8.9 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 routine operation of the proposed Russell City Energy Center (RCEC) and AWT plant.

Air will be the dominant pathway for public exposure to chemical substances released by the project. Emissions to the air will consist primarily of combustion by-products produced in the natural gas-fired turbines. Potential health risks from combustion emissions will occur almost entirely by direct inhalation. To be conservative, additional pathways were included in the health risk modeling; however, direct inhalation is considered the most likely exposure pathway. The risk assessment was conducted in accordance with guidance established by the California Air Pollution Control Officers' Association (CAPCOA, 1993).

Combustion byproducts with established CAAQS or NAAQS, including oxides of nitrogen (NO_x), carbon monoxide and fine particulate matter are addressed in the Ambient Air Quality section (see Section 8.1.3). However, some discussion of the potential health risks associated with these substances is presented in this section. Human health risks potentially associated with accidental releases of stored acutely hazardous materials at the proposed facility (aqueous ammonia) are also discussed in this section.

8.9.1 Affected Environment

The proposed RCEC will be located in the City of Hayward, Alameda County. Surrounding land uses are described in Section 8.6, Land Use. The nearest residences are located approximately 0.82 mile from the site. The amount of housing within a one-mile radius of the project is very small, and is confined to the Mt. Eden residential area east of Industrial Boulevard.

Terrain within a 10-mile radius of equal or greater elevation than the stack exhaust exit point (i.e., stack height plus grade elevation) is shown in Figure 8.9-1 (in pocket at back of section).

Sensitive receptors are defined as groups of individuals that may be more susceptible to health risks due to chemical exposure. Schools (public and private), day care facilities, convalescent homes, and hospitals are of particular concern. The nearest sensitive receptors within 6 miles of the RCEC site are listed in Table 8.9-1 below and shown in Figure 8.9-2 (in pocket).

Air quality and health risk data presented by CARB in the 2001 Almanac of Emissions and Air Quality for the San Francisco Bay Area Air Basin shows that over the period 1990 through 1999, the average concentrations and associated health risks for the top ten toxic air contaminants (TACs) has been substantially reduced, and the concentrations and associated health risks for the air basin are typically lower than the statewide averages. CARB estimated emissions inventory values for the top ten TACs for 2000 and ambient concentration and associated risk values for 1990-1999 are presented in Table 8.9-2 for Alameda County.

8.9.2 Environmental Consequences

8.9.2.1 Significance Criteria

Cancer Risk

Cancer risk is the probability or chance of contracting cancer over a human life span (assumed to be 70 years). Carcinogens are not assumed to have a threshold below which there would be no human health

impact. In other words, any exposure to a carcinogen is assumed to have some probability of causing cancer; the lower the exposure, the lower the cancer risk (i.e., a linear, no-threshold model). Under various state and local regulations, an incremental cancer risk of 10-in-one million due to a project is considered to be a significant impact on public health. For example, the 10-in-one-million risk level is 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.

Non-Cancer Risk

Non-cancer health effects can be either chronic or acute. In determining potential non-cancer health risks (chronic and acute) from air toxics, it is assumed there is a dose of the chemical of concern below which there would be no impact on human health. The air concentration corresponding to this dose is called the Reference Exposure Level (REL). Non-cancer health risks are measured in terms of a hazard quotient, which is the calculated exposure of each contaminant divided by its REL. Hazard quotients for pollutants affecting the same target organ are typically summed with the resulting totals expressed as hazard indices for each organ system. A hazard index of less than 1.0 is considered to be an insignificant health risk. For this health risk assessment, all hazard quotients were summed regardless of target organ. This method leads to a conservative (upper bound) assessment. RELs used in the hazard index calculations were those published in the CAPCOA AB 2588 Risk Assessment Guidelines (CAPCOA, 1993).

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 levels 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 hazard quotients are typically summed to calculate the acute hazard index. One-hour average concentrations are divided by acute RELs to obtain a hazard index for health effects caused by relatively high, short-term exposure to air toxics.

8.9.2.2 Construction Phase Impacts

The construction phase of the RCEC and AWT is expected to take approximately 18 to 21 months. No significant public health effects are expected during the construction phase. Strict construction practices that incorporate safety and compliance with applicable laws, ordinances, regulations, and standards (LORS) will be followed (see Section 8.9.5). In addition, mitigation measures to reduce air emissions from construction impacts will be implemented as described in Section 8.1.

Table 8.9-1. Sensitive receptors within six miles of the RCEC.

Name	Address	City
Elementary & Junior High Schools		
All Saints School	22870 2nd Street	Hayward
Alvarado Elementary School	31100 Fredi St	Union City
American Heritage Christian	425 Gresel St	Hayward
Ardenwood Elementary School	33955 Emilia Ln	Fremont
Barnard White Middle School	725 Wipple Rd	Union City
Bowman Elementary School	520 Jefferson St	Hayward
Brenkwitz School	22100 Princeton St	Hayward
Burbank Elementary School	353 B St	Hayward
Castro Valley Elementary	20185 San Miguel Ave	Castro Valley
Cesar Chavez Middle School	2801 Hop Ranch Rd.	Union City
Chabot Elementary School	19104 Lake Chabot Rd	Castro Valley
Cherryland Elementary School	585 Willow Ave	Hayward
Colonial Acres Elementary School	17115 Meekland Ave	Hayward
Corvallis School	14790 Corvallis St	San Leandro
Dayton Elementary School	1500 Dayton Ave	San Lorenzo
East Ave Elementary School	2424 East Ave	Hayward
Eden Gardens Elementary School	2184 Thayer Ave	Hayward
Eldridge Elementary School	26825 Eldridge Ave	Hayward
Fairview Elementary School	23515 Maud Ave	Hayward
Garfield Elementary School	13050 Aurora Dr	San Leandro
Glassbrook Elementary School	975 Schafer Rd	Hayward
Harder Elementary School	495 Wyeth rd	Hayward
Helen Turner Childrens Center	23640 Reed Way	Hayward
Highland Elementary School	2021 Highland Blvd	Hayward
Hillside School	15980 Marcella St	San Leandro
Hillview Crest School	31410 Wheelon Ave	Hayward
James Madison	14751 Juniper Street	San Leandro
Jefferson Elementary School	14311 Lark St	San Leandro
John Muir	24823 Soto Rd	Hayward
Lea's Christian School	26236 Adrian Ave	Hayward
Lewelling School	562 Lewelling Blvd	San Leandro
Longwood Elementary School	850 Longwood Ave	Hayward
Lorenzo Manor School	18250 Bengal Ave	Hayward
Markham Elementary School	1570 Ward St	Hayward

