5.9 Public Health

This section presents the methodology and results of a human health risk assessment performed to assess potential impacts and public exposure associated with airborne emissions from the construction and operation of the Carlsbad Energy Center Project (CECP). Section 5.9.1 introduces the subject of public health impact analysis for a power plant proposed in a California Energy Commission (CEC) Application for Certification (AFC). Section 5.9.2 describes the laws, ordinances, regulations and standards (LORS) relevant to potential public health impacts of such a project. Section 5.9.3 describes the potentially affected public health environment around the proposed project site. Section 5.9.4 discusses the environmental impacts from construction and operation of the power plant and associated facilities, and the retirement of existing boiler Units 1, 2, and 3 at the Encina Power Station.

This public health section also describes project design features that keep potential impacts below public health-related thresholds of significance (e.g., the sole use of clean-burning natural gas in the gas turbines). This clean fuel, along with other design and operating aspects, will assure that the public health impacts of the CECP will be below the level of significance. As discussed in Section 5.5, Hazardous Materials Handling, multiple design features will be implemented in the project to assure that potential public health impacts of a hypothetical accidental release of aqueous ammonia will also be kept below a level of public health-related significance. Section 5.9.5 discusses potential cumulative public health impacts of the combined toxic air contaminant[1] (TAC) emissions from the proposed project, existing Encina Power Station units that will continue to operate, and other projects, if any, in the process of obtaining Authority to Construct permits or reasonably known by the San Diego Air Pollution Control District (SDAPCD) to be entering the permitting process. Section 5.9.6 discusses mitigation measures as may be needed to reduce potentially significant impacts below a level of significance. Section 5.9.7 discusses the agencies involved in public health aspects of permitting and CEQA analysis for the proposed project, along with agency contact information. Section 5.9.8 describes public health-related permits for the CECP, and the schedule of obtaining those permits. Finally, Section 5.9.9 contains references cited or consulted in preparing this section.

5.9.1 Introduction

Air will be the dominant pathway for potential public exposure to non-criteria pollutants released by the CECP. Emissions to the air will consist primarily of combustion by-products produced by the combined-cycle gas turbine units. Potential health risks from combustion emissions will occur almost entirely by direct inhalation. To be conservative, additional pathways for dermal absorption, soil ingestion, and mother's milk ingestion were included in the health risk modeling. The health risk assessment methodology was conducted in accordance with guidance established by the California Office of Environmental Health

[1] Also called non-criteria pollutants.

Hazard Assessment (OEHHA)[2], the California Air Resources Board (CARB)[3], and the SDAPCD[4].

The CECP will use combined-cycle technology to minimize emissions of pollutants per unit electric energy generated, and use an optimized stack height to reduce ground-level concentrations of the emissions, thus reducing potential effects on public health. It is beyond the scope of this analysis to describe the public health benefits that derive from the generated electric power that is provided to homes, businesses, hospitals and other societal institutions.

Combustion byproducts with established national and California ambient air quality standards (referred to as "criteria pollutants") are addressed in Section 5.1, Air Quality. Discussion of the potential health risks associated with these criteria pollutants is presented in this section. Human health risks potentially associated with accidental releases of stored hazardous materials at the CECP (aqueous ammonia) are discussed in Section 5.5, Hazardous Materials Handling.

5.9.2 Laws, Ordinances, Regulations and Standards

An overview of the regulatory process for public health issues is presented in this section. The relevant LORS that affect public health and are applicable to the CECP are identified in Table 5.9-1. The compliance of the project with each of the LORS applicable to public health is also presented in this table.

TABLE 5.9-1
Laws, Ordinances, Regulations, and Standards Applicable to Public Health

LORS	Requirements/ Applicability	Administering Agency	AFC Section Explaining Conformance
Clean Air Act	Protect public health by limiting emissions and resulting exposure to air pollutants	U.S. Environmental Protection Agency (USEPA) Region 9 CARB SDAPCD	Based on acceptable risks shown in Section 5.9.4, computed in a health risk assessment that follows CARB/OEHHA and SDAPCD guidelines, the project emission rates of non-criteria pollutants are acceptable. Emissions of criteria pollutants will be minimized by using efficient combined-cycle turbine technology and natural gas as the only fuel, and applying BACT to the facility, resulting in project ambient levels that would not exceed primary ambient air quality standards established to protect public health.

[2] OEHHA. Air Toxics Hot Spots Program Risk Assessment Guidelines, The Air Toxics Hot Spots Program Guidance Manual for Preparation of Health Risk Assessments, April 2005.

[3] CARB. Consolidated Table of OEHHA/ARB-Approved Risk Assessment Health Values, April 25, 2005, http://www.arb.ca.gov/toxics/healthval/healthval.htm.

[4] SDAPCD. Supplemental Guidelines for Submission of Air Toxics "Hot Spots" Program Health Risk Assessments (HRAs), March 2005.

TABLE 5.9-1
Laws, Ordinances, Regulations, and Standards Applicable to Public Health

