPM Unit Risk Factor

The DPM inhalation potency factor is a best-estimate value established by the CARB 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 (CARB, 2000). 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 may include more sensitive individuals than the railroad workers evaluated in the study (CARB, 2004b).

Risk Assessment Results

As noted above, the HRA provides results for all of the included receptors in the AERMOD input file. The three highest Cancer/Chronic MIR locations, and highest Acute MIR location were identified based on the HARP output. A summary of cancer risk and non-cancer health impacts values at the MIR receptors is shown in Table 5.10-10.

Table 5.10-10 Summary of Maximum Impacts

Receptor Type	Receptor #	Maximum Cancer Risk (per million)	Maximum Acute Hazard Index	Maximum Chronic Hazard Index	UTM
Cancer/Chronic MIR 1	14845	7.19	0.550	0.312	628456, 3670260
Cancer/Chronic MIR 2	14844	7.09	0.555	0.304	628455, 3670290
Cancer/Chronic MIR 3	1395	7.08	0.543	0.312	628470, 3670260
Acute MIR	14834	3.07	0.593	0.129	628454, 3670560
Significance Criteria		**10**	**1**	**1**	
All identified MIR receptors are located on the facility fenceline.					

The modeling grid did not contain locations of the identified sensitive receptors, i.e., MEIR, MEIW, or other sensitive receptors, in the immediate project area, although the grid spacing used indicates that the identified sensitive receptor locations were covered by one or more grid points. The sensitive receptor file included in Appendix L was developed using Google Earth aerial photos of the project area, noting potential sensitive receptors and their respective coordinates. The Google coordinates were converted to NAD27 to match the modeling grid scheme. The closest sensitive receptor (school) is approximately 6.4 miles from the site. The closest worker receptor is approximately 0.4 miles from the site, and the closest residential receptor is approximately 1.1 miles from the site. The closest concentrations of multiple housing units would be the Niland area which lies approximately eight miles northeast from the site, or the Calipatria area which lies approximately six miles east from the site. As noted above, the three (3) highest maximum impacted receptors for cancer risk and chronic HI, and the highest acute HI receptor are all located on the project fenceline. Therefore, none of the identified sensitive receptors, residential receptors (MEIR), or worker receptors (MEIW) would be expected to have cancer risks, chronic HI's, or acute HI's greater than those noted in the table above. As such, the inclusion of the sensitive receptors in the base modeling or risk assessment evaluations would have no effect on the outcome, and would not change in any way the conclusions of the risk analysis. Figure 5.10-1 shows the locations of the identified sensitive receptors.

Cancer risks potentially associated with facility emissions were also assessed in terms of cancer burden. Cancer burden is a hypothetical upper-bound estimate of the additional number of cancer cases that could be associated with emissions from the facility. Cancer burden is calculated as the worst-case product of any potential carcinogenic risk greater than one in one million and the number of individuals at that risk level. The cancer burden for the project was estimated by using the radius distance to the 1.0×10^{-6} risk level and the population within this radius. The maximum distance to the 1.0×10^{-6} point is approximately 2,180 meters (1.35 miles; receptor #5481). The facility and the 1.0×10^{-6} impact area lie within Imperial County Census Tract 101, which has an adjusted population of approximately 10,794 people as of July 2006. Presently, there are less than 100 individuals residing within the 1.0×10^{-6} impact radius distance from

the site, i.e., the wildlife refuge staff housing area to the north of the site. As such, the cancer burden would be less than or equal to 0.0001 for the 1.0 x 10^{-6} impact radius area.

The HRA for the original project concluded that there would be some short-term, unavoidable significant impacts during commissioning, startup, and shutdown of the original project. Because commissioning, startup and shutdown activities associated with the Amended Project are very similar to the original project, and will result in similar emissions and associated impacts, modeling for these short-term events was not conducted for the Amended Project.

In conclusion, estimated cancer risks at all receptors in the health risk analysis were very low, with a worst-case cancer risk of 6.32 in one million at the MIR, which is lower than the T-BACT threshold value. All estimated health risks were below the ICAPCD significance criterion of 10 in one million for cancer risk and one for non-cancer chronic and acute health impacts. Based on results of the risk assessment, the Project poses an insignificant incremental cancer risk and non-cancer health risk impact, according to established regulatory guidelines.