Name	Address	City
Day Care Centers		
A Kids Kingdom	18550 Redwood Rd	Castro Valley
A Special Place	27305 Hintwood Ave	Hayward
ABC Academy	670 Sunset Blvd	Hayward
ABC pre-School & Day Care	20135 San Miguel Ave	Castro Valley
Adventure Montessori Academy	4101 Pleiades Pl	Union City
Adventure Time Lorenzo Manor	18250 Bengal Ave	Hayward
Avenue Pre-School	1521 159th Ave	San Leandro
Beth Sholom Pre-Shool	642 Dolores Ave	San Leandro
Broadmoor Parent Nursery	951 Dowling Blvd	San Leandro
Burbank Pre School	15661 Washington Ave	San Lorenzo
Calvary Lutheran School	17200 Via Magdalena	San Lorenzo
Camelot School	2330 Pomar Vista Ave	Castro Valley
Camelot Schools	21753 Vallejo St	Hayward
Castro Valley Parent Nursery	3657 Christensen Ln	Castro Valley
Cherubim's Children Center	30540 Mission Blvd	Hayward
Child Family & Community	20900 Corsair Blvd	Hayward
Children's Choice	185 W Harder Rd	Hayward
Circle Time Nursery	26555 Gading Rd	Hayward
Cornerstone Pentesostal Church	24150 Hesperian Blvd	Hayward
Creative Beginnings Preschool	20121 Sanata Maria Ave	Castro Valley
Creative Beginnings Preschool	268 Bay Fair Mall	San Leandro
Darwin Head Start	2560 Darwin St	Hayward
Debbie's Daycare	2664 Hawthorne Ave	Hayward
Early Head Start Program	680 W Tennyson Rd	Hayward
Eden Area Head Start	951 Palisade St	Hayward
Eldridge Elementary	96825 Eldridge Ave	Hayward
Elmhurst Daycare & Preschool	380 Elmhurst St	Hayward
Fairview Hills Pre-School	2841 Romagnolo St	Hayward
Free To Be School	188 Appian Way	Union City
Growing Years Day Camp	20166 Wisteria St	Castro Valley
Growing Years Preschool	20320 Anita Ave	Castro Valley
Happiness Hill Pre-School	20600 John Dr	Castro Valley
Hayward Parent Co-Op Nursery	2652 Vergil Ct	Castro Valley
Head Start Program	25926 Carlos Bee Blvd	Hayward

Table 8.9-1. (continued).

Name	Address	City
Elementary & Junior High Schools		
Marshall School	20111 Marshall St	Castro Valley
Monroe Elementary School	3750 Monterey Blvd	San Lorenzo
Montessori Children's House	166 W Harder Rd	Hayward
Montessori Children's School	1836 B St	Hayward
Moreau Catholic High School	27170 Mission Blvd	Hayward
Ochoa Intermediate School	2121 Depot Rd	Hayward
Palma Ceia School	27679 Melborne Ave	Hayward
Park Elementary School	411 Larchmont St	Hayward
Pioneer Elementary School	32737 Bel Aire St	Union City
Refugio M Cabello Elementary	4500 Cabello St.	Union City
Ruus School	28027 Dickens Ave	Hayward
Saint Bede's Ccd	26910 Patrick Ave	Hayward
Saint Clement's School	790 Calhoun St	Hayward
Saint Felicitas School	1650 Manor Blvd	San Leandro
Saint Joachim's Ccd	21250 Hesperian Blvd	Hayward
San Leandro Childrens	14311 Lark St	San Leandro
Schafer Park Elementary	26268 Flamingo Ave	Hayward
Shepard Elementary	27211 Tyrell Ave	Hayward
Southgate Elementary School	26601 Calaroga Ave	Hayward
Strobridge Elementary School	21400 Bedford Dr	Castro Valley
Treeview Elementary	30565 Treeview St	Hayward
Tyrell Elementary	27000 Tyrell Ave	Hayward
Washington Manor School	1170 Fargo Ave	San Leandro
Convalescent & Nursing Homes		
Bay Point Healthcare Center	442 Sunset Blvd	Hayward
Bethesda Christian Retirement	22427 Montgomery St	Hayward
Courtyard Care Center	1625 Denton Ave	Hayward
Diana's Care Home	27402 Manon Ave	Hayward
Driftwood Healthcare Center	19700 Hesperian Blvd	Hayward
Eden Villa	19960 Santa Maria Ave	Castro Valley
Eden-West Rehab & Convalescent	1805 West St	Hayward
Emerald Care Home	2729 Dowe Ave	Union City
Evergreen Residential Care	239 Blossom Way	Hayward
Fern Lodge Inc	18457 Madison Ave	Castro Valley