LORS	Requirements/ Applicability	Administering Agency	AFC Section Explaining Conformance
Health and Safety Code 25249.5 et seq. (Safe Drinking Water and Toxic Enforcement Act of 1986—Proposition 65)	Inform public at a facility of potential exposure to chemicals known to cause cancer or reproductive toxicity	OEHHA	Based on a health risk assessment that follows CARB/OEHHA and SDAPCD guidelines, non-criteria pollutant emission rates and resulting doses and carcinogenic risks (see Section 5.9.4) will not exceed thresholds that require Proposition 65 exposure warnings.
40 CFR Part 68 (Risk Management Plan)	Public exposure to acutely hazardous materials	USEPA Region 9 San Diego County Department of Environmental Health	As discussed in Section 5.5, Hazardous Materials Handling, an offsite consequence analysis has been performed to assess potential risks from a spill or rupture of the aqueous ammonia storage tank. A Risk Management Plan (RMP) will be prepared prior to commencement of facility operations.
Health and Safety Code, Article 2, Chapter 6.95, Sections 25531 to 25541; CCR Title 19 (Public Safety), Division 2 (Office of Emergency Services), Chapter 4.5 (California Accidental Release Prevention Program)	Public exposure to regulated substances	San Diego County Department of Environmental Health	As discussed in Section 5.5, Hazardous Materials Handling, an offsite consequence analysis has been performed to assess potential risks from a spill or rupture of the aqueous ammonia storage tank. A RMP will be prepared prior to commencement of facility operations.
Health and Safety Code Sections 44360 to 44366 (Air Toxics "Hot Spots" Information and Assessment Act—AB 2588)	Limit public exposure to toxic air contaminants based on a priority rating system.	SDAPCD CARB	Non-criteria pollutant concentrations will not exceed acceptable levels, based on the emission inventory for the existing Encina Power Station and proposed for the CECP, and previous SDAPCD annual health risk assessment ratings[5] per CARB/OEHHA guidelines.
SDAPCD Regulation XII – Toxic Air Contaminants, Rule 1200 - Toxic Air Contaminants New Source Review	Limit public exposure to toxic air contaminants based on specified cancer and non-cancer risk thresholds	SDAPCD	The project health risk assessment in Section 5.9.4 confirms that project design features and application of T-BACT will assure that potential health risks are less than Rule 1200 thresholds.

[5] SDAPCD. California Air Toxics "Hot Spots" Information and Assessment Act (AB2588), 2005 Air Toxics "Hot Spots" Program Report for San Diego County, December 2006, http://www.sdapcd.org/toxics/hotspots/Toxics05Rpt.pdf.

5.9.3 Affected Environment

Because health risks from operation of the CECP will be below public health significance criteria thresholds, no residential, workplace or sensitive receptors will be impacted. Sensitive receptors are locations where groups of individuals—including infants, children, the elderly and chronically ill—that may be more susceptible than the general population to health risks from air pollution may be found. Schools, day-care facilities, convalescent homes and hospitals are of particular concern. In accordance with guidance from the CEC,[6] a search was conducted for sensitive receptors within 3 miles of the CECP site. Daycare, hospital, park, preschool, and school receptors found within 3 miles are listed in Appendix 5.9A, Tables 5.9A-1 through 5.9A-4, with their Universal Transverse Mercator coordinates, and shown in Appendix 5.9A, Figures 5.9A-1 through 5.9A-4. The combined set of all sensitive receptors is shown on Figure 5.9-2, and in more detail on the scale of 1:24,000 in Appendix 5.9A, Figure 5.9A-5a and -5b. The figure shows no public health impacts because indices of cancer risk and non-cancer chronic and acute health hazards are less than significant at and beyond the project boundary (see Section 5.9.4).

The nearest residence to the CECP site is approximately 0.44 mile to the northeast, but residences are almost as close to the northwest (0.49 mile) and to the southwest (0.51 mile) of the project site (see Figure 5.9-1).

Beneficial aspects of the CECP regarding protection of public health include the following:

- Use of clean-burning natural gas fuel.
- Low-sulfur content of the natural gas, which reduces sulfate fine particulate generation.
- Advanced combined-cycle combustion gas turbine technology to minimize the amount of fuel and associated combustion emissions needed to produce electricity.
- Selective Catalytic Reduction (SCR) technology to control nitrogen oxide (NO_x) emissions.
- Oxidation catalyst technology to control carbon monoxide (CO) emissions, and to reduce emissions of various TACs.
- Optimized stack height to reduce ground-level concentrations of exhaust pollutants below public health-related significance thresholds.

Air quality and health risk data presented by CARB in the 2007 Almanac of Emissions and Air Quality for the San Diego Air Basin show that over the period 1990 through 2005, the average concentrations for the top ten TACs have been substantially reduced, and the associated health risks for the San Diego Air Basin are showing a steady downward trend as well. CARB-estimated emissions inventory values for the top ten TACs for 2006 and ambient levels and associated potential risks for 2005 are presented in Table 5.9-2 for the air basin.

[6] Personal communication from Michael Ringer, CEC staff to Eric Walther, January 29, 1999.

TABLE 5.9-2
Top Ten TACs Emitted by All Sources in the San Diego Air Basin

TAC	2006 Emissions (tons/year)	2005 Levels and Risks	
		Concentration (ppbv)	Potential Carcinogenic Risk (in 1 million)
Acetaldehyde	589	1.0	5
Benzene	869	0.40	37
1,3-Butadiene	241	0.07	27
Carbon tetrachloride	0.09	0.09 (2003)	25 (2003)
Chromium, hexavalent	0.23	0.04 ng/m^3	6
Para-Dichlorobenzene	122	0.15	10
Formaldehyde	1,426	2.4	18
Methylene chloride	367	0.14	<1
Perchloroethylene	422	0.04	2
Diesel PM	2,083	1.4 μg/m^3 (2000)	420 (2000)

Source: ARB. The California Almanac of Emissions and Air Quality, 2007 Edition, http://www.arb.ca.gov/aqd/almanac/almanac07/almanac2007all.pdf

μg/m^3 = micrograms per cubic meter
ng/m^3 = nanograms per cubic meter
ppbv = parts per billion by volume

Concerning the current incidence of cancer and respiratory illnesses and diseases in the vicinity[7] of the project, the County of San Diego Health and Human Services Agency offers the following information. The number of annual asthma hospitalizations in the north coastal portion of San Diego County, which includes the project area, has remained within the narrow range of 236-280 during the period of 2000 through 2003, the most recent period for which data are available[8]. This area of the County accounts for approximately 10 percentof the total county asthma hospitalizations. The contribution of the Carlsbad area to this North Coastal range was 28-50. Lung cancer deaths during this same period have also remained within a narrow range, from 168 to 190 per 100,000 population,[9] which is a slightly lower incidence rate than in the entire County. The contribution of the Carlsbad area to this North Coastal range was 27-39.

5.9.4 Environmental Analysis

This section is organized to discuss the sources and different kinds of air emissions associated with construction and operation of the CECP (see Section 5.1, Air Quality), the methodology used in health risk assessment, and the results of the assessment of potential health risks from the project. Other potential public health risks associated with the project are discussed in different sections of the AFC as follows:

[7] Defined in the CEC Data Adequacy Worksheet for public health as a distance of six miles.