5.10.4.3 Non-Chemical Substances of Potential Concern

Along with TAC emissions, water systems such as cooling towers can be sources of bacteria growth, including Legionella. Legionella is the bacterium that can cause Legionellosis, otherwise known as Legionnaires' disease. Outbreaks of Legionellosis have been linked to untreated or inadequately treated cooling water systems in the United States, including in Texas and Wisconsin. The EPA has investigated and published about the presence of Legionella in water systems and its possible transmission in air (EPA, 1999). In most cases, the EPA has determined that disease outbreaks from Legionella have involved indoor exposure or outdoor exposure within 200 meters of the source. The most prevalent transmission was found to be through the heating, ventilation, and air conditioning systems in older buildings but it is possible for growth to occur in industrial cooling towers. The EPA has not developed a dose-response threshold due to inadequate quantitative data on the infectivity of Legionella in humans. However, it is known that normally functioning immune systems would have antibodies to Legionella and would be able to defend against infection. Individuals susceptible to Legionella typically have a compromised immunization system, such as some of the elderly.

The Cooling Technology Institute (CTI), an industry consortium, has issued guidelines for best practices to control Legionella (CTI, 2000). To minimize risks from Legionella, the CTI recommends eliminating to the maximum extent possible water stagnation and nutrient sources that lead into the cooling system, and to maintain the overall system cleanliness, which includes the application of corrosion inhibitors, microbiological disinfectants, and the use of high efficiency mist eliminators. Good preventative maintenance is very important in the efficient operation of cooling towers. Preventive maintenance includes having effective drift eliminators, periodically cleaning the system if appropriate, maintaining mechanical components in working order, and maintaining an effective water treatment program with appropriate biocide concentrations. The following management strategies are directed at minimizing colonization/amplification within the cooling tower system:

- Avoid piping that is capped and has no flow (dead legs).
- Control input water temperature to avoid temperature ranges where Legionella grow. Keep cold water below 25°C (77°F) and hot water above 55°C (131°F).

- Apply biocides in accordance with label dosages to control growth of other bacteria, algae, and protozoa that may contribute to nutritional needs of Legionella. Rotating biocides and using different control methods is recommended. These include thermal shock, oxidizing biocides, chlorine-based oxidants, and ozone treatment.
- Conduct routine periodic "back-flushes" to remove bio-film buildup on the inside walls of the pipes.

Regulatory agencies have addressed the question of controlling bacteria levels in water systems. The EPA also published a Legionella Drinking Water Health Advisory (EPA, 2001), which suggests control measures for disinfecting water in cooling systems, including thermal, hyper-chlorination, copper-silver ionization, ultraviolet light sterilization, ozonation, and instantaneous steam heating systems.

The California Department of Health Services regulates microbial growth and reduction of the potential for Legionella in the CCR, Title 22, §60306. The section states, in part, that whenever a cooling system, using recycled water in conjunction with an air conditioning facility utilizes a cooling tower or otherwise creates a mist that could come into contact with employees or members of the public the cooling system will operate a drift eliminator whenever the cooling system is in operation and that chlorine or another biocide will be used to treat the cooling system circulating water to minimize the growth of Legionella and other microorganisms.

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 Amended Project 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 5.10.6.

5.10.5 Mitigation Measures

Public Health mitigation measures are embodied in the CEC's COCs for the original project. The single existing Public Health COC is shown in the following section. The Applicant proposes no changes to this COC.

5.10.6 Conditions of Certification

The Applicant considers the following COC appropriate for the Amended Project and proposes no changes.

PUBLIC HEALTH-1 The project owner shall develop and implement a Cooling Towers Biocide Use, Biofilm Prevention, and Legionella Control Program to ensure that the potential for bacterial growth is controlled. The Program shall be consistent with staff's "Biocide Monitoring Program Guidelines" or the Cooling Tower Institute's "Best Practices for Control of Legionella" guidelines.

Verification: At least 30 days prior to the commencement of cooling tower operations, the project owner shall submit the Biocide Use, Biofilm Prevention, and Legionella Control Program to the CPM for review and approval.

