Appendix B3

Health Risk Assessment

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1.0 Introduction

This appendix describes the methods and results of a health risk assessment (HRA) that evaluates potential public health effects from toxic air contaminant (TAC) emissions that would be generated during continued operation of the China Shipping Container Terminal at Berths 97-109. TACs are compounds that are known or suspected to cause adverse health effects after short-term (acute) or long-term (chronic) exposure. The following two Project scenarios were analyzed:

- **Revised Project:** this Project scenario is the proposed Project for which this supplemental EIR (SEIR) has been prepared. As described in Section 2 of the SEIR, the 2008 EIS/EIR for the China Shipping Container Terminal included a number of mitigation measures, some of which have yet to be fully implemented for various reasons. The Revised Project consists of continued operation of the terminal under the new or modified mitigation measures described in Section 2.5.1 of the SEIR.

- **FEIR Mitigated Project:** this Project scenario represents continued operation of the terminal assuming implementation of the 2008 EIS/EIR mitigation measures. Analysis of the FEIR Mitigated Project is provided for informational purposes to compare to the Revised Project.

Health values associated with the two Project scenarios described above were analyzed relative to the following two baseline scenarios:

- **Unmitigated Baseline:** this baseline scenario represents 2014 actual activity and actual mitigation implementation.

- **Mitigated Baseline:** this baseline scenario represents 2014 actual activity and assumed implementation of all mitigations imposed by the 2008 EIS/EIR.

Details of these Project and baseline scenarios are provided in Chapter 2 of the SEIR and Appendix B1.

The HRA was prepared as a Tier 1 risk assessment in accordance with OEHHA's *Guidance Manual for Preparation of Health Risk Assessments* (OEHHA, 2015) and the SCAQMD's *Supplemental Guidelines for Preparing Risk Assessments for the Air Toxics "Hot Spots" Information and Assessment Act* (SCAQMD, 2015). The HRA includes an evaluation of four different types of health effects: individual incremental cancer risk, population cancer burden, chronic noncancer hazard index, and acute noncancer hazard index.

- Individual incremental cancer risk (referred to hereafter simply as "individual cancer risk") is the additional chance for a person to contract cancer after long-term exposure to Project emissions (30 years for a resident or sensitive receptor, and 25 years for an off-site worker).

- Population cancer burden is the expected number of additional cancer cases in the population exposed to a 70-year individual cancer risk of 1 in a million or greater from the Project.

- The chronic hazard index is a ratio of annual average concentrations of TACs in the air to established reference exposure levels. A chronic hazard index below 1.0 indicates that adverse noncancer health effects from long-term exposure are not expected.
- The acute hazard index is a ratio of maximum 1-hour average concentrations of TACs in the air to established reference exposure levels. An acute hazard index below 1.0 indicates that adverse noncancer health effects from infrequent short-term exposure are not expected.

The OEHHA HRA guidelines also provide a methodology for determining an 8-hour chronic hazard index, which evaluates repeated 8-hour exposures over a significant fraction of a lifetime (OEHHA, 2015). This health value is applicable primarily to off-site workers with work schedules that align with the emitting facility's operational schedule. Because the China Shipping terminal operates 24 hours per day, the average 8-hour concentrations to which off-site workers would be exposed would roughly approximate the annual concentrations used to calculate the chronic hazard index. Moreover, the toxicity factors for the 8-hour chronic hazard index are less stringent and apply to fewer TACs than the toxicity factors for the chronic hazard index. As a result, the 8-hour chronic hazard indices associated with the proposed Project and alternatives would be less than the chronic hazard indices. Therefore, this HRA does not quantify 8-hour chronic hazard indices, and instead uses chronic hazard indices as a conservative health value for off-site workers.

The EPA dispersion model AERMOD, version 16216r (USEPA, 2017), was used to predict maximum ambient pollutant concentrations outside the Project site. The Hotspots Analysis and Reporting Program (HARP2), version 17052 (CARB, 2017), was used to perform the health risk calculations based on output from the AERMOD dispersion model.

The HRA was developed using a five-step process to estimate incremental health impact results: (1) quantify Project and baseline emissions; (2) identify ground-level receptor locations that may be affected by emissions, including a regular receptor grid as well as specific sensitive receptor locations nearby such as schools, hospitals, elder care facilities, child care centers, and recreational areas; (3) perform dispersion modeling analyses to estimate ambient TAC concentrations at each receptor location; (4) characterize the potential health risks at each receptor location; and (5) evaluate incremental health risk values by comparing potential health risks posed by the Project scenarios relative to the baseline scenarios. The following sections provide additional details on the methods used to complete the HRA.

2.0 Emission Estimation Approach

The following operational emission sources were included in the HRA:

- Container ships transiting between the SCAQMD overwater boundary and the terminal (about 40 nautical miles), anchoring while waiting for an available berth, and hoteling while at berth. Ship emission sources include propulsion engines, auxiliary engines, and boilers.
- Tugboats used to assist ships while arriving and departing the Port. Tugboat emission sources include propulsion and auxiliary engines.
- Locomotives performing switching activities at the on-dock rail yard; and line-haul locomotives moving and idling at the on-dock rail yard, and hauling trains to and from the yard. Locomotive emission sources include engine exhaust.
- Cargo handling equipment (CHE) working both on-terminal and handling China Shipping-related containers at the on-dock rail yard. CHE emission sources include engine exhaust.
- Trucks idling at the in-gate, out-gate, and on-terminal; driving on-terminal; and driving off-terminal along the primary truck routes. Truck emission sources include engine exhaust, tire wear, and brake wear.
- Worker vehicles driving both on- and off-terminal. Worker vehicle emission sources include engine exhaust, tire wear, and brake wear.

2.1 Emissions Used for Cancer Risk

To estimate cancer risk impacts for the two Project scenarios, annual volatile organic compound (VOC) and particulate matter less than 10 micron (PM_{10}) emissions associated with terminal operation were estimated for each year of several long-term exposure periods. The cancer risk exposure periods were 30 years for residential and sensitive receptors, 25 years for occupational receptors, and 70 years for population cancer burden. The initial year of each Project exposure period was assumed to be 2015, the first year after the baseline year. For example, the 30-year residential exposure period for the two Project scenarios was assumed to occur during the years 2015-2044.

Annual VOC and PM_{10} emissions were estimated using the methodology and assumptions described in Section 3.1.4.1 of the SEIR and Appendix B1. The Revised Project and FEIR Mitigated Project emissions account for the projected future growth in container throughput, and the future reduction in emission factors for most equipment in response to existing regulations (i.e., phase-in of existing regulatory requirements and normal turnover of vehicles and equipment in which older vehicles and equipment are periodically replaced with newer, lower emitting models) and to the suite of mitigation measures applicable to each scenario. Annual emissions between the analysis years of 2014, 2023, 2030, 2036, and 2045 were calculated via linear interpolation. In the case of the 70-year cancer burden calculation, the extent of this analysis assumes exposure beyond the lease termination date for the terminal in 2045, and therefore is a conservative estimate of the Project impacts. Emissions after 2045, the end of the lease, were held constant at their 2045 values.

To better apprise the public and decision makers of the Project's environmental impacts, the predicted cancer risks for the Project scenarios were compared to the following two variations of the two baseline scenarios: 2014 Unmitigated and Mitigated Baseline and Future Baseline. For both the 2014 Unmitigated and Mitigated Baseline and Future Baseline cancer risk calculations, 2014 activity levels were held constant over all exposure periods. The difference between the 2014 Baseline and Future Baseline is the emission factors. The 2014 Unmitigated Baseline cancer risk calculation holds the 2014 emission factors constant over the 25-, 30-, and 70-year exposure periods considering the actual implementation of mitigation measures that occurred in 2014. The 2014 Mitigated Baseline holds the 2014 emission factors constant over the 25-, 30- and 70-year exposure periods considering the timely implementation of all mitigation measures required in 2014 by the 2008 EIR/EIS. The Future Unmitigated and Mitigated Baseline cancer risk calculation allows the emission factors to change over the 25-, 30-, and 70-year exposure periods in response to the future effects of existing air quality regulations via phase-in of existing regulatory requirements and normal turnover of vehicles and equipment in which older vehicles and equipment are periodically replaced with newer, lower emitting models. Where mitigation measures associated with the Unmitigated or Mitigated Baseline were more stringent than regulations, these mitigations superseded the regulations and vice versa. The initial year of emission factors for each Future Baseline exposure period was assumed to be 2014. For example, the 30-year residential exposure period for the Future Baseline used emission factors associated with the years 2014-2043.

For the assessment of cancer risks, these two variations of the two baseline scenarios result in the following four variations for baseline:

- **Variations of Unmitigated Baseline (only for Cancer Risk)**
    - **Unmitigated Baseline:** this baseline scenario represents 2014 actual activity and actual mitigation implementation. Emission factors are held constant at 2014 values over the 25-, 30-, and 70-year cancer risk exposure periods.
    - **Future Unmitigated Baseline:** this baseline scenario represents 2014 actual activity and actual mitigation implementation. Emission factors vary by year, starting in 2014, over the 25-, 30-, and 70-year cancer risk exposure periods, in response to regulations that affect future year emissions from the various source categories.
- **Variations of Mitigated Baseline (only for Cancer Risk)**
    - **Mitigated Baseline:** this baseline scenario represents 2014 actual activity and assumed implementation of all mitigations imposed by the 2008 EIS/EIR. Emission factors are held constant at 2014 values over the 25-, 30-, and 70-year cancer risk exposure periods.
    - **Future Mitigated Baseline:** this baseline scenario represents 2014 actual activity and assumed implementation of all mitigations imposed by the 2008 EIS/EIR. Emission factors vary by year, starting in 2014, over the 25-, 30-, and 70-year cancer risk exposure periods, in response to regulations that affect future year emissions from the various source categories.

The Future Baseline cancer risks are typically lower than the Baseline cancer risks for both the Unmitigated and Mitigated scenarios, because emission factors for port-related equipment generally decline over time in response to existing air quality regulations and assumptions regarding equipment fleet turnover. This declining trend in future emission factors is accounted for in the Future Baseline but not the Baseline. As a result, the Project cancer risk increments relative to the Future Baseline are generally greater than the increments relative to the Baseline. Increments relative to the Future Baseline were used to determine significance of impacts.