[8] County of San Diego Health and Human Services Agency. Asthma Hospitalizations among San Diego County Residents, 2000-2003, http://www2.sdcounty.ca.gov/hhsa/documents/AsthmaRates00_03.pdf.

[9] County of San Diego Health and Human Services Agency. County of San Diego Community Profiles by Region and Subregional Area, North Coastal Region, p. 42 of 86, , http://www2.sdcounty.ca.gov/hhsa/documents/CHS-CommunityProfile_Region1_7_07.pdf.

- Potential exposure to wastes generated by the project is discussed in Section 5.14, Waste Management.
- Potential exposure to the hypothetical accidental release of aqueous ammonia onsite or during offsite transport is discussed in Section 5.5, Hazardous Materials Handling.
- Potential safety and health impacts relative to the work environment of project employees are discussed in Section 5.16, Worker Health and Safety.
- Potential exposure to transmission line electric and magnetic fields is discussed in Section 3.3, Transmission System Safety and Nuisance.

Project emissions to the air will consist of combustion by-products from the natural gas-fired turbines, and from routine testing and maintenance of the Diesel emergency firepump engine. After dispersion to ground-level, inhalation is the main pathway by which air pollutants can potentially cause public health impacts. Other pathways, including ingestion of soil and mother's milk, and dermal absorption, also are evaluated for potential exposure. As discussed below, these health risks are not significant.

To evaluate potential health risks, the measures of these risks are first described in terms of the types of public health effects and the significance criteria and thresholds for those effects.

5.9.4.1 Significance Criteria

Significance criteria exist for both carcinogenic and non-carcinogenic risks, and are discussed separately.

5.9.4.1.1 Cancer Risk

Cancer risk is the probability or chance of contracting cancer over a human life span (assumed to be 70 years). Carcinogens are assumed to have no 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). Under state and SDAPCD regulations, an incremental cancer risk greater than 10-in-one million due to a project is considered to be a significant impact on public health if the emitting units are determined by the District to be using Toxics Best Available Control Technology (T-BACT).[10] The 10-in-one-million risk level is also used by the Air Toxics "Hot Spots" (AB 2588) program and California's Proposition 65 as the public notification level for air toxic emissions from existing sources.

5.9.4.1.2 Non-Cancer Risk

Non-cancer health effects can be either long-term (chronic) or short-term (acute). In determining potential non-cancer health risks from air toxics, it is assumed there is a dose of the TAC below which there would be no impact on human health. The air concentration corresponding to this dose is called the Reference Exposure Level (REL). A non-cancer health risk is measured in terms of a health hazard quotient, which is the calculated maximum exposure (concentration) of each TAC divided by its REL. Health hazard quotients for TACs affecting the same target organ are typically summed with the resulting

[10] The threshold would be 1-in-one-million if the emitting units were determined not to be applying T-BACT.

totals expressed as health hazard indices for each organ system. A health hazard index of less than 1.0 is considered to be a less-than-significant health risk.

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

Acute toxicity is defined as adverse health effects caused by a brief chemical exposure of no more than 24 hours. For most chemicals, the air concentration required to produce acute effects is higher than the level required to produce chronic effects because the duration of exposure is shorter. Because acute toxicity is predominantly manifested in the upper respiratory system at threshold exposures, all acute health hazard quotients are typically summed to calculate the acute health hazard index. The maximum one-hour average concentration of each TAC with acute health effects is divided by the TAC's acute REL to obtain a health hazard index for health effects caused by relatively high, short-term exposure to air toxics. An additional conservative procedure in this health risk assessment is that the health hazard quotients for all TACs having potential acute impacts were summed regardless of target organ. This method leads to an upper bound assessment. RELs used in the hazard index calculations were those published in the CARB/OEHHA listings dated April 25, 2005.

5.9.4.2 Construction Impacts

Construction of the CECP is expected to take approximately 19 to 25 months depending on the construction schedule option implemented for the project (see Section 2.2.15 for a discussion of the Single Phase Construction and the Phased Construction schedules). No significant public health effects are expected during either of the construction schedule options. Strict construction practices that incorporate safety and compliance with applicable LORS will be followed. In addition, mitigation measures to reduce air emissions from construction impacts will be implemented as described in Section 5.1.

Temporary air emissions from construction are presented in detail in Appendix 5.1E, followed by a criteria pollutant air dispersion analysis that demonstrates ambient air quality standards will not be exceeded by construction of the project. The dominant emission with potential health risk is Diesel particulate matter (DPM) from combustion of Diesel fuel in construction equipment (e.g., cranes, dozers, excavators, graders, front-end loaders, backhoes). DPM emissions from construction are summarized in Table 5.9-3.

TABLE 5.9-3
Maximum Construction DPM Emissions

Emitting Activity	lbs/day	Tons per year
Construction Equipment	7.85	0.564

The detailed HRA calculations in Appendix 5.9B demonstrate that the potential cancer risk of DPM emissions during project construction will be less than the significance threshold of 10 in one million (see Appendix Table 5.9B-11), based on adjusting the 70-year lifetime risk for the 25-month duration of construction. If the 70-year lifetime risk is adjusted for a period of 9 years, following OEHHA (2003) guidance, the resulting maximum cancer risk would be 39 in one million. The area of potential impact between 10 and 39 in one million extends less than 300 meters out from the project east property line, which is occupied by the Interstate 5 right-of-way and uninhabited area on the south bank of Agua Hedionda Lagoon (see Figure 5.9-1).

Ambient air modeling for PM_{10}, CO, SO_2 and NO_X was performed as described in Section 5.1.5.3 and Appendix 5.1D. Construction-related emissions are temporary and localized, resulting in no long-term significant impacts to the public.

Small quantities of hazardous waste may be generated during the life of the project. Hazardous waste management plans will be in place so the potential for public exposure is minimal. Refer to Section 5.14, Waste Management, for more information. No acutely hazardous materials will be used or stored on-site during construction (see Section 5.5, Hazardous Materials Handling). To assure worker safety during construction, safe work practices will be followed (see Section 5.16, Worker Health and Safety).