Name	Address	City
Day Care Centers		
Head Start Program	975 Schafer Rd	Hayward
His Growing From Infant Care	2490 Grove Way	Castro Valley
Kids Klub Children's Center	2500 Oliver Dr	Hayward
Learning Game	31600 Alvarado Blvd	Union City
Lea's Christian School	26236 Adrian Ave	Hayward
Lighthouse Kiddie Kingdom	16053 Ashland Ave	San Lorenzo
Lil Angels Day Care Center	28924 Ruus Rd	Hayward
Little Lambs Preschool	14871 Bancroft Ave	San Leandro
Lollipop Lane Preschool	341 Paseo Grande	San Lorenzo
Montessori Children's House	26236 Adrian Ave	Hayward
Montessori Children's House	166 W Harder Rd	Hayward
Montessori Children's School	1836 B St	Hayward
Montessori School	1101 Walpert St	Hayward
Montessori School	19234 Lake Chabot rd	Castro Valley
Montessori School	147945 Washington Ave	San Leandro
Montessori School	16492 Foothill Blvd	San Leandro
Our Future Tots Learning Center	963 Manor Blvd	San Leandro
Redwood Forest Pre-School	19200 Redwood Rd	Castro Valley
Right World Nursery School	20613 Stanton Ave	Castro Valley
Rise'n Shine Preschool	20104 Center St	Castro Valley
Saint Therese Day Care	1507 Rieger Ave	Hayward
San Lorenzo Community Church	945 Paseo Grande	San Lorenzo
San Lorenzo Parent Nursery	820 Bockman Rd	San Lorenzo
Semore School	4312 Dyer St	Union City
Sir Love	27653 Pompano Ave	Hayward
Stivers Academy	461 Bartlett Ave	Hayward
Sunset Parent Nursery School	22100 Princeton St	Hayward
Supporting Future	22584 S Garden Ave	Hayward
Tennyson Parent Nursery School	27552 E 11th St	Hayward
Tri Cities Children's Centers	625 Berry Ave	Hayward
Tri Cities Children's Centers	541 Blanche St	Hayward
Tri Cities Children's Centers	23640 Reed Way	Hayward
Woodroe Woods School	22502 Woodroe Ave	Hayward
YMCA	951 Palisade St	Hayward
Yours & Mine	2894 D St	Hayward

Table 8.9-1. Sensitive receptors within six miles of the RCEC.

Name	Address	City
Convalescent & Nursing Homes		
Galicia's Tulip Care Home	1771 Tulip Ave	Hayward
Gerrylaide Manor	261 Medford Ave	Hayward
Hayward Convalescent Hospital	1832 B St	Hayward
Hayward Hills Health Care Center	1768 B St	Hayward
Jones Rest Home	524 Callan Ave	San Leandro
Majestic Pines Care Center	1628 B St	Hayward
Morton Bakar Center	494 Blossom Way	Hayward
Oakcreek Alzheimers and Dementia	6127 E Castro Valley Blvd	Castro Valley
Quail Ridge Health Care Center	1440 168th Ave	San Leandro
Redwood Convalescent Hospital	22103 Redwood Rd	Castro Valley
Rose Gate	1345 Clarke St	San Leandro
Saint Anthony Care Center	553 Smalley Ave	Hayward
Saint Christopher Convalescent	22822 Myrtle St	Hayward
Saint Francis Extended Care	718 Bartlett Ave	Hayward
Saint Therese Convalescent Hospital	21863 Valleio St	Hayward
San Leandro Healthcare Center	368 Juana Ave	San Leandro
Santo Domingo Residential Care	3327 San Marco Ct	Union City
Seaton Rehabilation Hospital	1652 Mono Ave	San Leandro
St Anthony Care Center	553 Smalley Ave	Hayward
St Anthony Residential Care	4491 Ariel Ave	Fremont
St Christopher Convalescent	22822 Myrtle St	Hayward
St Francis Extended Care	718 Bartlett Ave	Hayward
St Gregory Care Center Center	22424 Charlene Way	Castro Valley
St John Kronstadt Convalescent	4432 James Ave	Castro Valley
St Therese Convalescent Hospital	21863 Vallejo St	Hayward
Sunbridge Care & Rehab Center	26660 Patrick Ave	Hayward
Sunbridge Care & Rehab Center	14766 Washington Ave	San Leandro
Valley Pointe Rehab & Nursing	20090 Stanton Ave	Castro Valley
Villa Fairmont Mental Health	15200 Foothill Blvd	San Leandro
Vintage Estates of Hayward	25919 Gading Rd	Hayward
Whispering Pines Rest Haven	565 Schafer Rd	Hayward
Wisteria Care Center	20524 Wisteria St	Castro Valley

Name	Address	City
Hospitals		
Alameda County Medical Center	15400 Foothill Blvd.	San Leandro
Alzheimer's Services	561 A St	Hayward
Courtyard Care Center	1625 Denton Ave	Hayward
Evergreen Senior Center	985 Sueirro St	Hayward
Laurel Grove hospital	19933 Lake Chabot	Castro Valley
San Leandro Healthcare Center	368 Juana Ave.	San Leandro
San Leandro Hospital	13855 E. 14th St.	San Leandro
San Leandro Surgery Center	15035 E 14th St	San Leandro
Seaton Rehabilitation Hospital	15705 Liberty St.	San Leandro
Senior Friends	13847 E 14th St.	San Leandro
St. Luke's Sub Acute Cure	1652 Mono Ave.	San Leandro

Table 8.9-2. Top ten Bay Area TACs.