The use of both the Baseline and Future Baseline for cancer risk helps to resolve the complication of evaluating the terminal during a fixed point in time (2014 baseline conditions) for a health impact that is based on decades-long exposure periods. This complication does not exist for the chronic and acute hazard indices because they are based on modeled TAC concentrations of one year and one hour, both of which fit within the 2014 baseline period. Therefore, the Future Baseline was used only for cancer risk.

2.2 Emissions Used for Non-Cancer Hazard Indices

To estimate chronic and acute noncancer hazard indices for the operational scenarios, annual and peak hour operational emissions of VOC and PM_{10} were calculated for analysis years 2023, 2030, 2036, and 2045. The emissions were estimated using the methodology and assumptions described in Section 3.1.4.1 of the SEIR and Appendix B1. Because prior Port projects have shown that the chronic and acute hazard indexes are unlikely to exceed the significance thresholds, a conservative screening approach was used where each AERMOD source was modeled with its maximum emissions from all analysis years even if the emissions would not occur at the same time as other sources.

To estimate chronic and acute noncancer hazard indices for the Unmitigated Baseline and Mitigated Baseline, annual and peak hour emissions of VOC and PM_{10} were calculated using 2014 activity levels and 2014 emission factors. As explained in the previous section, calculation of a Future Baseline was not necessary for the evaluation of chronic and acute hazard indices because the annual and peak hour averaging periods fit within the 2014 baseline period.

Appendix B1 of this SEIR documents the overall emission calculation methodology and assumptions for the Project and baseline scenarios.

2.3 TAC Speciation

Diesel internal combustion (IC) engines represent the biggest source of TAC emissions associated with terminal operation. Diesel IC engine sources include container ship propulsion and auxiliary engines, tugboats, locomotives, diesel CHE, and diesel trucks. For the determination of cancer risk and chronic hazard indices, OEHHA and CARB use diesel particulate matter (DPM) from IC engines as a surrogate for total diesel exhaust (CARB, 2017b). The toxicity factors for DPM that were established by OEHHA and CARB account for the individual toxic species contained in total diesel IC engine exhaust. Therefore, diesel IC engine exhaust was not speciated into its chemical components for the determination of cancer risk and chronic noncancer hazard indices.

Sources other than diesel IC engines include container ship boilers, LNG- and LPG-fueled CHE, LNG trucks, gasoline-fueled worker vehicles, and vehicle tire and brake wear. For these sources, VOC and PM_{10} emissions were speciated into their individual TAC components for the determination of cancer risk and chronic hazard indices. The speciation profiles used in the HRA were developed by CARB (2016). Table B3-1 presents the speciation profiles that were used to convert PM_{10} emissions into individual TACs for all emission sources. Table B3-2 presents the speciation profiles that were used to convert total organic gas (TOG) emissions into individual TACs for all emission sources. Prior to speciation, VOC emissions were converted to TOG using factors provided by CARB (2016).

OEHHA and CARB have not established acute toxicity factors for DPM. Therefore, peak hour VOC and PM_{10} emissions from all sources, including diesel IC engines, were speciated into their individual TAC components for the determination of acute hazard indices.

Table B3-1. Speciation Profiles for PM_{10}

Toxic Air Contaminant	HARP2 TAC ID	Speciation Profile and TAC Weight Fraction							
		Profile 42514: Diesel Vehicles[a]	Profile 123: Gas IC Engines	Profile 119: Marine Vessels Liquid Fuel[a]	Profile 4251: Marine Vessels MGO[a]	Profile 112: Fuel Combustion Distillate	Profile 400: Gasoline Vehicles	Profile 473: Brake Wear	Profile 472: Tire Wear
Arsenic	7440382	0	0	0	0	0.00542	0	0.00001	0
Cadmium	7440439	0	0	0	0	0.0005	0	0	0
Chlorine	7782505	0	0.07	0	0	0	0.07	0.0015	0.0078
Copper	7440508	0.000356	0.0005	0	0	0	0.0005	0.0115	0.00049
Hexavalent Chromium[b]	18540299	0.0000304	0.000025	0	0	0.000271	0.000025	0.00006	0.0000015
Lead	7439921	0	0	0	0	0.0055	0	0.00005	0.00016
Manganese	7439965	0	0.0005	0	0	0	0.0005	0.0017	0.0001
Nickel	7440020	0	0.0005	0	0	0.0005	0.0005	0.00066	0.00005
Selenium	7782492	0	0	0	0	0.0005	0	0.00002	0.00002
Sulfates	9960	0.286	0.45	0.15	0.08	0.25	0.45	0.0334	0.0025
Vanadium	7440622	0	0	0.0055	0	0	0	0.00066	0
Applicable sources:		Diesel trucks, loco-motives, CHE	LNG trucks, LNG/ LPG CHE	Harbor-craft	Ship main and auxiliary engines	Ship boilers	Gasoline auto-mobiles	Brake wear	Tire wear

Notes:
[a] Profiles No. 42514, 119, and 4251 are associated with diesel IC engines and therefore were only used for the determination of the acute hazard index. For the determination of cancer risk and the chronic hazard index, DPM emissions were used without speciation because CARB provides toxicity factors for DPM as a whole (CARB 2017b).
[b] Hexavalent chromium is assumed to be 5 percent of total chromium, according to CARB's AB2588 Technical Support Document (CARB 1989), page 57.
[c] Only TACs that have OEHHA/CARB toxicity factors are shown in the table.
[d] Source for speciation profiles: CARB 2016.

Table B3-2. Speciation Profiles for TOG

Toxic Air Contaminant	HARP2 TAC ID	Speciation Profile and TAC Weight Fraction[a]			
		Profile 818: Diesel IC Engines[b]	Profile 504: Boilers	Profile 2114: Automobiles	Profile 719: Natural Gas IC Engines
Acetaldehyde	75070	0.0735	0	0.0025	0.0003
Acrolein	107028	0	0	0.0012	0
Acrylonitrile	107131	0	0	0	0
Benzene	71432	0.02	0.0216	0.0225	0.0011
1,3-Butadiene	106990	0.0019	0	0.005	0
Chlorobenzene	108907	0	0.0005	0	0
Ethyl benzene	100414	0.0031	0.0007	0.0095	0.0001
Ethyl chloride	75003	0	0	0	0
Ethylene oxide	75218	0	0	0	0
Formaldehyde	50000	0.147	0.001	0.0143	0.0081

Toxic Air Contaminant	HARP2 TAC ID	Speciation Profile and TAC Weight Fraction [a]			
		Profile 818: Diesel IC Engines [b]	Profile 504: Boilers	Profile 2114: Automobiles	Profile 719: Natural Gas IC Engines
Hexane	110543	0.0016	0.0159	0.0145	0.0002
Isopropyl alcohol	67630	0	0	0	0
Methanol	67561	0.0003	0	0.0011	0
Methyl ethyl ketone	78933	0.0148	0	0.0002	0
Naphthalene	91203	0.0009	0.0007	0.0004	0
Phenol	108952	0	0	0	0
Propylene	115071	0.026	0.0456	0.0278	0.0169
Propylene oxide	75569	0	0	0	0
Styrene	100425	0.0006	0	0.0011	0
Toluene	108883	0.0147	0.0215	0.0523	0.0004
Vinyl chloride	75014	0	0	0	0
Xylenes	1330207	0.0105	0.011	0.0436	0.0004
Applicable sources:		Diesel trucks, locomotives, CHE, harbor-craft, ship main and auxiliary engines	Ship boilers	Gasoline automobiles	LNG trucks, LNG/ LPG CHE

Notes:
[a] VOC emissions were converted to TOG by dividing by the following VOC/TOG ratios: 0.8785 for Profile 818; 0.946 for Profile 504; 0.7276 for Profile 2114; and 0.0931 for Profile 719 (CARB 2016).
[b] Profile No. 818 is associated with diesel IC engines and therefore was only used for the determination of the acute hazard index. For the determination of cancer risk and the chronic hazard index, DPM emissions were used without speciation because CARB provides toxicity factors for DPM as a whole (CARB 2017b).
[c] Only TACs that have OEHHA/CARB toxicity factors are shown in the table.
[d] Source for speciation profiles: CARB, 2016.

3.0 Receptors

The HRA modeled TAC concentrations and health effects at 2,641 locations (receptors) throughout the project area, including the locations of potential exposure for residents, offsite workers, and sensitive members of the public. Sensitive receptor groups include children, the elderly, and the acutely and chronically ill. The locations of sensitive receptor groups include schools, child care centers, elder care facilities, and hospitals. For health risk assessment purposes, LAHD also treats recreational areas, such as parks, marinas, and public waterfront areas, as sensitive receptors.

Initial model runs were conducted with a 22 by 22 kilometer (km) coarse grid, with receptors placed 1,000 meters (m) apart, covering the Project vicinity. Embedded within this first grid was a second coarse grid, with receptors placed 500 m apart, covering an area 9 km x 12 km. Also embedded within these first two grids was a third grid, with receptors placed 250 m apart, covering an area 7.5 km x 10.5 km and centered over the

terminal. Receptor points were also placed along the terminal boundary at 50 meter intervals and directly over specific sensitive receptor locations, including schools, child care centers, elder care facilities, hospitals, and recreational areas. Multiple fine grids, with receptors positioned every 50 meters, were placed over the maximum coarse grid receptors to obtain HRA results to the nearest 50 meters.

Figures B3-1 and B3-2 show the full set of receptor points modeled in the HRA. Figure B3-3 shows only the sensitive receptors modeled in the HRA; the figure is paired with Table B3-3, which provides descriptions and addresses of the sensitive receptors.