5.9.4.3 Operations Impacts

Potential human health impacts associated with the CECP stem from exposure to air emissions from operation of the natural gas-fired combined-cycle units, and routine testing of the emergency firepump engine. The non-criteria pollutants emitted from the project include certain volatile organic compounds and polycyclic aromatic hydrocarbons (PAHs) from the combustion of natural gas, ammonia from the SCR NO_x control systems, and DPM from combustion of Diesel fuel in the emergency firepump engine. These pollutants are listed in Table 5.9-4, and the detailed emission summaries and calculations are presented in Appendix 5.9B.

Emissions of criteria pollutants will not cause violations of the national or California ambient air quality standards as discussed in Section 5.1, Air Quality. The project will include Best Available Control Technology (BACT) as required under SDAPCD rules.

Air dispersion modeling results (see Section 5.1.5) show that emissions will not result in ambient concentrations of criteria pollutants that exceed ambient air quality standards, with the exception of the state PM_{10} and $PM_{2.5}$ standards. For these pollutants, existing 24-hour average PM_{10} background concentrations and PM_{10} and $PM_{2.5}$ annual background concentrations already exceed state standards, while the project would not add a significant contribution. These standards are intended to protect the general public with a wide margin of safety. Therefore, the project will not have a significant impact on public health from emissions of criteria pollutants.

The health risk assessment presented in this section was implemented using the latest version (1.3) of the HARP model.

TABLE 5.9-4
Pollutants Emitted to the Air from the CECP

Criteria Pollutants	**Non-criteria Pollutants (Continued)**
Carbon monoxide	Formaldehyde
Oxides of nitrogen	Hexane
Particulate matter	Naphthalene
Oxides of sulfur	Propylene
Volatile organic compounds	Propylene oxide
	Toluene
Non-criteria (Toxic) Pollutants	Xylene
Ammonia	Hexane
Acetaldehyde	PAHs
Acrolein	Benzo(α)anthracene
1,3-Butadiene	Benzo(α)pyrene
Benzene	Benzo(β)fluoranthene
Dichlorobenzene	Benzo(k)fluoranthene
Diesel Exhaust Particulate Matter	Chrysene
Ethylbenzene	Dibenz(a,h)anthracene
	Indeno(1,2,3-cd)pyrene

5.9.4.4 Public Health Impact Study Methods

Emissions of non-criteria pollutants from the project were estimated using emission factors approved by the SDAPCD, CARB, and USEPA. Air dispersion modeling combined the emissions with site-specific terrain and meteorological conditions to estimate short-term and long-term arithmetic mean concentrations in air for use in the health risk assessment. The USEPA-recommended air dispersion model, AERMOD, was used along with three years 2003-2005) of compatible meteorological data assembled and provided by the Meteorology Group at the SDAPCD. The meteorological data combined surface measurements made at Camp Pendleton with upper air data from the Marine Corps Air Station Miramar. The health risk assessment has been prepared using the CARB's Hotspots Analysis and Reporting Program (HARP) computer program (Version 1.3), and associated guidance.[11] Because HARP is built on a previous EPA-approved air dispersion model, Industrial Source Complex Short Term, Version 3 (ISCST3), a special method was used to integrate the air dispersion modeling output from the required air dispersion model, AERMOD, with the risk calculations in the HARP risk module. The following paragraphs describe the procedures used to prepare this risk assessment.

[11] OEHHA. Air Toxics Hot Spots Program Guidance Manual for Preparation of Health Risk Assessments, August 2003; and SDAPCD. Supplemental Guidelines for Submission of Air Toxics "Hot Spots" Program Health Risk Assessments (HRAs), March 2005.

5.9.4.4.1 Modeling Inputs

The risk assessment module of the HARP model was run using unit ground level impacts to obtain derived cancer risks for each TAC.[12] Cancer risks were obtained for the Derived (OEHHA) Method, the Derived (Adjusted) Method, Average Point Estimate and High-End Point Estimate options. Only the Derived (Adjusted) Method is used to determine compliance with SDAPCD Rule 1200. The HARP model output was cancer risk by pollutant and route for each type of analysis, based on an exposure of 1.0 $\mu g/m^3$. Individual cancer risks are expressed in units of risk per $\mu g/m^3$ of exposure. To calculate the weighted risk for each source, the annual average emission rate in g/s for each pollutant was multiplied by the individual cancer risk for that pollutant in $(\mu g/m^3)^{-1}$. The resulting weighted cancer risks for each pollutant were then summed for the source (see Appendix 5.9B Table 5.9B-5). An identical approach was used to determine the acute and chronic health impacts associated with the project (see Appendix 5.9B Tables 5.9B-6 and 5.9B-7).

5.9.4.4.2 Risk Analysis Method

The screening analysis for the criteria pollutant modeling analysis was performed using the AERMOD model, the 2003 through 2005 Camp Pendleton meteorological data, specific receptor grids, and the stack parameters for operating cases at four different ambient temperatures. The results of the screening modeling analysis (see Section 5.1, Air Quality) were used to determine the maximum impact operating conditions in modeling the annual and 1-hour averaging periods, used in determining cancer risk and chronic HHI, and acute HHI, respectively. The total weighted risk "rate" for each source was used in place of emission rates in the modeling analysis. The weighted risk "rates" used for the HRA modeling are summarized in Appendix Table 5.9B-9. The value calculated by the model was the total risk at each receptor.

The contribution of each toxic compound to total cancer risk and total HHI for each analysis method was then determined using the individual contribution of each compound to the total weighted risk "rate" (see Appendix Tables 5.9B-5 through 5.9B-8). Health risks potentially associated with the estimated concentrations of pollutants in air were characterized in terms of potential lifetime cancer risk (for carcinogenic substances), or comparison with RELs for non-cancer health effects (for non-carcinogenic substances).