TAC	Year 2000 tons/yr	1990-1999 Data Averages	
		Concentration	Risk per Million
Acetaldehyde	363	1.00 ppb	4.9
Benzene	890	1.18 ppb	109.2
1,3 Butadiene	141	0.24 ppb	91.3
Carbon tetrachloride	<.01	0.11 ppb	28.8
Chromium 6	0.019	0.17 ng/m3	25.2
Para-Dichlorobenzene	66	0.11 ppb	7.2
Formaldehyde	798	1.80 ppb	13.4
Methylene Chloride	366	0.62 ppb	2.29
Perchloroethylene	371	0.13 ppb	5.29
Diesel PM	947	ND	ND

Temporary emissions from construction-related activities are discussed in Section 8.1. Ambient air modeling for PM_{10}, CO, SO_2 and NO_X was performed as described in Section 8.1. Construction-related emissions are temporary and localized, resulting in no long-term impacts to the public.

Small quantities of hazardous waste may be generated during the construction phase of the project. Hazardous waste management plans will be in place so the potential for public exposure is minimal. Refer to Section 8.14 (Waste Management) for more information. No acutely hazardous materials will be used or stored on-site during construction (see section 8.5, Hazardous Materials Handling). To ensure worker safety during construction, safe work practices will be followed (see Section 8.16, Worker Safety).

8.9.2.3 Operational Phase Impacts

Environmental consequences potentially associated with the project are potential human exposure to chemical substances emitted into the air. The human health risks potentially associated with these chemical substances were evaluated in a health risk assessment. The chemical substances potentially emitted to the air from the proposed facility include ammonia, volatile organic compounds (VOCs) and polycyclic aromatic hydrocarbons (PAHs) from the combustion turbines, and metals from the cooling tower. These chemical substances are listed in Table 8.9-3.

Emissions of criteria pollutants will adhere to NAAQS or CAAQS as discussed in the Ambient Air Quality section (see Section 8.1.4). The proposed facility also will include emission control technologies necessary to meet the required emission standards specified for criteria pollutants under Bay Area Air Quality Management District (BAAQMD) rules. Offsets will be required for emissions of criteria pollutants that exceed specified thresholds, to assure that the project will not result in an increase in total emissions in the vicinity. Finally, air dispersion modeling results (presented in the Ambient Air Quality section, Section 8.1.5.1.2) show that emissions will not result in concentrations of criteria pollutants in air that exceed ambient air quality standards (either NAAQS or CAAQS). These standards are intended to protect the general public with a wide margin of safety. Therefore, the project is not anticipated to have a significant impact on public health from emissions of criteria pollutants.

Potential impacts associated with emissions of toxic pollutants to the air from the proposed facility were addressed in a health risk assessment, presented in Appendix 8.1D. The risk assessment was prepared using guidelines developed under the AB 2588 Air Toxics "Hot Spots" Information and Assessment Act (CAPCOA, 1993).

Table 8.9-3. Chemical substances potentially emitted to the air from RCEC.

Criteria Pollutants
Carbon monoxide
Oxides of nitrogen
Particulate matter
Oxides of sulfur
Volatile organic compounds
Noncriteria Pollutants (Toxic Pollutants)
Ammonia
Acetaldehyde
Acrolein
1,3-Butadiene
Benzene
Ethylbenzene
Formaldehyde
Hexane
Propylene
Propylene oxide
Toluene
Xylene
Polycyclic aromatic hydrocarbons (PAHs)
Benzo(a)anthracene
Benzo(a)pyrene
Benzo(b)fluoranthene
Benzo(k)fluoranthene
Chrysene
Dibenz(a,h)anthracene
Indeno(1,2,3-cd)pyrene
Naphthalene
Arsenic
Cadmium
Chromium
Copper
Lead
Mercury
Nickel
Silver
Zinc

8.9.2.4 Public Health Impact Study Methods

Emissions of toxic pollutants potentially associated with the facility were estimated using emission factors approved by BAAQMD, CARB, and the U.S. Environmental Protection Agency (USEPA). Concentrations of these pollutants in air potentially associated with the emissions were estimated using dispersion modeling. Modeling allows the estimation of both short-term and long-term average concentrations in air for use in a risk assessment, accounting for site-specific terrain and meteorological conditions. Health risks potentially associated with the estimated concentrations of

pollutants in air were characterized in terms of excess lifetime cancer risks (for carcinogenic substances), or comparison with reference exposure levels for noncancer health effects (for noncarcinogenic substances).

Health risks were evaluated for a hypothetical maximum exposed individual (MEI) located at the MIR (maximum impact receptor). The hypothetical MEI is an individual assumed to be located at the point (MIR) where the highest concentrations of air pollutants associated with facility emissions are predicted to occur, based on air dispersion modeling. Human health risks associated with emissions from the proposed facility are unlikely to be higher at any other location than at the location of the MIR. If there is no significant impact associated with concentrations in air at the MIR location, it is unlikely that there would be significant impacts in any location in the vicinity of the facility.

Health risks potentially associated with concentrations of carcinogenic pollutants in air were calculated as estimated excess lifetime cancer risks. The excess lifetime cancer risk for a pollutant is estimated as the product of the concentration in air and a unit risk value. The unit risk value is defined as the estimated probability of a person contracting cancer as a result of constant exposure to an ambient concentration of 1 $\mu g/m^3$ over a 70-year lifetime. In other words, it represents the increased cancer risk associated with continuous exposure to a concentration in air over a 70-year lifetime. Evaluation of potential noncancer 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 noncancer 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 unit risk values and RELs used to characterize health risks associated with modeled concentrations in air were obtained from the *Consolidated Table of OEHHA/ARB Approved Risk Assessment Health Values* (CARB, 9/2000), and are presented in Table 8.9-4.