Figure B3-1. HRA Modeled Receptor Locations (Far Field)

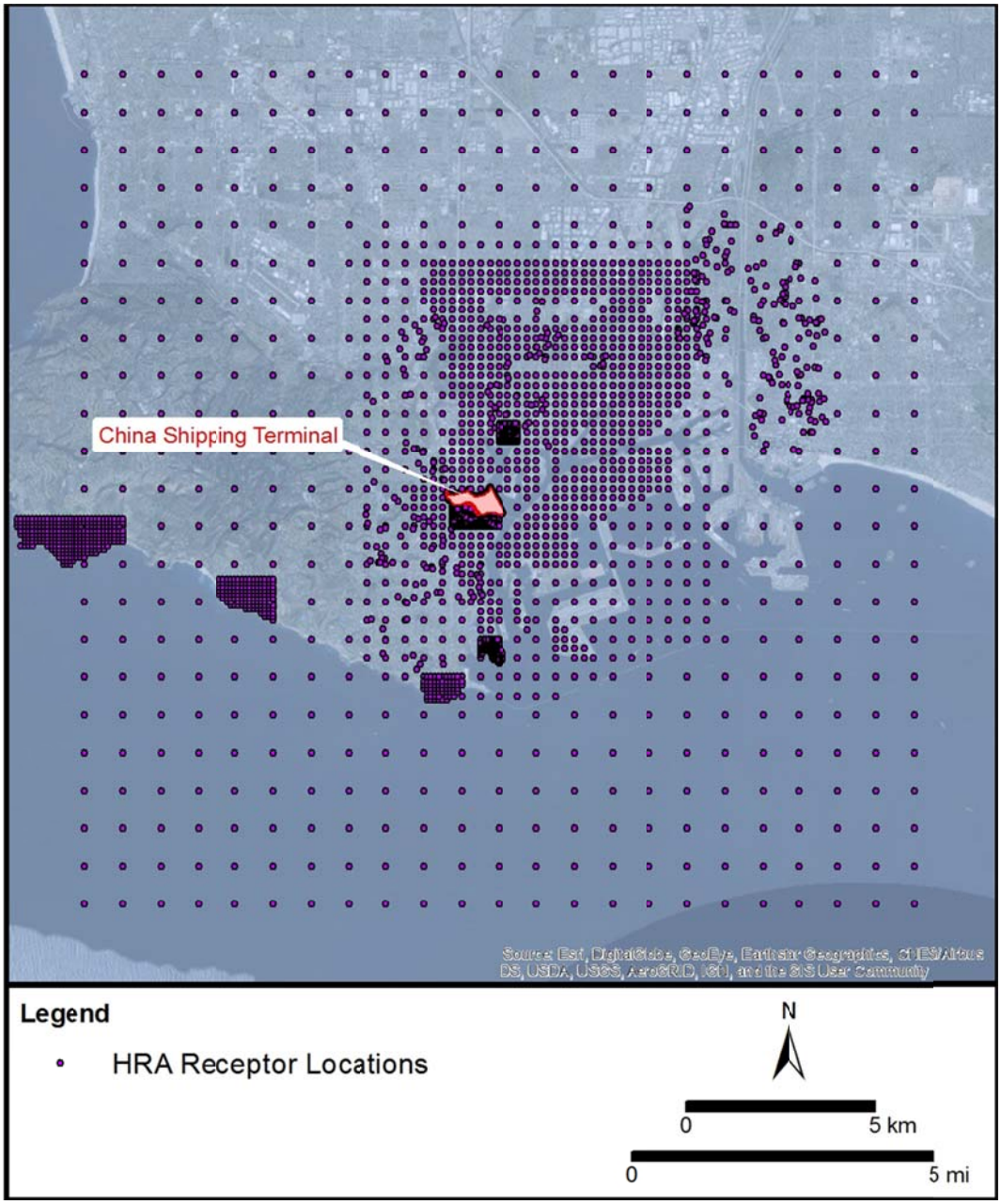


Figure B3-2. HRA Modeled Receptor Locations (Near Field)