5.10.7 References

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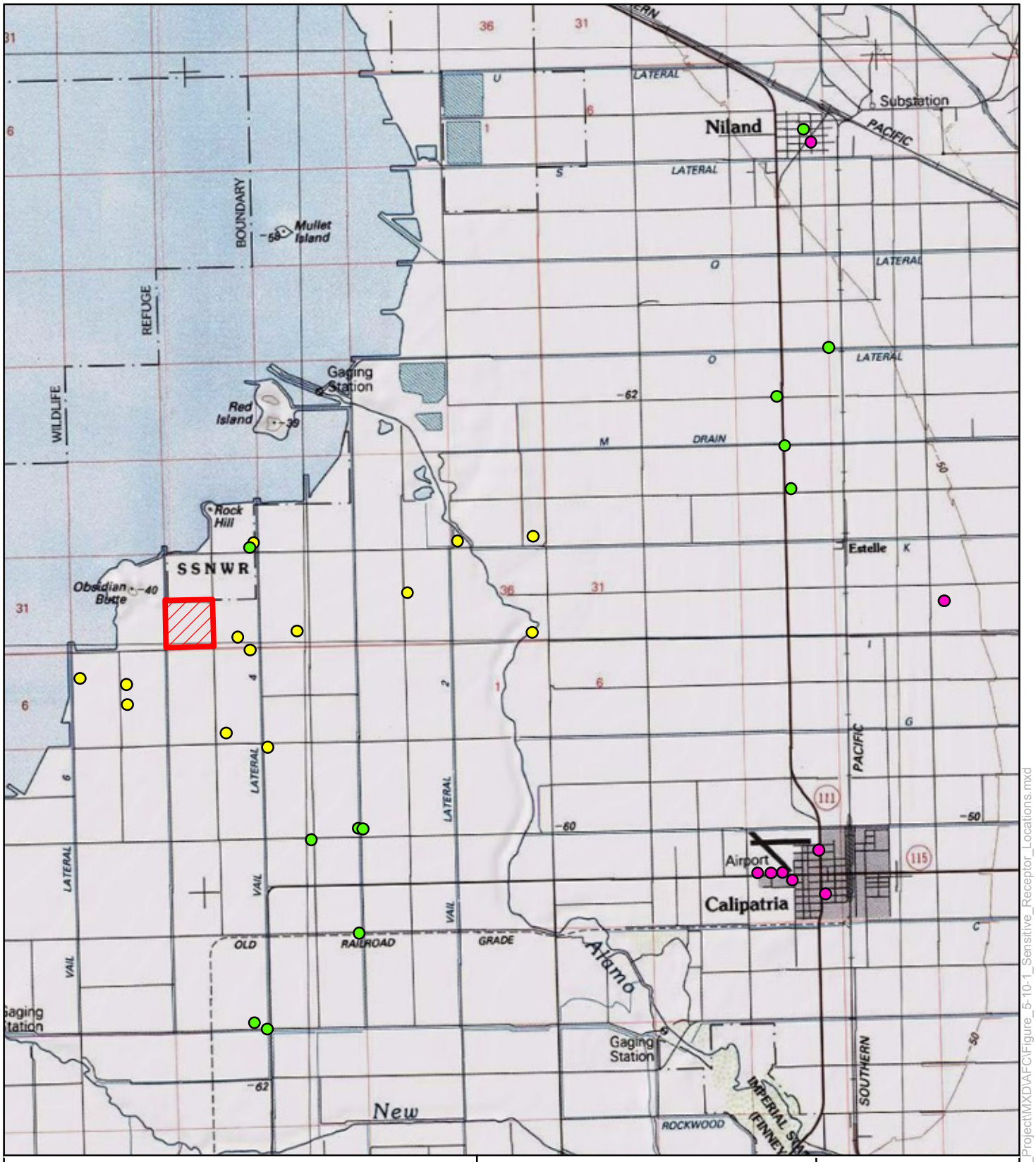