8.9.2.5 Characterization of Risks from Toxic Air Pollutants

The excess lifetime cancer risk associated with concentrations in air estimated for the MIR location is estimated to be 0.174×10^{-6}. Excess lifetime cancer risks less than 1×10^{-6} are unlikely to represent significant public health impacts that require additional controls of facility emissions. Risks higher than 1×10^{-6} may or may not be of concern, depending upon several factors. These include the conservatism of assumptions used in risk estimation, size of the potentially exposed population and toxicity of the risk-driving chemicals. Risks associated with pollutants potentially emitted from the facility are presented by exposure pathway in Table 8.9-5. Further description of the methodology used to calculate health risks associated with emissions to the air is presented in Appendix 8.1D. As described previously, human health risks associated with emissions from the proposed facility are unlikely to be higher at any other location than at the location of the MIR. If there is no significant impact associated with concentrations in air at the MIR location, it is unlikely that there would be significant impacts in any other location in the vicinity of the facility.

Cancer risks potentially associated with facility emissions 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 facility. Cancer burden is calculated as the product of excess lifetime cancer risk and the number of individuals at that risk level. A worst-case estimate of cancer burden was calculated based upon the following assumptions.

The MIR concentration was applied to all affected portions of identified census tracts within the 6 mile radius area of the site. A detailed listing and map of affected census tracts and adjusted 1999 population estimates are provided in Appendix 8.1D. Figure 8.10-1 also shows the census tract locations. This procedure results in a conservatively high estimate of cancer burden.

As described previously, human health risks associated with emissions from the proposed facility are unlikely to be higher at any other location than at the location of the MIR. Therefore, the risks for all of these individuals would be lower (and in most cases, substantially lower) than 0.174×10^{-6}. The estimated cancer burden was 0.043, indicating that emissions from the facility would not be associated with any increase in cancer cases in the previously defined population. As stated previously, the methods used in this calculation considerably overstate the potential cancer burden, further suggesting that facility emissions are unlikely to represent a significant public health impact in terms of cancer risk.

Table 8.9-4. Toxicity values used to characterize health risks.

Compound	Unit Risk Factor $(\mu g/m^3)^{-1}$	Chronic Reference Exposure Level $(\mu g/m^3)$	Acute Reference Exposure Level $(\mu g/m^3)$
Acetaldehyde	2.7E-06	9.00E+00	--
Acrolein	--	2.00E-02	1.90E-01
Ammonia	--	2.00E+02	3.2E+03
Arsenic	3.3E-03	5.10E-01	1.9E-01
Benzene	2.9E-05	6.0E+01	1.3E+03
1,3-Butadiene	1.7E-04	--	--
Cadmium	4.2E-03	3.50E+00	--
Chromium	1.5E-01	2.00E-03	--
Copper	--	2.40E+00	1.0E+02
Ethylbenzene	--	2.0E+03	--
Formaldehyde	6.0E-06	3.0E+00	9.4E+01
Hexane	--	--	--
Lead	1.2E-05	--	--
Mercury(inorganic)	--	9.0E-02	1.8E+00
Naphthalene	--	9.0E+00	--
Nickel	2.6E-04	5.0E-02	6.0E+00
Polycyclic aromatic hydrocarbons	5.6E-03	--	--
Propylene	--	3.0E+03	--
Propylene oxide	3.7E-06	3.00E+01	3.1E+03
Silver	--	--	--
Toluene	--	3.00E+02	3.7E+04
Xylene	--	7.00E+02	2.2E+04
Zinc	--	3.50E+01	--

Source: CARB/OEHHA, 9-26-2000

Table 8.9-5 Summary of excess lifetime cancer risks for the Maximum Impact Receptor.

	Increased Lifetime Cancer Risk by Exposure Pathway				
Emission Source	**Inhalation of Ambient Air**	**Soil Ingestion**	**Dermal Contact with Soil**	**Ingestion of Garden Fruits and Vegetables**	**Infant Ingestion of Mother's Milk**
Total Pathway Risk (Combustion Sources[a] and Cooling Tower)	5.74E-08	2.88E-08	1.83E-08	6.99E-08	0.0E-08
Total Risk	0.174 in one million (70 year exposure)				

Note: [a]Combustion sources include turbines and duct burners.

The chronic noncancer hazard quotients associated with concentrations in air estimated for the MIR location were well below one for all target organs. A noncancer hazard quotient less than one is unlikely to represent a significant impact to public health. Chronic noncancer hazard quotients associated with inhalation of pollutants potentially emitted from the facility are presented in Table 8.9-6. The chemicals providing the largest contribution to noncancer risks associated with facility emissions are acrolein and ammonia, from combustion sources. The chronic noncancer hazard indices associated with non-inhalation exposure pathways are well below one for all target organs. Chronic noncancer hazard indices for non-inhalation exposure pathways are presented in Table 8.9-7. A noncancer reference exposure level (REL) is not available for lead. However, lead exposures are well below typical estimates of average daily exposures estimated for lead (ATSDR, 1996).

Table 8.9-6 Summary of chronic noncancer hazard quotients (inhalation exposure pathway) for the Maximum Impact Receptor.