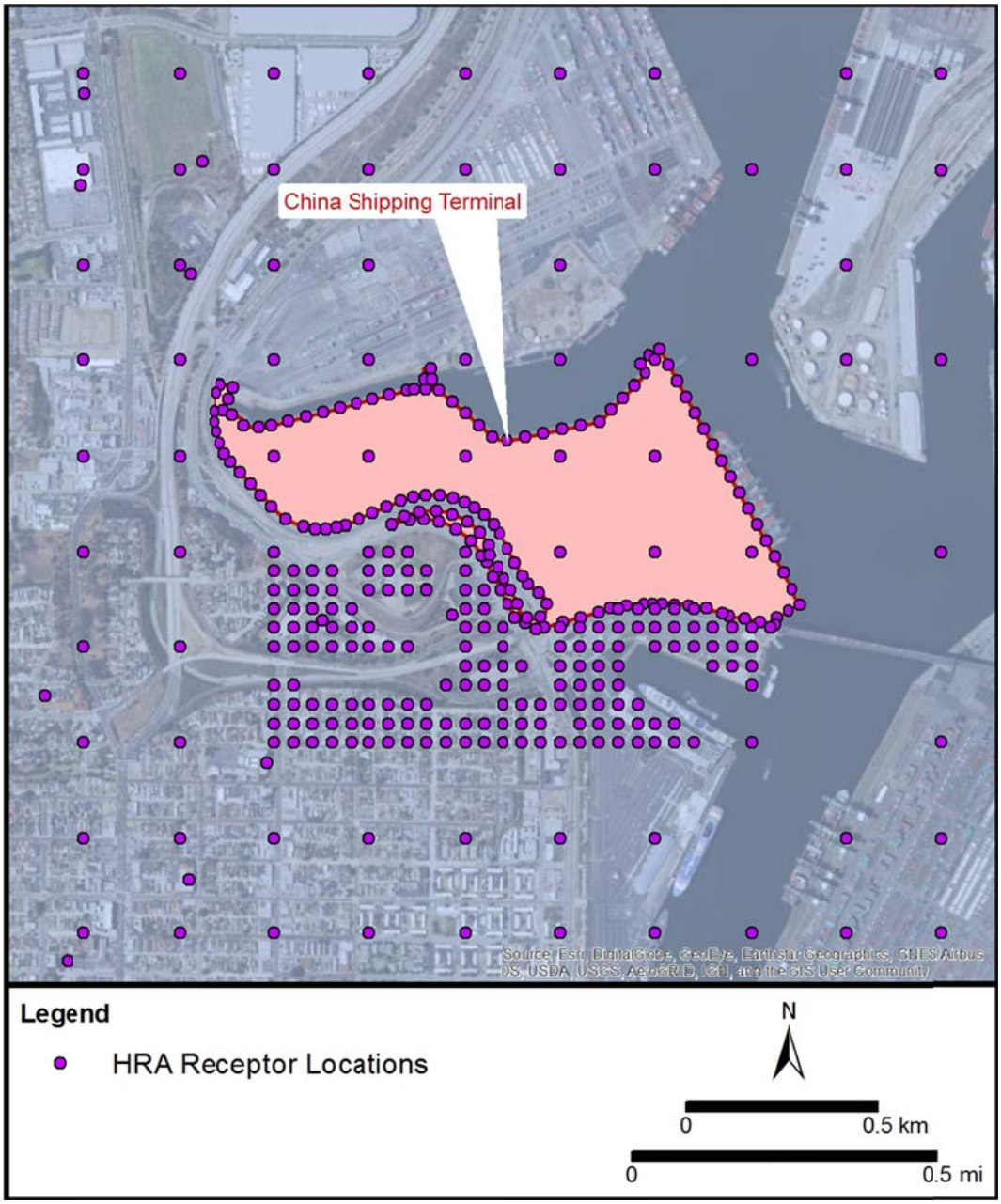


Figure B3-3. HRA Modeled Sensitive Receptors

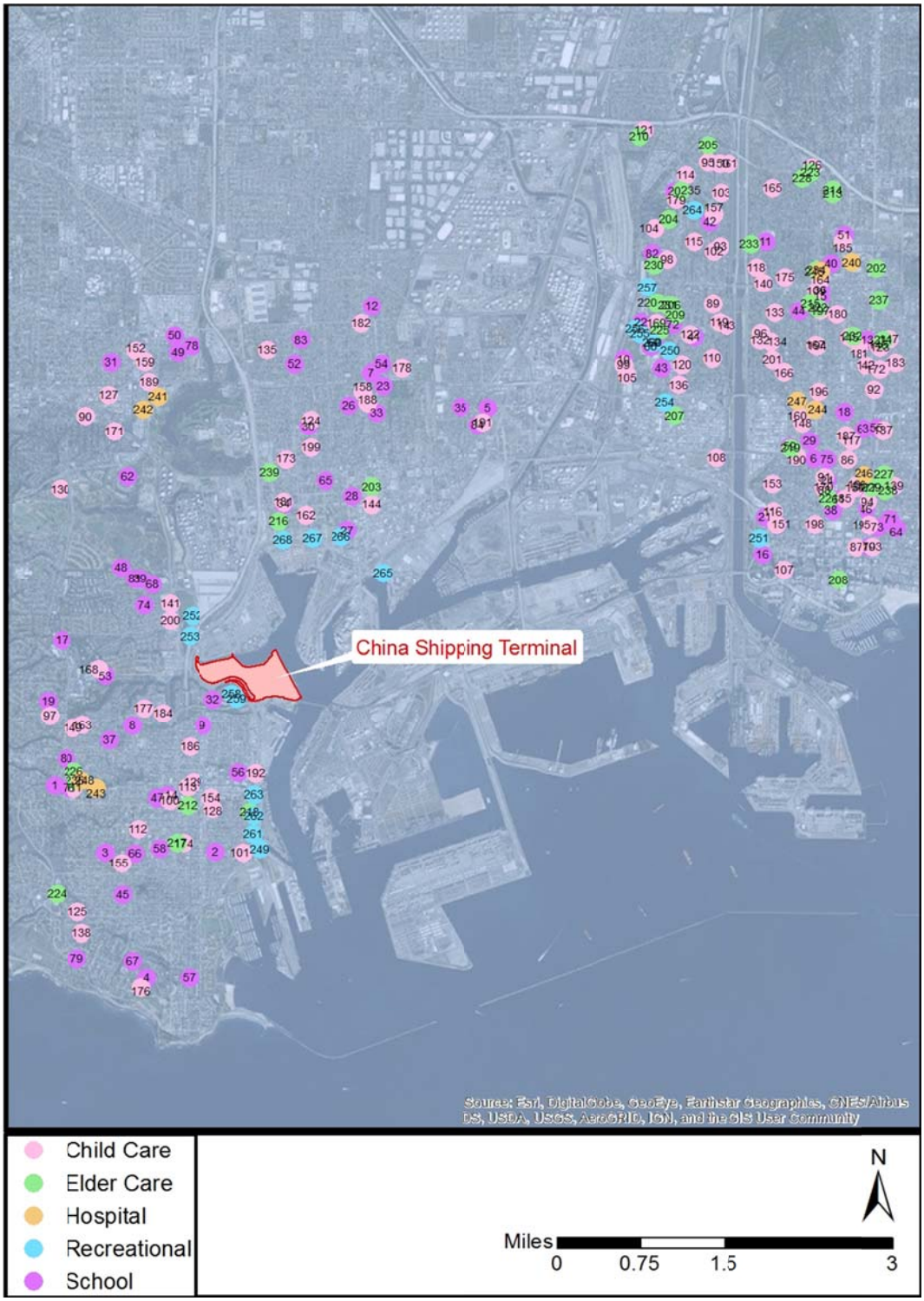


Table B3-3. Sensitive Receptor Descriptions

No. [a]	Receptor Description	Street Address	City, State, Zip	Category
1	7th Street Elementary School	1570 W. 7th St	San Pedro, CA 90731	School
2	15th Street Elementary School	1527 Mesa St	San Pedro, CA 90731	School
3	Academy of the Two Hearts School	1540 S. Walker Ave	San Pedro, CA 90731	School
4	Angel's Gate High School	3607 S. Gaffey St	San Pedro, CA 90731	School
5	Apostolic Faith Center/Apostolic Faith Academy	1530 E Robidoux St	Wilmington, CA 90744	School
6	Artesia Well Preparatory Academy	1235 Pacific Ave	Long Beach, CA 90813	School
7	Avalon High School	1425 N Avalon Blvd	Wilmington, CA 90744	School
8	Bandini Street Elementary School	425 N. Bandini St	San Pedro, CA 90731	School
9	Barton Hill Elementary School	423 N. Pacific Ave	San Pedro, CA 90731	School
10	Bethune Mary School	2101 San Gabriel Ave	Long Beach, CA 90810	School
11	Birney Elementary School	710 W. Spring St	Long Beach, CA 90806	School
12	Broad Avenue Elementary School	24815 Broad Ave	Wilmington, CA 90744	School
13	Burnett Elementary	565 East Hill St.	Long Beach, CA 90806	School
14	Cabrillo Avenue Elementary School	732 S. Cabrillo Ave	San Pedro, CA 90731	School
15	Cambodian Christian	2474 Pacific Ave	Long Beach, CA 90806	School
16	Cesar Chavez Elementary	730 West Third St.	Long Beach, CA 90802	School
17	Christ Lutheran Elementary School	28850 S. Western Ave	Rancho Palos Verdes, CA 90275	School
18	Colegio New City	1637 Long Beach Blvd	Long Beach, CA 90813	School
19	Crestwood Street Elementary School	1946 W. Crestwood St	Rancho Palos Verdes, CA 90275	School
20	Daniel Webster Elementary School and Head Start	1755 W 32nd Way	Long Beach, CA 90810	School
21	Edison Elementary	625 Maine Ave.	Long Beach, CA 90802	School
22	Elizabeth Hudson Elementary School and Development Center Daycare	2335 Webster Ave	Long Beach, CA 90810	School
23	First Baptist Christian School	1360 Broad Ave	Wilmington, CA 90744	School
24	First Baptist Church School	1000 Pine Ave	Long Beach, CA 90813	School
25	First Lutheran Day Care, Preschool and Elementary School	946 Linden Ave	Long Beach, CA 90813	School
26	Fries Ave. Elementary School	1301 N Fries Ave	Wilmington, CA 90744	School
27	Gang Alternative Program	231 Island Ave	Wilmington, CA 90744	School
28	George de la Torre Jr. Elementary School	500 Island Ave	Wilmington, CA 90744	School
29	George Washington Middle School	1450 Cedar Ave	Long Beach, CA 90813	School
30	Gulf Avenue Elementary School	828 W. L St	Wilmington, CA 90744	School
31	Harbor City Elementary School	1508 254th St	Harbor City, CA 90710	School
32	Harbor Occupational Center	740 N. Pacific Ave.	San Pedro, CA 90731	School
33	Harry Bridges Span School	1235 Broad Ave	Wilmington, CA 90744	School
34	Hawaiian Avenue Elementary School	540 Hawaiian Ave	Wilmington, CA 90744	School
35	Holy Family Preschool and Elementary School	1122 E Robidoux St	Wilmington, CA 90744	School
36	Holy Innocents Elementary School	2500 Pacific Ave	Long Beach, CA 90806	School
37	Holy Trinity Elementary School	1226 W. Santa Cruz St	San Pedro, CA 90732	School
38	International Elementary	700 Locust Ave	Long Beach, CA 90813	School
39	J F Cooper High School	2210 N. Taper Ave	San Pedro, CA 90731	School
40	Jackie Robinson Academy	2750 Pine Ave	Long Beach, CA 90806	School
41	James Garfield Elementary School / LBUSD Child Development Center	2240 Baltic Ave	Long Beach, CA 90810	School
42	John Muir Elementary School	3038 Delta Ave	Long Beach, CA 90810	School
43	Juan Rodriguez Cabrillo High School	2001 Santa Fe Ave	Long Beach, CA 90810	School

No. [a]	Receptor Description	Street Address	City, State, Zip	Category
44	Lafayette Elementary School	2445 Chestnut Ave	Long Beach, CA 90806	School
45	Leland Street Elementary School	2120 S. Leland St	San Pedro, CA 90731	School
46	Long Beach Montessori School	525 E. 7th St	Long Beach, CA 90813	School
47	Mary Star of the Sea Elementary School	717 S. Cabrillo Ave	San Pedro, CA 90731	School
48	Mary Star of the Sea High School	810 W. 8th St	San Pedro, CA 90731	School
49	Normont Elementary School	1001 253rd St	Harbor City, CA 90710	School
50	Normont Terrace Childrens Center	25028 Petroleum Ave	Harbor City, CA 90710	School
51	Oakwood Academy	2951 Long Beach Blvd	Long Beach, CA 90806	School
52	Pacific Harbor Christian School	1530 N. Wilmington Blvd	Wilmington, CA 90744	School
53	Park Western Place Elementary School	1214 Park Western Place	San Pedro, CA 90732	School
54	Phineas Banning Senior High School	1527 Lakme Ave	Wilmington, CA 90744	School
55	Polytechnic High School	1600Atlantic Ave.	Long Beach, CA 90813	School
56	Port of Los Angeles High School	250 W 5th St	San Pedro, CA 90731	School
57	Pt. Fermin Elementary School	3333 Kerckhoff Ave	San Pedro, CA 90731	School
58	R H Dana Middle School	1501 S. Cabrillo	San Pedro, CA 90731	School
59	Regency High School	490 W. 14th Street	Long Beach, CA 90813	School
60	Reid Continuation High School	2153 W Hill St	Long Beach, CA 90810	School
61	Renaissance High School for the Arts	235 East Eighth St.	Long Beach, CA 90813	School
62	Rolling Hills Preparatory School	1 Rolling Hills Prep Way	San Pedro, CA 90732	School
63	Roosevelt Elementary	1574 Linden Ave.	Long Beach, CA 90813	School
64	Saint Anthony Preschool / Elementary	855 East Fifth St.	Long Beach, CA 90802	School
65	Saints Peter & Paul School	706 Bay View Ave	Wilmington, CA 90744	School
66	San Pedro High School	1001 W. 15th St	San Pedro, CA 90731	School
67	San Pedro High School Olguin Campus	3210 S Alma St	San Pedro, CA 90731	School
68	San Pedro MST Center	2201 Barrywood Ave	San Pedro, CA 90731	School
69	Savannah Academy	2152 W Hill St	Long Beach, CA 90810	School
70	Select Community Day School	5869 Atlantic Ave.	Long Beach, CA 90802	School
71	St. Anthony High School/Constellation Community Charter Middle	620 Olive Ave.	Long Beach, CA 90802	School
72	St. Lucy School	2320 Cota Ave	Long Beach, CA 90810	School
73	Stevenson Elementary; Stevenson Child Development Centers/Preschool	515 Lime Ave.	Long Beach, CA 90802	School
74	Taper Avenue Elementary School	1824 N. Taper Ave	San Pedro, CA 90731	School
75	The New City School	1230 Pine Ave	Long Beach, CA 90813	School
76	Trinity Luthern School	1450 W. 7th St	San Pedro, CA 90731	School
77	True Social Justice Academy	630 Magnolia Ave	Long Beach, CA 90802	School
78	Vermont Christian School	931 Frigate Ave	Wilmington, CA 90744	School
79	White Point Elementary School	1410 Silvius Ave	San Pedro, CA 90731	School
80	Willenberg Special Education	308 S. Weymouth Ave.	San Pedro, CA 90731	School
81	William J. Johnston Community Day School	2210 N Taper Ave	San Pedro, CA 90731	School
82	William Logan Stephens Middle School	1830 W Columbia St	Long Beach, CA 90810	School
83	Wilmington Middle School	1700 Gulf Ave	Wilmington, CA 90744	School
84	Wilmington Park Elementary School/Mahar House	1140 Mahar Ave	Wilmington, CA 90744	School
85	8th Street Early Head Start	820 Long Beach Blvd	Long Beach, CA 90813	Child Care
86	12th Street Head Start	1212 Long Beach Blvd	Long Beach, CA 90806	Child Care
87	A Love 4 Learning Academy	306 Elm Ave	Long Beach, CA 90802	Child Care
88	ABC 123 Long Beach Learning Center	909 Pine Ave	Long Beach, CA 90813	Child Care
89	Agu Family Child Care	4400 Boyar Ave	Long Beach, CA 90807	Child Care
90	Armstrong Academy	1682 Anaheim St	Harbor City, CA 90710	Child Care