Health risks were evaluated for a hypothetical maximum exposed individual (MEI) located at the Point of Maximum Impact (PMI). Human health risks associated with emissions from the project are unlikely to be higher at any other location than at the PMI. If there is no significant impact associated with concentrations in air at the PMI location, it is assumed to be unlikely that there would be significant impacts in any other location. The Maximally Exposed Individual Resident (MEIR) is an individual assumed to be located at the MEIR point (i.e., a residential receptor) where the highest concentrations of air pollutants associated with facility emissions are predicted to occur, based on air dispersion modeling.

[12] Procedure is described in Part B of Topic 8 of the HARP How-To Guides: How to Perform Health Analyses Using a Ground Level Concentration.

Health risks potentially associated with concentrations of carcinogenic pollutants in air were calculated as estimated excess lifetime cancer risks. The inhalation excess cancer risk associated with the project is calculated by the software from the ground-level concentration and inhalation cancer potency slope as follows:

$$ECR_{ij} = CONC_{ij} * ICPF_i * BR$$

where: ECR_{ij} = excess cancer risk from carcinogen i at location j

$CONC_{ij}$ = ground-level concentration (in $\mu g/m^3$) of carcinogen i at location j

$ICPF_i$ = inhalation cancer potency factor for carcinogen i (in kg-day/mg)

BR = breathing rate (in L/kg-day)

The total carcinogenic risk at location j is found by summing the contributions from each carcinogen i. The resulting ECR_j can be plotted over all calculated locations.

Evaluation of potential non-cancer health effects from exposure to short-term and long-term concentrations in air was performed by comparing modeled concentrations in air with the RELs. An REL is a concentration in air at or below which no adverse health effects are anticipated. RELs are based on the most sensitive adverse effects reported in the medical and toxicological literature. Potential non-cancer effects were evaluated by calculating a ratio of the modeled concentration in air and the REL. This ratio is referred to as a hazard quotient. The inhalation cancer potency factors and RELs used to characterize health risks associated with modeled concentrations in air are imbedded in the risk module of HARP and in the *Consolidated Table of OEHHA/ARB Approved Risk Assessment Health Values* (CARB, 4/05), and are presented in Table 5.9-5.

TABLE 5.9-5
Toxicity Values Used to Characterize Health Risks

Toxic Air Contaminant	Inhalation Cancer Potency Factor $(mg/kg\text{-}d)^{-1}$	Chronic Reference Exposure Level ($\mu g/m^3$)	Acute Reference Exposure Level ($\mu g/m^3$)
Acetaldehyde	0.010	9.00	—
Acrolein	—	0.06	0.19
Ammonia	—	200	3,200
Benzene	0.10	60	1,300
1,3-Butadiene	0.60	20	—
Diesel PM	1.1	5.0	—
Ethylbenzene	—	2,000	—
Formaldehyde	0.021	3.0	94
Hexane	—	7,000	—
Naphthalene	0.12	9.0	—
PAHs (as BaP for HRA)	3.9	—	—
Propylene	—	3,000	—
Propylene oxide	0.013	30	3.100
Toluene	—	300	37,000
Xylene	—	700	22,000

Source: CARB/OEHHA, April 25, 2005.

5.9.4.5 Characterization of Risks from Toxic Air Pollutants

The estimated potential maximum cancer risk associated with concentrations in air estimated for the MIR location is shown in Table 5.9-6. The maximum carcinogenic risk is well below the 10 x 10^{-6} threshold of significance for emitting units determined by the District to be applying T-BACT.

TABLE 5.9-6
Summary of Potential Health Risks

Receptor	Carcinogenic Risk [a] (per million)	Cancer Burden	Acute Health Hazard Index	Chronic Health Hazard Index
Maximum Incremental Cancer Risk (MICR) at PMI	0.16	0	0.10	0.005
MEIR	0.075		0.057	0.0021
Maximally Exposed Individual Worker [b] (MEIW)	0.080		0.030	Not applicable
Significance Level	10	1.0	1.0	1.0

Notes:

[a] Derived (Adjusted) Method used by San Diego Air Pollution Control District to determine compliance with Regulation 1200.

[b] The worker is assumed to be exposed at the work location 8 hours per day, instead of 24, 245 days per year, instead of 365, and for 40 years, instead of 70. Hence, a 70 year-based chronic HHI is not applicable to a worker.

Cancer risks potentially associated with the project also were 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 project. Cancer burden is calculated as the maximum product of any potential carcinogenic risk greater than 1 in one million and the number of individuals at that risk level. Because the MICR is less than 1 in one million, the potential cancer burden is zero. If the potential MICR had substantially exceeded 1 in one million, then the worst-case estimate of cancer burden would have been calculated based on the assumptions described below.

The MICR concentration would have been applied to all affected portions of identified census tracts within the radius area defined by the distance to the 1st high (MIR) concentration. A detailed listing and map of affected census tracts and year 2000 population estimates would then have been provided. Figures would then have been presented to show the 1-, 2-, and 3-mile radius plots in relationship to the census tract locations and site. This procedure, if it had been needed, would result in a conservatively high estimate of cancer burden. However, as described above, beacuse the calculated MICR for the project is less than 1 in one million, this procedure is not required.

By definition, human health risks associated with emissions from the project cannot be higher elsewhere than at the location of the MICR. Therefore, the potential cancer risk elsewhere also would be lower than the maximum listed in Table 5.9-6. Because the potential cancer burden listed in Table 5.9-6 is less than one, the emissions from the project would not be associated with any increase in cancer cases in the previously defined population. In addition, the cancer burden is less than the Rule 1200 threshold value of 1.0.

The methods that would have been used in this calculation considerably overstate the potential cancer burden, further supporting the conclusion that project emissions would not cause a significant public health impact in terms of cancer risk.

The maximum potential acute non-cancer health hazard index associated with concentrations in air is shown in Table 5.9-6. The acute non-cancer health hazard index for all target organs falls below 1.0, the threshold of significance.

Similarly, the maximum potential chronic non-cancer health hazard index associated with concentrations in air is shown in Table 5.9-6. The chronic non-cancer health hazard index falls below 1.0, the threshold of significance.