	Target Organ[a]							
Emission Source	**Resp**	**CV/BL**	**CNS**	**Skin**	**Repro**	**Kidn**	**GI/LV**	**Immun**
Combustion Sources[b] and Cooling Tower	0.0107	<0.0001	<0.0001	0.0095	<0.0001	<0.0001	<0.0001	--
Total, All Pathways	<0.0216							

Notes:
[a]Resp = respiratory
[b]Combustion sources include turbines and duct burners
CV/BL = cardiovascular/blood, CNS = central nervous system, Repro = reproductive system, Kidn = renal system, GI/LV = gastrointestinal/liver, Immun = immunological system

Table 8.9-7. Summary of chronic noncancer hazard quotients (non-inhalation exposure pathway) for the Maximum Impact Receptor.

Chemical	Total Dose from Non-Inhalation Exposure Pathways (mg/kg-d)	REL[a] (mg/kg-d)	Hazard Quotient (Total Dose/REL)
	Combustion Sources and Cooling Tower		
Naphthalene	3.35E-08	--	--
PAH	9.75E-09	--	--

Notes:
[a]REL - noncancer Reference Exposure Level

The acute noncancer hazard quotients associated with concentrations in air are shown in Table 8.9-8. The noncancer hazard quotients for all target organs fall below one. The chemicals providing the largest contribution to acute noncancer health risks are ammonia and acrolein. As described previously, a hazard quotient less than one is unlikely to represent significant impact to public health. Further description of the methodology used to calculate health risks associated with emissions to the air is presented in Appendix 8.1C. As described previously, human health risks associated with emissions from the proposed facility are unlikely to be higher at any other location than at the location of the MIR. If there is no significant impact associated with concentrations in air at the MIR location, it is unlikely that there would be significant impacts in any other location in the vicinity of the facility.

Table 8.9-8. Summary of acute noncancer hazard quotients for the Maximum Impact Receptor.

Emission Source	Target Organ[a]							
	Resp	CV/BL	CNS	Eye	Repro	Kidn	GI/LV	Immun
Combustion Sources[b] and Cooling Tower	0.1207	<0.0001	<0.0001	0.1207	<0.0001	--	--	0.0038
Total Acute Hazard Quotient	<0.246							

Notes:
[a]Resp = respiratory
[b]Combustion sources include turbines HRSG ducts burner, Diesel fire pump, and emergency generator
CV/BL = cardiovascular/blood, CNS = central nervous system, Repro = reproductive system, Kidn = renal system
GI/LV = gastrointestinal/liver, Immun = immunological system

The estimates of excess lifetime cancer risks and noncancer risks associated with chronic or acute exposures fall below thresholds used for regulating emissions of toxic pollutants 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. Since risks at low levels of exposure cannot be quantified directly by either animal or epidemiological studies, mathematical models have used to extrapolate 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 man is as sensitive as the most sensitive animal species). Therefore, the true risk is not likely to be higher than risks estimated using unit risk factors and is most likely lower, and could even be zero (USEPA, 1986; USEPA, 1996).

An excess lifetime cancer risk of 1×10^{-6} is typically used as a threshold of significance for potential exposure to carcinogenic substances in air. The excess cancer risk level of 1×10^{-6}, which has historically been judged to be an acceptable risk, originates from efforts by the Food and Drug Administration (FDA) to use quantitative risk assessment for regulating carcinogens in food additives in light of the zero tolerance provision of the Delany Amendment (Hutt, 1985). The associated dose, known as a "virtually safe dose" (VSD) has become a standard used by many policy makers and the lay public for evaluating cancer risks. However, a recent study of regulatory actions pertaining to carcinogens found that an acceptable risk level can often be determined on a case-by-case basis. This analysis of 132 regulatory decisions, found that regulatory action was not taken to control estimated risks below 1×10^{-6} (one-in-one million), which are called *de minimis* risks. *De minimis* risks are historically considered risks of no regulatory concern. Chemical exposures with risks above 4×10^{-3} (four-in-ten thousand), called *de manifestis* risks, were consistently regulated. *De manifestis* risks are typically risks of regulatory concern. The risks falling between these two extremes were regulated in some cases, but not in others (Travis et al, 1987).

The estimated lifetime cancer risks to the maximally exposed individual located at the MIR are less than 1×10^{-6}, and the aggregated cancer burden associated this risk level is less than one excess cancer case. These risk estimates were calculated using assumptions that are highly health conservative. Evaluation of the risks associated with the facility emissions should consider that the conservatism in the assumptions and methods used in risk estimation considerably overstate the risks from facility emissions. Based on the results of this risk assessment, there are no significant public health impacts anticipated from emissions of toxic pollutant to the air from the proposed facility.

8.9.2.6 Hazardous Materials

Hazardous materials will be used and stored at the facility. The hazardous materials stored in significant quantities on-site and descriptions of their uses are presented in Section 8.5. Use of chemicals at the proposed facility 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, accidental releases that migrate offsite could result in potential impacts to the public.

The California Health and Safety Code Sections 25531 to 25541 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 a Risk Management Plan (RMP), which is a comprehensive program to identify hazards and predict the areas that may be affected by a release of an acutely hazardous material (AHM). AHMs to be used at the facility include aqueous ammonia and cyclohexylamine, as discussed in Section 8.5.

An offsite consequence analysis was performed to assess potential risks to humans offsite if a spill or rupture of the aqueous ammonia storage tank were to occur; results of this analysis are presented in Section 8.5.