No. [a]	Receptor Description	Street Address	City, State, Zip	Category
91	Aspiranet Foster Family Agency	1043 Pine Ave	Long Beach, CA 90813	Child Care
92	Atlantic Headstart	1862 Atlantic Ave	Long Beach, CA 90806	Child Care
93	Babineaux Family Child Care	2881 Delta Ave	Long Beach, CA 90810	Child Care
94	Benford Family Child Care	530 E 8th St	Long Beach, CA 90813	Child Care
95	Bobo Family Daycare	3532 Delta Ave	Long Beach, CA 90810	Child Care
96	Briggs Family Child Care	Golden Ave	Long Beach, CA 90806	Child Care
97	Brighter Days Montessori	1903 W. Summerland St	San Pedro, CA 90732	Child Care
98	Brown Family Child Care	1831 W Jeanette Pl	Long Beach, CA 90810	Child Care
99	Cabrillo Child Development Center	2205 San Gabriel Ave	Long Beach, CA 90810	Child Care
100	Cabrillo Early Education Center	741 W. 8th St	San Pedro, CA 90731	Child Care
101	Carmen's Cry Baby Care	1509 S. Palos Verdes St	San Pedro, CA 90731	Child Care
102	Carol Daycare	2842 Easy Ave	Long Beach, CA 90810	Child Care
103	Casian Family Child Care	3256 Fashion Ave	Long Beach, CA 90810	Child Care
104	Ceja Family Child Care	2030 W Spring St	Long Beach, CA 90810	Child Care
105	Century Villages at Cabrillo Homeless Housing Community	2001 River Ave	Long Beach, CA 90810	Child Care
106	Child Care Center At St Mary Medical Center	930 Elm Ave	Long Beach, CA 90813	Child Care
107	Childtime Learning Center	1 World Trade Ctr # 199	Long Beach, CA 90813	Child Care
108	City of Long Beach Multi-Service Center; The Play House	1301 W 12th St	Long Beach, CA 90813	Child Care
109	Comprehensive Child Development	2565 Pacific Ave.	Long Beach, CA 90806	Child Care
110	Costa Family Child Care	2085 Easy Ave	Long Beach, CA 90810	Child Care
111	Dahlquist Preschool	1420 W. 7th St	San Pedro, CA 90731	Child Care
112	Davis Family Child Care	957 W 12th St	San Pedro, CA 90731	Child Care
113	Day Star Early Learning Center	631 W. 6th St	San Pedro, CA 90731	Child Care
114	Delgado Family Child Care	3383 Adriatic Ave	Long Beach, CA 90810	Child Care
115	Duran, Ramona Family Day Care	2935 Baltic Ave	Long Beach, CA 90810	Child Care
116	Edison Child Development Center	640 W 7th St	Long Beach, CA 90813	Child Care
117	Elm Street Head Start	1425 & 1429 Elm Ave	Long Beach, CA 90806	Child Care
118	Fords Family Day Care	2726 San Francisco Ave	Long Beach, CA 90806	Child Care
119	Franklin Day Care Center	2333 Fashion Ave	Carson, CA 90810	Child Care
120	Gallegos Family Child Care	2024 Adriatic Ave	Long Beach, CA 90810	Child Care
121	Garcia Family Child Care	2145 Wardlow Rd	Long Beach, CA 90810	Child Care
122	Garfield Head Start	2240 Baltic Ave	Long Beach, CA 90810	Child Care
123	Garibay Family Child Care	2172 Lime Ave	Long Beach, CA 90806	Child Care
124	Gomez Family Child Care	1156 Ronan Ave	Wilmington, CA 90744	Child Care
125	Good Shepherd Preschool and Infant Center	1350 W 25th St	San Pedro, CA 90732	Child Care
126	Grace Lutheran Preschool	245 W Wardlow Rd	Long Beach, CA 90807	Child Care
127	Happy Tots Montessori School & Infant Center	1518 Pacific Coast Hwy	Harbor City, CA 90710	Child Care
128	Harbor Area YWCA	437 W 9th St	San Pedro, CA 90731	Child Care
129	Harbor Day Preschool	580 W 6th St	San Pedro, CA 90731	Child Care
130	Harbor Hills Early Education Center	1874 Palos Verdes Dr N	Lomita, CA 90717	Child Care
131	Hawaiian Avenue Children's Center	909 W. D St	Wilmington, CA 90744	Child Care
132	Hernandez Family Child Care	2200 Golden Ave	Long Beach, CA 90806	Child Care
133	Hernandez Family Child Care	5322 Elm Ave	Long Beach, CA 90805	Child Care
134	Herrera Family Child Care	737 W Hill St	Long Beach, CA 90806	Child Care
135	Jardin De Ninos Home Child Care	1319 W Lowen St	Wilmington, CA 90744	Child Care
136	Job Corps Head Start - Daycare and Nursery	1903 Santa Fe Ave	Long Beach, CA 90810	Child Care
137	Jones Family Child Care	2275 Baltic Ave	Long Beach, CA 90810	Child Care
138	Just Like Home	1346 W 27th St	San Pedro, CA 90731	Child Care

No. [a]	Receptor Description	Street Address	City, State, Zip	Category
139	Kelly's Care	943 N Washington Pl	Long Beach, CA 90813	Child Care
140	Kelly's Kids Daycare Center	855 W Willow St	Long Beach, CA 90806	Child Care
141	Kidazzle Preschool	1921 N Gaffey St	San Pedro, CA 90731	Child Care
142	Kim Family Child Care	2035 Linden Ave	Long Beach, CA 90806	Child Care
143	Lara Family Day Care	1303 W 253rd St	Harbor City, CA 90710	Child Care
144	Lil Cowpoke Preschool	445 N Avalon Blvd	Wilmington, CA 90744	Child Care
145	Long Beach Blvd Head Start	2236 Long Beach Blvd	Long Beach, CA 90806	Child Care
146	Long Beach Center for Child Development	622 E. Hill St	Long Beach, CA 90806	Child Care
147	Long Beach Child Development Center	2222 Olive Ave	Long Beach, CA 90806	Child Care
148	Long Beach Day Nursery - West Branch	1548 Chestnut Ave	Long Beach, CA 90813	Child Care
149	Look Who's Learning Pre-School	1491 W O'Farrell St	San Pedro, CA 90732	Child Care
150	Lopez Family Child Care	3500 Fashion Ave	Long Beach, CA 90810	Child Care
151	Loves Family Child Care	527 Daisy Ave	Long Beach, CA 90802	Child Care
152	Loving Day Care	1303 253rd St	Harbor City, CA 90710	Child Care
153	Lucy's Baby Care	940 Maine Ave	Long Beach, CA 90813	Child Care
154	Merry Go Round Nursery School	446 W 8th St	San Pedro, CA 90731	Child Care
155	Mills Family Daycare	1061 W 17th St	San Pedro, CA 90731	Child Care
156	Montessori On Elm Preschool + Kindergarten	930 Elm Ave	Long Beach, CA 90813	Child Care
157	Muir Child Development Center	3105 Easy Ave	Long Beach, CA 90810	Child Care
158	Munchkin Center	1348 N Marine Ave	Wilmington, CA 90744	Child Care
159	My First School	25405 Normandie Ave	Harbor City, CA 90710	Child Care
160	N 2 Lil Folkz	1624 Chestnut Ave	Long Beach, CA 90813	Child Care
161	Nero-Morrison Family Child Care	3500 Gale Ave	Long Beach, CA 90810	Child Care
162	New Harbor Vista Child Development Center	909 W D St	Wilmington, CA 90744	Child Care
163	Nursery Rhymes Day Care	1410 W. Ofarrell St	San Pedro, CA 90732	Child Care
164	Oakwood Children's Center	2650 Pacific Ave	Long Beach, CA 90806	Child Care
165	Old King Cole Day Care	3300 Oregon Ave	Long Beach, CA 90806	Child Care
166	P.A.L. Family Day Care	1980 Daisy Ave	Long Beach, CA 90806	Child Care
167	Pacific Head Start	2179 Pacific Ave	Long Beach, CA 90806	Child Care
168	Park Western Place Children's Center	1220 Park Western Pl	San Pedro, CA 90732	Child Care
169	Patterson Family Child Care	2133 Canal Ave	Long Beach, CA 90810	Child Care
170	Pine Head Start	927 Pine Ave	Long Beach, CA 90813	Child Care
171	Pines Christian Preschool	1516 W Anaheim St	Harbor City, CA 90710	Child Care
172	Poole Family Child Care	2002 Lime Ave	Long Beach, CA 90806	Child Care
173	Reece Family Day Care	911 King Ave	Wilmington, CA 90744	Child Care
174	Robin's Nest Day Care	645 W. 14th St	San Pedro, CA 90731	Child Care
175	Ruiz Family Daycare	2670 Daisy Ave	Long Beach, CA 90806	Child Care
176	San Pedro - Wilmington Early Education Center	920 W. 36th St	San Pedro, CA 90731	Child Care
177	San Pedro Child Care	926 W Elberon Ave	San Pedro, CA 90731	Child Care
178	Sanchez Family Child Care	1443 Deepwater Ave	Wilmington, CA 90744	Child Care
179	Sanders Teeny Tiny Preschool	3211 Santa Fe Ave	Long Beach, CA 90810	Child Care
180	Sandford Family Child Care	215 E Burnett St	Long Beach, CA 90806	Child Care
181	Sar Family Child Care	2171 Pasadena Ave	Long Beach, CA 90806	Child Care
182	Small World Learning Center	1749 N Avalon Blvd	Wilmington, CA 90744	Child Care
183	Smart & Manageable	2054 Myrtle Ave	Long Beach, CA 90806	Child Care
184	Smith Family Daycare	787 W Elberon Ave	San Pedro, CA 90731	Child Care
185	Tender Child Care	211 E 29th St	Long Beach, CA 90806	Child Care
186	Toberman Child Care Center	131 N. Grand Ave	San Pedro, CA 90731	Child Care
187	Un Mundo De Amigos Preschool	1480 Long Beach Blvd	Long Beach, CA 90813	Child Care