Legend

Plant Site Boundary

Receptor Type

- Residential Receptor
- Sensitive Receptor
- Worker Receptor

N W E S

Amended SSU6 Project
Figure 5.10-1
Sensitive Receptor Locations

1:90,000

0 7,500 15,000 Feet

CE GENERATION LLC
A MIDAMERICAN ENERGY HOLDINGS COMPANY AFFILIATE

AECOM

Project: 12676-001
Date: February 2009

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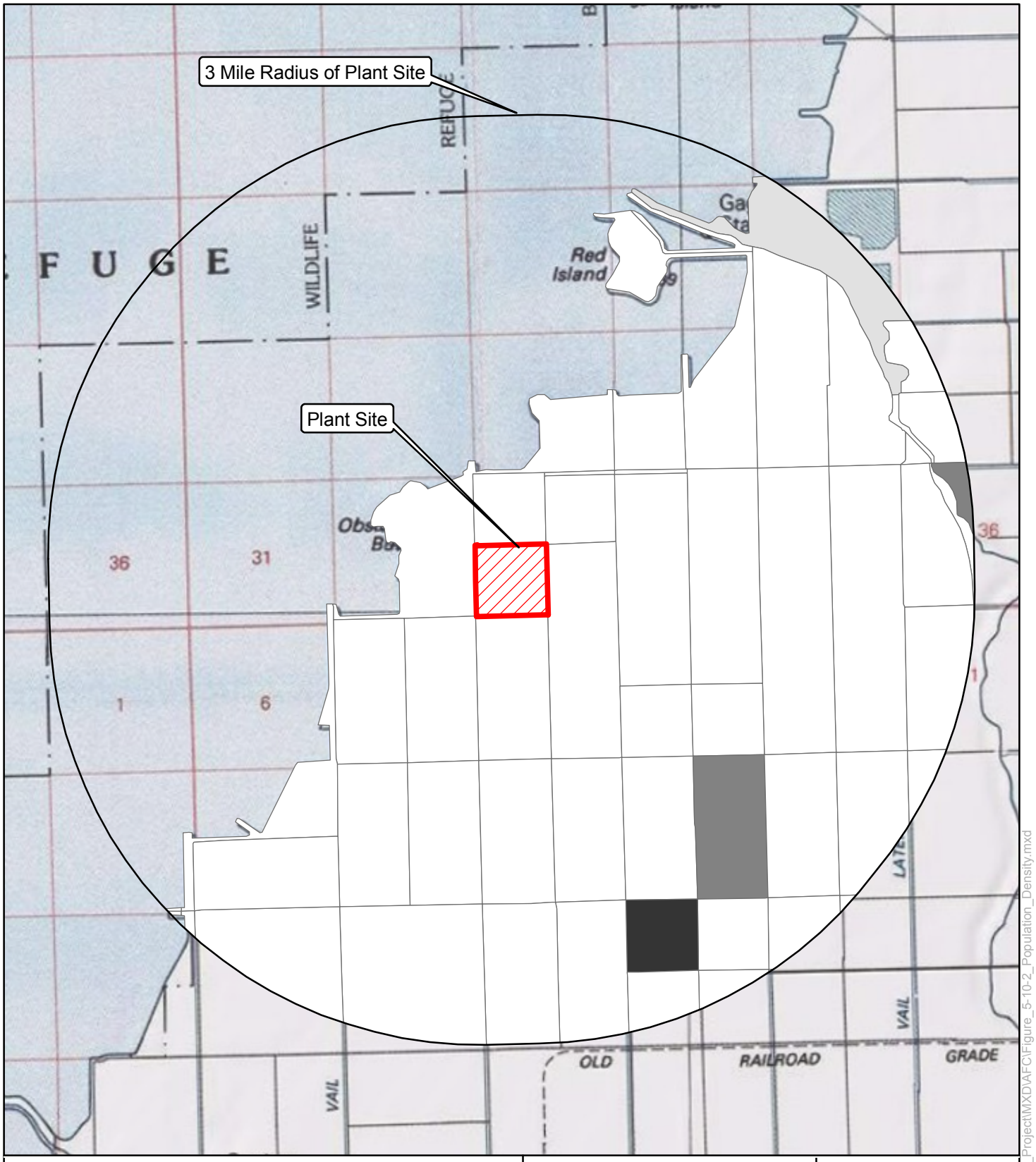

Persons Per Square Mile by Census Block

- 0
- 0-1
- 1-5
- 5-10
- >10

N W E S

1:60,000

0 2,500 5,000 10,000 Feet

Source: 2000 U.S. Census Bureau

Amended SSU6 Project

Figure 5.10-2
Population Density by Census Block

CE GENERATION LLC
A MIDAMERICAN ENERGY HOLDINGS COMPANY AFFILIATE

AECOM

Project: 12676-001
Date: February 2009

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