8.9.2.7 Operation Odors

Small amounts of ammonia used to control oxides of nitrogen (NO_x) emissions may escape up the exhaust stack but would not produce objectionable odors. The expected exhaust gas ammonia

concentration, known as ammonia "slip," will be less than 5 parts per million (ppm). After mixing with the atmosphere, the concentration at ground level will be far below the detectable odor threshold of 5 ppm that the Compressed Gas Association has determined to be acceptable. Therefore, potential ammonia emissions are not expected to create objectionable odors. Other combustion contaminants are not present at concentrations that could produce objectionable odors.

8.9.2.8 Electromagnetic Field Exposure

Because the electric transmission line does not travel through residential areas, and based on recent findings of the National Institute of Environmental Health Sciences (NIEHS 1999), electromagnetic field exposures are not expected to result in a significant impact on public health. The NIEH 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)."

8.9.2.9 Summary of Impacts

Results from an air toxics risk assessment based on emissions modeling indicate that there will be no significant incremental public health risks from construction or operation of the proposed project. Results from criteria pollutant modeling for routine operations indicate that potential ambient concentrations of NO_2, CO, SO_2, and PM_{10} will not significantly impact air quality (Section 8.1). Potential concentrations are below the federal and California standards established to protect public health, including the more sensitive members of the population.

8.9.3 Cumulative Impacts

The health risk assessment for the proposed project indicates that the maximum cancer risk will be approximately 0.174 in one million (verses a significance threshold of 1.0 in one million) at the point of maximum exposure to air toxics from power plant emissions. This risk level is considered to be insignificant. Non-cancer chronic and acute effects will also be less than significant.

8.9.4 Mitigation Measures

8.9.4.1 Criteria Pollutants

Emissions of criteria pollutants will be minimized by applying Best Available Control Technology (BACT) to the facility. BACT for the combustion turbine includes the combustion of natural gas.

The proposed project location is in an area that is designated by the state as nonattainment for ozone and particulate matter (PM). Therefore, all increases in emissions of NO_x, volatile organic compound (VOC), particulate matter with an aerodynamic diameter less than a nominal 10 micrometers (PM_{10}), and sulfur oxides (SO_x) must be fully offset if emissions exceed specified trigger limits. The combination of using BACT and providing emission offsets as needed will result in no net increase in criteria pollutants. Therefore, further mitigation of emissions are not required to protect public health.

8.9.4.2 Toxic Pollutants

Emissions of toxic pollutants to the air will be minimized through the use of natural gas as the only fuel at the proposed facility. Emissions from tanks storing liquid organic chemicals will be minimized through the use of one or a combination of the following:

- Use of small capacity fixed roof tanks
- Use of low vapor pressure organic substances

- Use of exempt compounds
- Use of vapor balance and/or vapor recovery systems on a case-by-case basis as deemed appropriate

8.9.4.3 Hazardous Materials

Mitigation measures for hazardous materials are presented below and discussed in more detail in Section 8.5. Potential public health impacts from the use of hazardous materials are only expected to occur as a result of an accidental release. The plant has many safety features designed to prevent and minimize impacts from the use and accidental release of hazardous materials. The RCEC plant site will include the following design features:

- Curbs, berms, and/or concrete pits will be provided where accidental release of chemicals may occur.
- A fire protection system will be included to detect, alarm, and suppress a fire, in accordance with the applicable laws, ordinances, regulations, and standards (LORS).
- Construction of the aqueous ammonia storage system will be in accordance with applicable LORS.

A Risk Management Plan (RMP) for the RCEC facility will be prepared prior to commencement of facility operations. The RMP will estimate the risk presented by handling ammonia at the facility. The RMP will include a hazard analysis, off-site consequence analysis, seismic assessment, emergency response plan, and training procedures. The RMP process will accurately identify and propose adequate mitigation measures to reduce the risk to the lowest possible level.

A safety program will be implemented and will include safety training programs for contractors and operations personnel, including instructions on: 1) the proper use of personal protective equipment, 2) safety operating procedures, 3) fire safety, and 4) emergency response actions. The safety program will also include programs on safely operating and maintaining systems that use hazardous materials. Emergency procedures for RCEC personnel include power plant evacuation, hazardous material spill cleanup, fire prevention, and emergency response.

Areas subject to potential leaks of hazardous materials will be paved and bermed. Incompatible materials will be stored in separate containment areas. Containment areas will be drained to either an oily waste collection sump or to the wastewater neutralization tank. Also, piping and tanks exposed to potential traffic hazards will be additionally protected by traffic barriers.

8.9.5 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 this project are identified in Table 8.9-9. Table 8.9-10 also summarizes the primary agencies responsible for public health, as well as the general category of the public health concern regulated by each of these agencies. The conformity of the project to each of the LORS applicable to public health is also presented in this table, as well as references to the selection locations within this report where each of these issues is addressed. Points of contact with the primary agencies responsible for public health are identified in Table 8.9-10.

Table 8.9-9. Summary of primary regulatory jurisdiction for public health.