No. [a]	Receptor Description	Street Address	City, State, Zip	Category
188	VOA/Cesar Chavez Head Start	1269 N. Avalon St	Wilmington, CA 90744	Child Care
189	Volunteers of America-Parent Child Center	1135 257th St	Harbor City, CA 90710	Child Care
190	West Anaheim Child Care Center	440 W. Anaheim St	Long Beach, CA 90813	Child Care
191	Wilmington Park Children's Center	1419 E Young St	Wilmington, CA 90744	Child Care
192	World Tots LA Day Care Center	100 W. 5th St	San Pedro, CA 90731	Child Care
193	YMCA GLB Fairfield 3rd Street Preschool	607 E. 3rd St	Long Beach, CA 90802	Child Care
194	YMCA Play & Learn Preschool	2179 Pacific Ave	Long Beach, CA 90806	Child Care
195	Young Horizons Child Development Center	501 Atlantic Ave	Long Beach, CA 90802	Child Care
196	Young Horizons Child Development Center	1840 Pacific Ave	Long Beach, CA 90806	Child Care
197	Young Horizons Child Development Center	2418 Pacific Ave	Long Beach, CA 90806	Child Care
198	Young Horizons/El Jardin de la Felicidad	507 Pacific Ave	Long Beach, CA 90813	Child Care
199	Yvette's Daycare	815 W. Opp St	Wilmington, CA 90744	Child Care
200	YWCA Venture Park Pre-School	1921 N. Gaffey St	San Pedro, CA 90731	Child Care
201	Zarate Family Child Care	2496 Oregon Ave	Long Beach, CA 90806	Child Care
202	Akin's Post Acute Rehab Hospital; Atlantic Memorial Healthcare Center	2750 Atlantic Ave	Long Beach, CA 90806	Elder Care
203	American AAA Health Care Center	629 N Avalon Blvd	Wilmington, CA 90744	Elder Care
204	American Gold Star Manor Healthcare	3021 Gold Star Dr	Long Beach, CA 90810	Elder Care
205	Am's Residential Facility-2	3627 Delta Ave	Long Beach, CA 90810	Elder Care
206	Aquarius Home	1765 Aquarius St	Long Beach, CA 90810	Elder Care
207	Bay Breeze Care	1653 Santa Fe Ave	Long Beach, CA 90813	Elder Care
208	Breakers of Long Beach, The	210 E Ocean Blvd	Long Beach, CA 90802	Elder Care
209	Burnett Home Care	1740 W Burnett St	Long Beach, CA 90810	Elder Care
210	Cameron Home	W Cameron St	Long Beach, CA 90810	Elder Care
211	Caruthers Royale Care	2204 Lime Ave	Long Beach, CA 90806	Elder Care
212	Crow Flora Boarding & Care Homes	624 W. 9th St	San Pedro, CA 90731	Elder Care
213	Deluxe Guest Home	3260 Pine Ave	Long Beach, CA 90807	Elder Care
214	Deluxe Guest Home II	3266 Pine Ave	Long Beach, CA 90806	Elder Care
215	Garden, The	2485 Cedar Ave	Long Beach, CA 90806	Elder Care
216	Grandma's House	1218 W D St	Wilmington, CA 90744	Elder Care
217	Harbor Rose Trading Post	1400 S Gaffey St	San Pedro, CA 90731	Elder Care
218	Harbor View House	921 S. Beacon St	San Pedro, CA 90731	Elder Care
219	Harbor View Rehabilitation Center	490 W. 14th Street	Long Beach, CA 90813	Elder Care
220	Hayes Home	2470 Hayes Ave	Long Beach, CA 90810	Elder Care
221	Healthview - Pine Villa Assisted Living	117 E 8th St	Long Beach, CA 90813	Elder Care
222	Heritage Board & Care #2	1509 E 4th St	Long Beach, CA 90802	Elder Care
223	Hillcrest Care Center	3401 Cedar Ave	Long Beach, CA 90807	Elder Care
224	Little Sisters of the Poor	2100 S. Western Ave.	San Pedro, CA 90732	Elder Care
225	Loram Manor	1925 Gemini St	Long Beach, CA 90810	Elder Care
226	Los Palos Convalescent Hospital	1430 W 6th St	San Pedro, CA 90731	Elder Care
227	Olive Tree Home	1035 Olive St	Long Beach, CA 90813	Elder Care
228	Pacific Care Nursing Center	3355 Pacific Place	Long Beach, CA 90806	Elder Care
229	Padua House	940 Atlantic Ave	Long Beach, CA 90813	Elder Care
230	Pioneer Homes Of California	2041 W Carolyn Pl	Long Beach, CA 90810	Elder Care
231	Reliable Residential Care	1840 Aquarius St	Long Beach, CA 90810	Elder Care
232	Right At Home	2245 Elm Ave	Long Beach, CA 90806	Elder Care
233	RMR Residential Care Facility, LLC	2900 De Forest Ave	Long Beach, CA 90806	Elder Care
234	Royal Care Skilled Nursing Center	2725 Pacific Avenue	Long Beach, CA 90806	Elder Care
235	Santa Fe Convalescent Hospital	3294 Santa Fe Ave	Long Beach, CA 90810	Elder Care

No. [a]	Receptor Description	Street Address	City, State, Zip	Category
236	Seacrest Convalescent Hospital	1416 W 6th St	San Pedro, CA 90731	Elder Care
237	Serra Project Long Beach	1043 Elm Ave	Long Beach, CA 90813	Elder Care
238	Villa Maria Care Center	723 E 9th St	Long Beach, CA 90813	Elder Care
239	Wilmington Gardens	1311 W Anaheim St	Wilmington, CA 90744	Elder Care
240	Earl & Lorraine Miller Children's Hospital; Long Beach Memorial Medical Center and Hospital	2801 Atlantic Ave	Long Beach, CA 90806	Hospital
241	Kaiser Permanente Foundation Hospital	25825 S. Vermont Ave	Harbor City, CA 90710	Hospital
242	Kaiser Permanente South Bay Medical Center	25825 S Vermont Ave	Harbor City, CA 90710	Hospital
243	Little Company of Mary San Pedro Hospital	1300 W. 7th St	San Pedro, CA 90732	Hospital
244	Long Beach Doctors Hospital	1725 Pacific Ave	Long Beach, CA 90813	Hospital
245	Pacific Hospital of Long Beach (Hospital and Convalescent/Nursing Home)	2776 Pacific Ave	Long Beach, CA 90806	Hospital
246	St Mary Medical Center (Hospital and Convalescent/Nursing Home)	1050 Linden Ave	Long Beach, CA 90813	Hospital
247	Tom Redgate Memorial Hospital	1775 Chestnut Ave	Long Beach, CA 90813	Hospital
248	Torrance Memorial Medical Center	3330 Lomita Blvd	Torrance, CA 90505	Hospital
249	22nd Street Park	140 W 22nd Street	San Pedro, CA 90731	Recreational
250	Admiral Kidd Park	2125 Santa Fe Ave	Long Beach, CA 90810	Recreational
251	Cesar Chavez Park	401 Golden Ave	Long Beach, CA 90802	Recreational
252	Field of Dreams	501 Westmont Drive	San Pedro, CA 90731	Recreational
253	Gaffey Street Community Gardens	1400 N Gaffey Street	San Pedro, CA 90731	Recreational
254	Harbor Japanese Community Cultural Center	1766 Seabright Ave	Long Beach, CA 90813	Recreational
255	Hudson Park	2335 Webster Ave	Long Beach, CA 90810	Recreational
256	Hudson Park Community Garden	2335 Webster Ave	Long Beach, CA 90810	Recreational
257	Khemara Buddhikaram Cambodian Buddhist Temple	2100 W Willow Street	Long Beach, CA 90810	Recreational
258	Knoll Hill Baseball Fields	766 Eastview Little League Drive	San Pedro, CA 90731	Recreational
259	Knoll Hill Dog Park	705-711 N Front Street	San Pedro, CA 90731	Recreational
260	Pramuan Simsriwatna Place of Worship	2015 W Hill Street	Long Beach, CA 90810	Recreational
261	San Pedro Plaza Park	7000 S Beacon Street	San Pedro, CA 90731	Recreational
262	San Pedro Plaza Park	7000 S Beacon Street	San Pedro, CA 90731	Recreational
263	San Pedro Plaza Park	7000 S Beacon Street	San Pedro, CA 90731	Recreational
264	Silverado Park Community Center	1545 W 31st Street	Long Beach, CA 90810	Recreational
265	Wilmington Waterfront Promenade	Water Street	Wilmington, CA 90744	Recreational
266	Wilmington Waterfront Park	S. C Street	Wilmington, CA 90744	Recreational
267	Wilmington Waterfront Park	S. C Street	Wilmington, CA 90744	Recreational
268	Wilmington Waterfront Park	S. C Street	Wilmington, CA 90744	Recreational

Note:
[a] The receptor numbers correspond to receptor labels in Figure B3-3.

Maximally exposed individual (MEI) locations were selected from the modeled receptor grids for three different receptor types: residential, occupational, and sensitive. The selection methodology for the MEI locations was:

- The residential MEI was selected from all receptors in residential or residentially-zoned areas that are not located within modeled roadways or railways. Marinas where live-aboards may be present were treated as valid residential receptors.

- The occupational MEI was selected from all receptors on or outside the China Shipping terminal boundary that are not located on water or within modeled roadways or railways.

- The sensitive MEI was selected from all modeled schools, child care centers, elder care facilities, hospitals, and recreational areas such as parks, marinas, and public waterfront areas.

4.0 Health Risk Calculation Approach

4.1 Model Selection

The air dispersion modeling was performed using the USEPA AERMOD dispersion model, version 16216r (USEPA, 2017), based on the *Guideline on Air Quality Models* (USEPA, 2017b). The emission source parameters, meteorological data, model options, and temporal distribution assumptions used in the HRA are the same as described in Appendix B2. For compatibility with HARP2, each source group in AERMOD was modeled with a 1 gram per second "unit" emission rate. The actual TAC emission rates for each source group were modeled in HARP2.

The health risk calculations were performed using HARP2, version 17052 (CARB, 2017), based on the TAC unit concentrations predicted by AERMOD. HARP2 calculated values for individual cancer risk, chronic hazard index, and acute hazard index at each modeled receptor for the Project and baseline scenarios. For each health value calculated by HARP2, the HRA determined a Project increment by subtracting the baseline health value from the Project health value at each modeled receptor. For each receptor type (residential, occupational, and sensitive), the modeled receptor with the highest increment was selected for reporting and comparison to the appropriate significance threshold.

4.2 Toxicity Factors

An inhalation cancer potency factor represents the probability that a person will contract cancer from the continuous inhalation of one milligram (mg) of a chemical per kilogram (kg) of body weight per day over a period of 70 years. Inhalation potency factors were used by HARP2 to calculate individual cancer risk using the risk assessment algorithms defined in OEHHA (2015).

To assess the potential for non-cancer health effects resulting from chronic and acute inhalation exposure, OEHHA has established Reference Exposure Levels (REL) (CARB, 2017b). An REL is an estimate of the continuous inhalation exposure concentration to which the human population (including sensitive subgroups) may be exposed without appreciable risk of experiencing adverse non-cancer effects. The chronic hazard index is the sum of the chemical-specific chronic hazard quotients affecting a particular target organ. The acute hazard index is the sum of the chemical-specific acute hazard quotients affecting a particular target organ. A hazard quotient is a chemical's predicted concentration divided by its REL. A separate hazard index is calculated for each target organ affected by the TACs because not all TACs affect the same target organ. A hazard index below 1.0 for all affected target organs indicates that adverse non-cancer health effects are not expected.