The estimates of cancer and non-cancer risks associated with chronic or acute exposures fall below thresholds used for regulating emissions of toxic air contaminants to the air. Historically, exposure to any level of a carcinogen has been considered to have a finite risk of inducing cancer. In other words, there is no threshold for carcinogenicity. Because risks at low levels of exposure cannot be quantified directly by either animal or epidemiological studies, mathematical models have estimated such risks by extrapolation from high to low doses. This modeling procedure is designed to provide a highly conservative estimate of cancer risks based on the most sensitive species of laboratory animal for extrapolation to humans (i.e., the assumption being that humans are as sensitive as the most sensitive animal species). Therefore, the true risk is not likely to be higher than risks estimated using inhalation cancer potency factors and is most likely lower, and could even be zero (USEPA, 1986; USEPA, 1996).

The analysis of potential cancer risk described in this section employs methods and assumptions generally applied by regulatory agencies for this purpose. Given the importance of assuring public health, these methods and assumptions are highly conservative. Conservative methodology and assumptions are as follows:

- The analysis includes representative weather data over a period of three years to assure that the least favorable conditions producing the highest ground-level concentration of power plant emissions are included.
- The CECP is assumed to operate at hourly, daily, and annual emission conditions that produce the highest ground-level concentrations.
- The location of the highest ground-level concentration of CECP emissions is identified and the analysis then assumes that a sensitive individual resides at this location constantly over the entire 70-year period.

Taken together, these methods and assumptions create a scenario that cannot exist in the real world. For example, if the worst-case weather conditions occur on a winter evening, but the worst-case emission rates occur on a summer afternoon, the analysis nonetheless assumes that these events occur at the same time. The point of using these unrealistic assumptions is to consciously overstate the potential impacts. No one individual will experience exposures as great as those assumed for this analysis. By determining that even this highly overstated exposure will not be significant, the analysis enables a high degree of confidence that the much lower exposures that actual persons will experience will not result in any significant increase in cancer risk. In short, the analysis assures that there will not be

any significant public health impacts at any location, under any weather condition, under any operating condition.

A separately transmitted compact disk contains the HRA modeling input and output files.

5.9.4.6 Hazardous Materials

Hazardous materials will be used and stored at the CECP site. The hazardous materials stored in significant quantities on-site and descriptions of their uses are presented in Section 5.5. Use of chemicals at the project site will be in accordance with standard practices for storage and management of hazardous materials. Normal use of hazardous materials, therefore, will not pose significant impacts to public health. While mitigation measures will be in place to prevent releases, if an accidental release migrated offsite, potential impacts to the public could result.

The California Accidental Release Program (CalARP) regulations and Code of Federal Regulations (CFR) Title 40 Part 68 under the Clean Air Act establish emergency response planning requirements for acutely hazardous materials. These regulations require preparation of an RMP, which is a comprehensive program to identify hazards and predict the areas that may be affected by a release of a program-listed hazardous material. Materials listed in the RMP and proposed to be used at the facility include aqueous ammonia, as discussed in Section 5.5.

An offsite consequence analysis was performed to assess potential risks to offsite human populations if a spill or rupture of one of the two aqueous ammonia storage tanks were to occur. The results of this analysis, presented in Section 5.5, show that offsite ammonia concentrations do not exceed the CEC's 75 parts per million by volume (ppmv) significance threshold, the Short-Term Public Emergency Limit at the project site boundary; therefore, no significant public health impacts are expected.

5.9.4.7 Operation Odors

A small amount of ammonia used to control NO_x emissions can "slip" past the SCR catalyst and be emitted from the exhaust stack, but this amount is less than that required to produce an odor offsite. The expected exhaust gas ammonia concentration, known as ammonia "slip," will be less than 5 ppmv. After mixing with the atmosphere, the concentration at ground level will be far below the detectable odor threshold of 5 ppmv that the Compressed Gas Association has determined to be acceptable, as well as being below the ACGIH[13] TLV[14] and STEL[15] values of 25 and 35 ppm respectively (adopted 2003). Therefore, potential ammonia emissions would not create a significant odor. Other combustion contaminants are not present at concentrations that could produce a significant odor.

5.9.4.8 Electromagnetic Field Exposure

The CECP will connect to the existing SDG&E switchyards on the Encina Power Station and the project does not include any new offsite transmission lines or upgrades to the existing offsite transmission lines. The project will include additional onsite electric power handling

[13] American Congress of Government Industrial Hygienists

[14] Threshold Limit Value

[15] Short-Term Exposure Level

transformers and associated equipment, and are discussed in more detail in Section 3.3. Based on recent findings of the National Institute of Environmental Health Sciences (NIEHS, 1999), electromagnetic field exposures from the electric power handling equipment would not result in a significant impact on public health. The NIEHS report to the U.S. Congress found that "the probability that EMF exposure is truly a health hazard is currently small. The weak epidemiological associations and lack of any laboratory support for these associations provide only marginal scientific support that exposure to this agent is causing any degree of harm"(NIEH 1999).

5.9.4.9 Summary of Impacts

Results from the health risk assessment based on emissions modeling indicate that there will be no significant incremental public health risks from construction or operation of the CECP. Results from criteria pollutant modeling for routine operations indicate that potential ambient concentrations of NO_2, CO, SO_2, and PM_{10} would not exceed ambient air quality standards, with the exception of the state PM_{10} and $PM_{2.5}$ standards. For these pollutants, existing 24-hour average PM_{10} background concentrations and PM_{10} and $PM_{2.5}$ annual background concentrations already exceed state standards, while the project would not add a significant contribution. The ambient air quality standards protect public health with a margin of safety for the most sensitive subpopulations (Section 5.1).

5.9.5 Cumulative Effects

An analysis of potential cumulative air quality impacts that may result from the CECP and other reasonably foreseeable projects is required by the CEC. The following requirements for other projects to qualify for cumulative air quality impact analysis were submitted to the SDAPCD in a request letter on June 8, 2007:

- have a net emissions increase of 5 tons per year or more of NO_x, PM_{10}, SO_x, or CO;
- be located within a six-mile radius of the CECP project site; and
- be issued a new Authority to Construct permit after January 1, 2006.