LORS	Public Health Concern	Primary Regulatory Agency	Project Conformance
Clean Air Act	Public exposure to air pollutants	USEPA Region IX CARB BAAQMD	Based on results of risk assessment as per CAPCOA guidelines, toxic contaminants do not exceed acceptable levels. (see Section 8.6.2.2) Emissions of criteria pollutants will be minimized by applying BACT to the facility. Increases in emissions of criteria pollutants will be fully offset. (Section 8.6.3.1)
Health and Safety Code 25249.5 *et seq.* (Safe Drinking Water and Toxic Enforcement Act of 1986—Proposition 65)	Public exposure to chemicals known to cause cancer or reproductive toxicity	Office of Environmental Health and Hazard Assessment (OEHHA)	Based on results of risk assessment as per CAPCOA guidelines, toxic contaminants do not exceed thresholds that require exposure warnings. (see Section 8.6.2.2)
40 CFR Part 68 (Risk Management Plan)	Public exposure to acutely hazardous materials	USEPA Region IX Alameda County Office of Emergency Services (OES) City of Hayward Fire Department	A vulnerability analysis will be performed to assess potential risks from a spill or rupture of the aqueous ammonia storage tank. (See Section 8.6.2.3) An RMP will be prepared prior to commencement of facility operations. (See Section 8.6.3.3)
Health and Safety Code Sections 25531 to 25541	Public exposure to acutely hazardous materials	Alameda County Office of Emergency Services (OES) CARB BAAQMD	A vulnerability analysis will be performed to assess potential risks from a spill or rupture of the aqueous ammonia storage tank. (See Section 8.6.2.3)
Health and Safety Code Sections 44360 to 44366 (Air Toxics "Hot Spots" Information and Assessment Act—AB 2588)	Public exposure to toxic air contaminants	CARB BAAQMD	Based on results of risk assessment as per CAPCOA guidelines, toxic contaminants do not exceed acceptable levels. (see Section 8.6.2.2)

Table 8.9-10. Summary of agency contacts for public health.

LORS	Public Health Concern	Primary Regulatory Agency	Regulatory Contact
Clean Air Act	Public exposure to air pollutants	USEPA Region IX	David Howekamp, (916) 744-1219
		CARB	Ray Menebroker, (916) 322-6026
		BAAQMD	William deBoisblanc, (415) 744-1254
Health and Safety Code 25249.5 *et seq.* (Safe Drinking Water and Toxic Enforcement Act of 1986—Proposition 65)	Public exposure to chemicals known to cause cancer or reproductive toxicity	Office of Environmental Health and Hazard Assessment (OEHHA)	Cynthia Oshita or Susan Long, (916) 445-6900
40 CFR Part 68 (Risk Management Plan)	Public exposure to acutely hazardous materials	USEPA Region IX" Alameda County Office of Emergency Services (OES) City of Hayward Fire Department	David Howekamp, (916) 744-1219 Mark Blanchard, (510) 618-3490 Hugh Murphy, (510) 583-4924

Table 8.9-10. (continued)

LORS	Public Health Concern	Primary Regulatory Agency	Regulatory Contact
Health and Safety Code Sections 25531 to 25541	Public exposure to acutely hazardous materials	Alameda County Office of Emergency Services (OES)	Mark Blanchard, (510) 618-3490
		BAAQMD	William deBoisblanc, (415) 744-1254
Health and Safety Code Sections 44360 to 44366 (Air Toxics "Hot Spots" Information and Assessment Act—AB 2588)	Public exposure to toxic air contaminants	CARB	Ray Menebroker, (916) 322-6026
		BAAQMD	William deBoisblanc, (415) 744-1254

8.9.6 Permits Required and Schedule

Agency-required permits related to public health include a Risk Management Plan and Bay Area Air Quality Management District Authority to Construct/Permit to Operate. These requirements are discussed in detail in Sections 8.5 (Hazardous Materials Handling) and 8.1 (Air Quality), respectively

8.9.7 References

ATSDR. 1996. *Toxicological Profile for Lead. Update.* Agency for Toxic Substances and Disease Registry.

CAPCOA. 1993. *Air Toxics "Hot Spots" Program, Revised 1992 Risk Assessment Guidelines.* California Air Pollution Control Officers Association. October 1993.

California Air Resources Board (CARB). 2000. Consolidated table of OEHHA/ARB approved risk assessment health values. (http://arbis.arb.ca.gov/toxics/healthval/contable.pdf)

Hutt. P.B. 1985. Use of quantitative risk assessment in regulatory decision making under federal health and safety statutes, in *Risk Quantitation and Regulatory Policy.* Eds. D.G. Hoel, R.A. Merrill and F.P. Perera. Banbury Report 19, Cold Springs Harbor Laboratory.

National Institute of Environmental Health Sciences. 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.

Travis, C.C., E.A.C. Crouch, R. Wilson and E.D. Klema. 1987. Cancer risk management: a review of 132 federal regulatory cases. Environ. Sci. Technol. 21:415-420.

U.S. Environmental Protection Agency (USEPA). 1986. Guidelines for carcinogen risk assessment. Federal Register. 51:33992. September 24, 1986.

USEPA. 1996. *Proposed Guidelines for Carcinogen Risk Assessment.* Office of Health and Environmental Assessment. EPA/600/P-92/003C. April 1996.

San Leandro

Castro Valley

San Lorenzo

Hayward

Russell City Energy Center

880

92

Union City

Fremont

Elevation Above Stack Height

30 Meter Contour Interval

Primary road

10 Mile Buffer Zone

Water

1 0 1 2 Miles

1 : 24,000

N

Source: USGS Quad DRGs - GIS Data Depot

Figure 8.9-1

Terrain Above Stack Height
Within Ten Miles

RUSSELL CITY ENERGY CENTER

FOSTER WHEELER ENVIRONMENTAL CORPORATION

Russell City Energy Center

Legend

- Convalescent Centers
- Daycare Centers
- Schools
- Hospitals
- 6 - Mile Radius

1 0 1 2 Miles

1 : 24,000

Sources: Geographic Data Technology, Environmental Systems Research Institute, USGS Quad DRGs - GIS Data Depot

Figure 8.9-2

Sensitive Receptors
Russell City Energy Center

FOSTER WHEELER ENVIRONMENTAL CORPORATION