In addition to the inhalation exposure pathway, several noninhalation exposure pathways were also incorporated in the HRA, including dermal adsorption, soil ingestion, home-grown produce ingestion, and mother's milk ingestion (the latter two pathways were evaluated only for residential and the following sensitive receptors: schools, hospitals, child care, and elder care). The TACs evaluated for noninhalation pathways include arsenic, cadmium, hexavalent chromium, lead, nickel, and selenium from all sources except diesel IC engines. For diesel IC engines, the inhalation toxicity factors for DPM already include the effects from exposure to whole diesel exhaust, so a separate evaluation of noninhalation pathways is not required. The various exposure parameters and settings used in HARP2 for the noninhalation exposure pathways are consistent with OEHHA default recommendations (OEHHA, 2015). The results of this analysis show that the contributions of the noninhalation exposure pathways to the HRA results are small compared to the inhalation pathway.

Table B3-4 presents the toxicity factors used to assess health risks in this study.

Table B3-4. Toxicity Factors Used In the HRA

Toxic Air Contaminant	HARP2 TAC ID	Inhalation Cancer Potency Factor $(mg/kg\text{-}d)^{-1}$	Chronic Inhalation REL ($\mu g/m^3$)	Target Organ for Chronic Exposure[b]	Acute Inhalation REL ($\mu g/m^3$)	Target Organ for Acute Exposure[b]
Acetaldehyde	75070	0.01	140	I	470	D,I
Acrolein	107028	—	0.35	I	2.5	D,I
Acrylonitrile	107131	1	5	I	—	—
Arsenic[a]	7440382	12	0.015	B,C,G,I,J	0.2	B,C,G
Benzene	71432	0.1	3	E	27	C,E,F
1,3-Butadiene	106990	0.6	2	C	660	C
Cadmium[a]	7440439	15	0.02	I,M	—	—
Chlorine	7782505	—	0.2	I	210	D,I
Chlorobenzene	108907	—	1,000	A,C,M	—	—
Copper	7440508	—	—	—	100	I
Diesel PM (DPM)	9901	1.1	5	I	—	—
Ethyl benzene	100414	0.0087	2,000	A,C,L,M	—	—
Ethyl chloride	75003	—	30,000	A,C	—	—
Ethylene oxide	75218	0.31	30	G	—	—
Formaldehyde	50000	0.021	9	I	55	D
Hexane	110543	—	7,000	G	—	—
Hexavalent chromium[a]	18540299	510	0.2	E,I	—	—
Isopropyl alcohol	67630	—	7,000	C,M	3,200	D,I
Lead[a]	7439921	0.042	—	—	—	—
Manganese	7439965	—	0.09	G	—	—
Methanol	67561	—	4,000	C	28,000	G
Methyl ethyl ketone	78933	—	—	—	13,000	D,I
Naphthalene	91203	0.12	9	I	—	—
Nickel[a]	7440020	0.91	0.014	C,E,I	0.2	F
Phenol	108952	—	200	A,B,G,M	5,800	D,I
Propylene	115071	—	3,000	I	—	—
Propylene	75569	0.013	30	I	3,100	C,D,I

Toxic Air Contaminant	HARP2 TAC ID	Inhalation Cancer Potency Factor (mg/kg-d)$^{-1}$	Chronic Inhalation REL (µg/m^3)	Target Organ for Chronic Exposure[b]	Acute Inhalation REL (µg/m^3)	Target Organ for Acute Exposure[b]
oxide						
Selenium [a]	7782492	—	20	A,B,G	—	—
Styrene	100425	—	900	G	21,000	C,D,I
Sulfates	9960	—	—	—	120	I
Toluene	108883	—	300	C,G,I	37,000	C,D,G,I
Vanadium	7440622	—	—	—	30	D,I
Vinyl chloride	75014	0.27	—	—	180,000	D,G,I
Xylenes	1330207	—	700	D,G,I	22,000	D,G,I

Notes:
[a] Arsenic, cadmium, hexavalent chromium, lead, nickel, and selenium were also evaluated for noninhalation exposure pathways. For arsenic, the cancer risk oral slope factor is 1.5 (mg/kg/day)$^{-1}$, and the noncancer chronic oral REL is 0.0000035 mg/kg/day. For cadmium, the noncancer chronic oral REL is 0.0005 mg/kg/day. For hexavalent chromium, the cancer risk oral slope factor is 0.5 (mg/kg/day)$^{-1}$, and the noncancer chronic oral REL is 0.02 mg/kg/day. For lead, the cancer risk oral slope factor is 0.0085 (mg/kg/day)$^{-1}$. For nickel, the noncancer chronic oral REL is 0.011 mg/kg/day. For selenium, the noncancer chronic oral REL is 0.005 mg/kg/day. The deposition rate was assumed to be the HARP2 default of 0.02 meters per second (controlled sources).
[b] Key to non-cancer acute and chronic exposure target organs:
A. Alimentary Tract
B. Cardiovascular System
C. Reproductive/Developmental System
D. Eye
E. Hematologic System
F. Immune System
G. Nervous System
I. Respiratory System
J. Skin
K. Bone
L. Endocrine System
M. Kidney
Source: CARB, 2017b.

4.3 Exposure Scenarios for Individual Cancer Risk

According to OEHHA (2015), individual cancer risk is directly proportional to the frequency and duration of exposure to TACs, modified by age sensitivity factors. The age sensitivity factors multiply the risk by 10 for 3rd-trimester fetuses to age 2 (labeled by OEHHA as "0 < 2"); by 3 for children from age 2 to 16 ("2 < 16"), and by 1 for persons age 16 and older ("≥ 16").

Table B3-5 summarizes the primary exposure assumptions used in this HRA to calculate individual cancer risks by receptor type. The exposure assumptions for residential and occupational receptors were obtained from OEHHA (2015) and SCAQMD (2015). The exposure assumptions for sensitive receptors are not explicitly provided by OEHHA (2015) and SCAQMD (2015). Therefore, LAHD conservatively evaluated schools, hospitals, elder care facilities, and child care centers with 30-year residential exposure assumptions, and recreational receptors with reasonable worst case exposure assumptions of 250 days/year, 2 hr/day, for 30 years.

Because the Revised Project, FEIR Mitigated Project and Unmitigated and Mitigated Future Baseline scenarios have emissions that change over time in the HRA, it was necessary to subdivide the exposure durations listed in Table B3-5 into smaller time periods (sub-periods) and run HARP2 separately for each sub-period. These sub-periods correspond to the years when the modeled receptor's age falls within the ranges defined

by the age sensitivity factors (0 < 2, 2 < 16, and ≥ 16). For residential exposures, the range 0 < 2 also includes the 3rd trimester before birth.

For each receptor type, the youngest expected age range was modeled in the HRA to produce the most conservative (highest) risk result. For example, the calculation of 30-year residential cancer risk assumes that the exposed person is in the 3rd trimester before birth at the beginning of the 30-year exposure period. This assumption maximizes the use of the childhood age sensitivity factors in the cancer risk calculation. Moreover, the calculated cancer risk is increased even further during childhood years by using higher breathing rates per body weight than adults.

For each sub-period modeled in HARP2, the average annual operational or baseline emissions that would occur during that sub-period were used by HARP2. The HARP2 cancer risk results for each sub-period were then summed to obtain the cancer risk for the entire exposure duration. For example, the 30-year residential cancer risk for the Revised Project was determined by running HARP2 once for each of three sub-periods. The first sub-period represents a receptor age of 0 < 2, assumes an exposure duration of 2 years, and uses Revised Project emissions averaged over the time period 2015-2016. The second sub-period represents a receptor age of 2 < 16, assumes an exposure duration of 14 years, and uses Revised Project emissions averaged over the time period 2017-2030. The third sub-period represents a receptor age of 16 < 30, assumes an exposure duration of 14 years, and uses Revised Project emissions averaged over the time period 2031-2044. The cancer risks calculated by HARP2 for these three sub-periods were then summed to obtain the total cancer risks for the entire 30-year exposure duration.

Other HARP2 assumptions for the calculation of cancer risk include: residential and sensitive receptors except recreational were evaluated with inhalation, soil ingestion, dermal contact, mother's milk ingestion, and homegrown garden ingestion pathways. Occupational and recreational receptors were evaluated with inhalation, soil ingestion, and dermal contact pathways. A deposition settling velocity of 0.02 meters per second was assumed in HARP2 for all noninhalation exposure pathways (SCAQMD, 2015).

Table B3-5. Cancer Risk Exposure Assumptions by Receptor Type

Receptor Type	Exposure Duration			Cancer Risk Calculation Approach	Exposed Person's Age Range [6]
	Days per Year	Hours per Day	Years		
Residential					
Individual Cancer Risk	350	24	30	RMP Using the Derived Method [2]	3TM[5] < 30
Population Cancer Burden	350	24	70	RMP Using the Derived Method	3TM < 70
Occupational	250	8	25	OEHHA Derived Method [3]	≥ 16
Sensitive					
Schools, Hospitals, Elder Care, Child Care	350	24	30	RMP Using the Derived Method	3TM < 30
Recreational [4]	250	2	30	OEHHA Derived Method	0 < 30

Notes:

1. The exposure assumptions for residential and occupational receptors were obtained from OEHHA (2015) and SCAQMD (2015). The exposure assumptions for sensitive receptors are not explicitly provided by OEHHA (2015) and SCAQMD (2015). Therefore, LAHD conservatively evaluated schools, hospitals, elder care, and child care with 30-year residential exposure assumptions, and recreational receptors with reasonable worst case exposure assumptions.
2. The "RMP Using the Derived Method" uses CARB's Risk Management Policy (RMP), and is recommended by the SCAQMD (2015) for residential receptors. It uses high end breathing rates (95th percentile) for children from the 3rd trimester through age 2, and 80th percentile breathing rates for all other ages.
3. The "OEHHA Derived Method" is recommended by the SCAQMD (2015) for occupational receptors. For cancer risk, it uses high end (95th percentile) exposure parameters for the top two exposure pathways (one of which is nearly always inhalation), and mean (65th percentile) exposure parameters for the remaining pathways.
4. Recreational receptors were modeled in HARP2 with occupational exposure assumptions, which reflect 8 hours per day of pollutant exposure. Therefore, the HARP2-calculated risk values for recreational receptors were scaled by 2 hr/8 hr to reflect 2 hours per day of pollutant exposure.
5. 3TM = third trimester (prior to birth).
6. The exposed person's age ranges were conservatively selected to maximize the cancer risk (i.e., the youngest expected age range).