The SDAPCD responded with a list, from which no facilities satisfied these requirements. Hence, a cumulative impacts analysis for either criteria pollutants or TACs is not required.

5.9.6 Mitigation Measures

No mitigation measures are needed for the CECP TAC emissions because the potential air quality and public health impacts are less than significant.

5.9.7 Involved Agencies and Agency Contacts

Table 5.9-7 provides contact information for agencies involved with public health.

TABLE 5.9-7
Agency Contacts for Public Health

Issue	Agency	Contact
Public exposure to air pollutants	USEPA Region 9	Gerardo Rios USEPA Region 9 75 Hawthorne Street San Francisco, CA 94105 (916) 972-3974
	CARB	Mike Tollstrup Project Assessment Branch California Air Resources Board 1001 I Street Sacramento, CA 95812 (916) 323-8473
	San Diego Air Pollution Control District	Tom Weeks Chief, Engineering Division 10124 Old Grove Road San Diego, CA 92131 (858) 586-2715
Public exposure to chemicals known to cause cancer or reproductive toxicity	Cal-EPA, Office of Environmental Health and Hazard Assessment (OEHHA)	Cynthia Oshita or Susan Long Office of Environmental Health Hazard Assessment 1001 I Street, Sacramento, CA 95814 (916) 445-6900
Public exposure to accidental releases of hazardous materials	USEPA Region 9	Deborah Jordan USEPA Region 9 75 Hawthorne Street San Francisco, CA 94105 (916) 947-4157
	California Office of Emergency Services	Moustafa Abou-Taleb Governor's Office of Emergency Services 3650 Schriever Avenue Mather, CA 95655 (916) 845-8741
	San Diego County Department of Environmental Health	Matt Trainor County of San Diego Department of Environmental Health Administrative Offices 1255 Imperial Avenue, 3rd Floor San Diego, CA 92101 (619) 338-2372

5.9.8 Permits Required and Permit Schedule

Agency-required permits related to public health are listed in Table 5.9-8, and include a Risk Management Plan for hazardous materials, and the SDAPCD Determination of Compliance (DOC). Upon approval of the CECP by the CEC, the DOC serves as the SDAPCD Authority

to Construct. A Permit to Operate will be issued by the SDAPCD after construction and commencement of operation. These requirements are discussed in detail in Sections 5.1 (Air Quality) and 5.5 (Hazardous Materials Handling).

TABLE 5.9-8
Permits and Permit Schedule for Public Health

Permit	Agency Contact	Schedule
Determination of Compliance / Authority to Construct/ Permit to Operate	San Diego Air Pollution Control District Tom Weeks Chief, Engineering Division 10124 Old Grove Road San Diego, CA 92131 (858) 586-2715	District must issue a Preliminary DOC within 180 days after issuing the Application Completeness Determination Letter.
Risk Management Plan (CalARP)	San Diego County Department of Environmental Health Matt Trainor Administrative Offices 1255 Imperial Avenue, 3rd Floor San Diego, CA 92101 (619) 338-2372	RMP application must be approved before arrival of hazardous materials on site.

5.9.9 References

California Air Resources Board (CARB). 2005. Consolidated table of OEHHA/ARB approved risk assessment health values. (http://arbis.arb.ca.gov/toxics/healthval/contable.pdf). August 25.

California Air Resources Board (CARB). HARP Model, Version 1.3, http://www.arb.ca.gov/toxics/harp/harp.htm.

National Institute of Environmental Health Sciences (NIEHS). 1999. Environmental Health Institute report concludes evidence is 'weak' that EMFs cause cancer. Press release. National Institute of Environmental Health Sciences, National Institutes of Health.

Office of Environmental Health Hazard Assessment (OEHHA). 2003. Air Toxics Hot Spots Program Risk Assessment Guidelines, The Air Toxics Hot Spots Program Guidance Manual for Preparation of Health Risk Assessments, California Environmental Protection Agency. August.

San Diego Air Pollution Control District (SDAPCD). 2005. Supplemental Guidelines for Submission of Air Toxics "Hot Spots" Program Health Risk Assessments (HRAs). March.

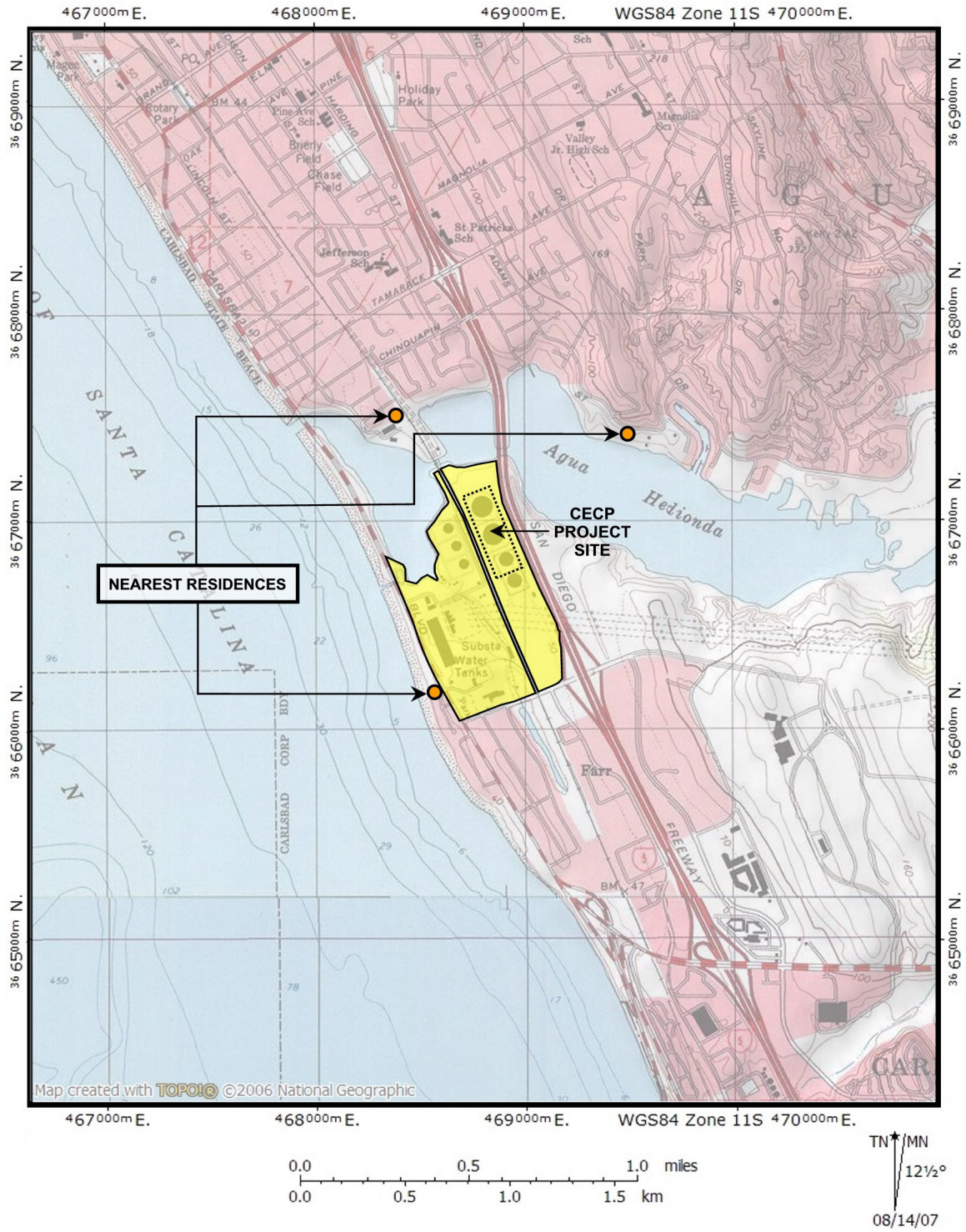

FIGURE 5.9-1
NEAREST RESIDENTIAL RECEPTORS
CARLSBAD ENERGY CENTER PROJECT
CARLSBAD, CALIFORNIA

CH2MHILL

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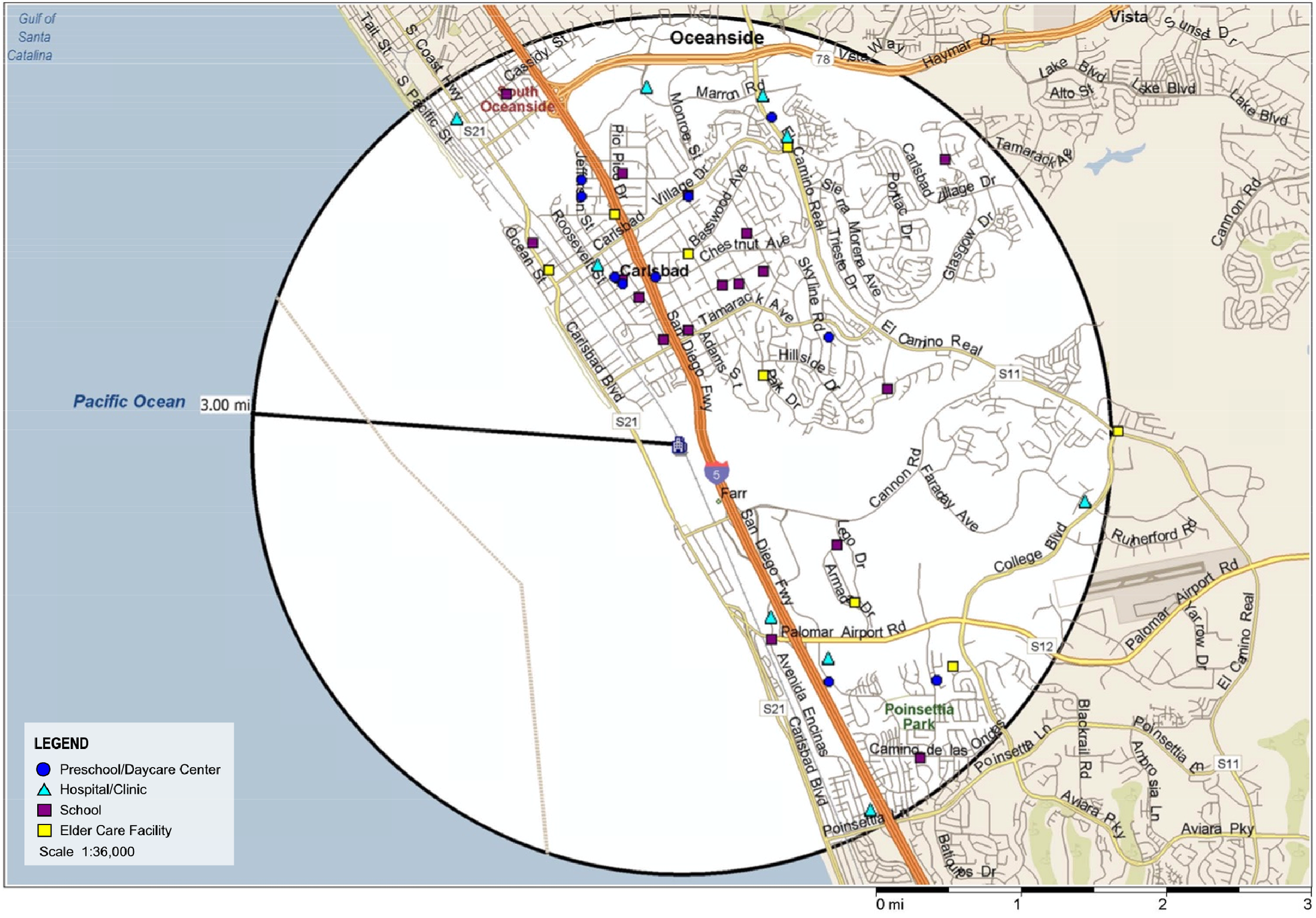

FIGURE 5.9-2
LOCATION OF SENSITIVE RECEPTORS
CARLSBAD ENERGY CENTER PROJECT
CARLSBAD, CALIFORNIA

CH2MHILL

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