4.3.1 Population Cancer Burden Methodology

Population cancer burden is defined by OEHHA as an estimate of the number of cancer cases expected from a 70-year exposure to emissions (OEHHA, 2015). Whereas individual cancer risk represents the probability of a single exposed person to develop cancer, population cancer burden estimates the number of individuals that would be expected to contract cancer by multiplying the cancer risk by the exposed population. The exposed population is defined as the number of persons within a facility's zone of impact, which is defined by the LAHD and SCAQMD as the area within the Project's one in a million cancer risk isopleth. Population cancer burden was calculated using census block population data contained in HARP2, which are based on the 2010 U.S. Census.

4.4 Exposure Scenarios for Non-Cancer Hazard Indices

Chronic hazard indices were calculated in HARP2 using the "OEHHA Derived" method, which evaluates inhalation exposure, the two most dominant noninhalation exposure pathways using high-end (95th percentile) intake rates, and the remaining noninhalation

exposure pathways using mean (65th percentile) intake rates (SCAQMD, 2015). All receptors were conservatively evaluated with inhalation, soil ingestion, dermal contact, mother's milk ingestion, and homegrown garden ingestion pathways. A deposition settling velocity of 0.02 meters per second was assumed in HARP2 for all noninhalation exposure pathways (SCAQMD, 2015).

Acute hazard indices were calculated in HARP2 using the conservative "simple" approach, whereby the highest pollutant concentrations generated by each modeled source group in AERMOD are summed, even if they would not occur at the same time. Although this approach can produce a substantial overstatement of the acute hazard index, it is sufficient to use as a screening approach to demonstrate that the significance threshold would not be exceeded. HARP2 evaluates only the inhalation exposure pathway for the acute hazard index.

5.0 Significance Criteria

The LAHD has adopted a significance threshold of 10 in a million for individual cancer risk (project increment). Based on this threshold, the Revised Project or FEIR Mitigated Project would produce less than significant cancer risk impacts if the maximum cancer risk due to the Project is less than 10 in 1 million (10×10^{-6}) relative to both the Unmitigated and Mitigated Baseline and the Unmitigated and Mitigated Future Baseline. The LAHD has also adopted the air quality significance threshold for cancer burden of 0.5 excess cancer cases in areas with Project-attributable individual cancer risk above one in a million (1×10^{-6}) (SCAQMD, 2015b). In addition, the LAHD has adopted the significance threshold of 1.0 for chronic and acute non-cancer hazard indices; the Revised Project or FEIR Mitigated Project would produce less than significant non-cancer impacts if the chronic and acute hazard indices are less than 1.0 (SCAQMD, 2015b).

6.0 Predicted Incremental Health Impacts

6.1 Revised Project Relative to the Mitigated Baseline

Table B3-6 presents the maximum predicted health impacts of the Revised Project relative to the Mitigated Baseline. The table includes estimates of individual cancer risk, chronic noncancer hazard index, and acute noncancer hazard index at the maximally exposed residential, occupational, and sensitive receptors. Results are presented for the Revised Project (before subtracting baseline), Mitigated Baseline, Revised Project Minus Mitigated Baseline increment, Future Mitigated Baseline, and the Revised Project Minus Future Mitigated Baseline increment (the latter two categories are applicable only to cancer risk). The table also presents the population cancer burden increments for the Revised Project relative to the Mitigated Baseline and Future Mitigated Baseline.

Figure B3-4 shows the locations of the maximum predicted individual cancer risk, chronic hazard index, and acute hazard index increments for the Revised Project relative to the Mitigated Baseline and Future Mitigated Baseline.

Table B3-6. Maximum Health Impacts Estimated for the Revised Project Relative to the Mitigated Baseline

Health Impact	Receptor Type	Revised Project [b]	Mitigated Baseline	Revised Project Minus Mitigated Baseline [c,d]	Future Mitigated Baseline	Revised Project Minus Future Mitigated Baseline [c]	Significance Threshold	Threshold Exceeded? [a]
Individual Cancer Risk	Residential	48.2 × 10-6 48.2 in a million	50.4 × 10-6 50.4 in a million	23.1 × 10-6 **23.1 in a million**	39.4 × 10-6 39.4 in a million	28.2 × 10-6 **28.2 in a million**	10×10^{-6} 10 in a million	Yes
	Occupational	19.0 × 10-6 19.0 in a million	20.1 × 10-6 20.1 in a million	8.8 × 10-6 8.8 in a million	11.1 × 10-6 11.1 in a million	10.6 × 10-6 **10.6 in a million**		Yes
	Sensitive	31.2 × 10-6 31.2 in a million	32.7 × 10-6 32.7 in a million	20.5 × 10-6 **20.5 in a million**	25.8 × 10-6 25.8 in a million	22.6 × 10-6 **22.6 in a million**		Yes
Chronic Hazard Index	Residential	0.11	0.14	< 0	n/a [e]	n/a [e]	1.0	No
	Occupational	0.35	0.64	0.01	n/a	n/a		No
	Sensitive	0.22	0.38	< 0	n/a	n/a		No
Acute Hazard Index	Residential	0.18	0.14	0.05	n/a	n/a	1.0	No
	Occupational	0.31	0.33	0.08	n/a	n/a		No
	Sensitive	0.22	0.21	0.04	n/a	n/a		No
Population Cancer Burden			Revised Project Minus Mitigated Baseline		Revised Project Minus Future Mitigated Baseline		0.5	No
			0.12		0.28			

Notes:

[a] The significance thresholds apply only to the two Project increments: "Revised Project Minus Mitigated Baseline" and, for cancer risk and cancer burden, "Revised Project Minus Future Mitigated Baseline". Exceedances of the thresholds are indicated in **bold**.

[b] The "Revised Project" column represents the maximum Revised Project health values prior to subtracting baseline.

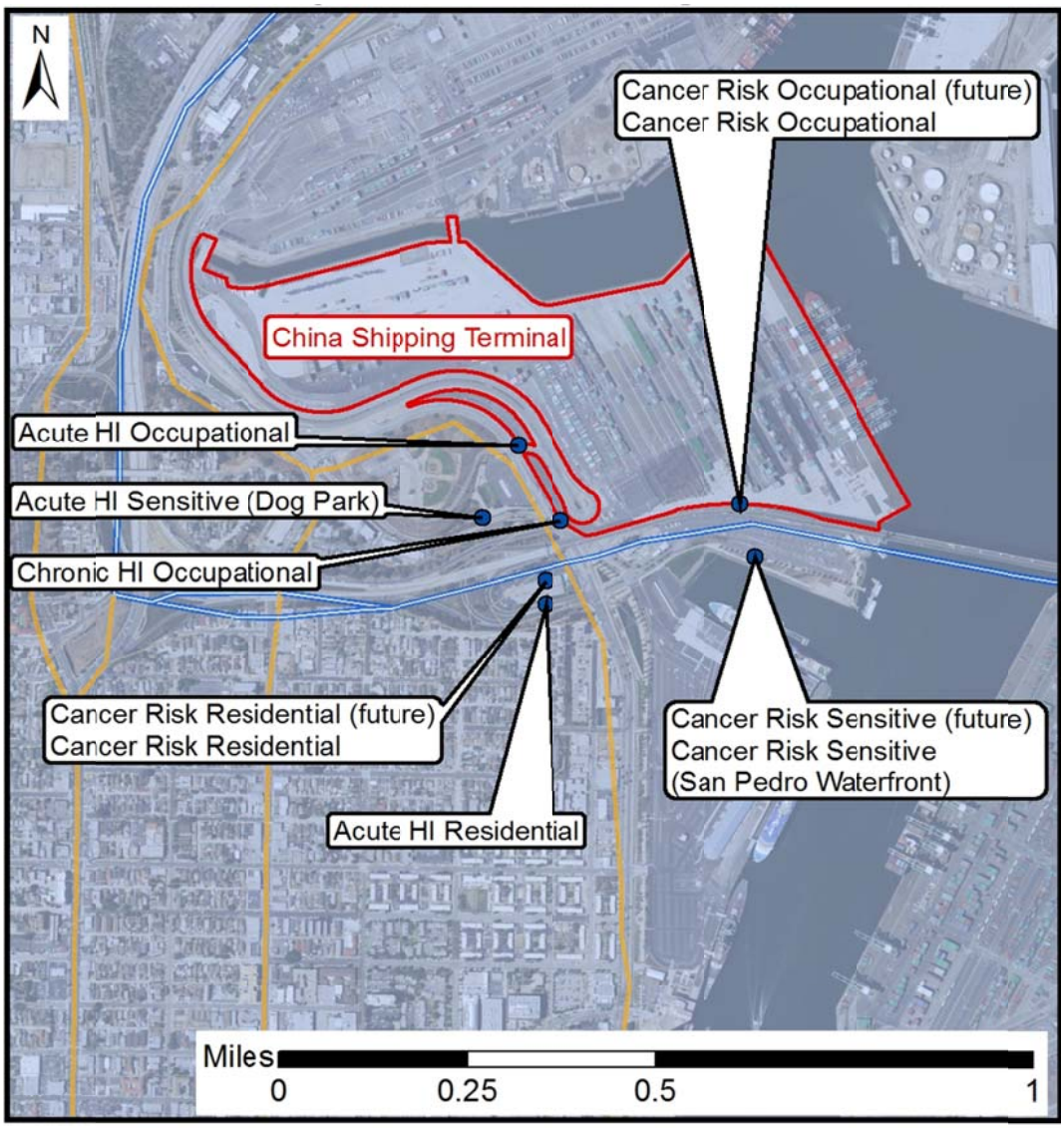
[c] The maximum health values for the "Revised Project", "Mitigated Baseline", and "Revised Project Minus Mitigated Baseline" shown in the table may not occur at the same receptor location. Therefore, the maximum health values for the "Revised Project" and "Mitigated Baseline" may not necessarily subtract to equal the maximum health value for the "Revised Project Minus Mitigated Baseline". The same is true for the "Revised Project", "Future Mitigated Baseline", and "Revised Project Minus Future Mitigated Baseline" maximum health values. The example given in the text provides more explanation on the determination of maximum health values.

[d] A maximum health value increment less than zero means that the Project health value would be less than the Baseline health value at every modeled receptor.

[e] Future Mitigated Baseline health values are not applicable to chronic and acute hazard indices, as explained in Section 2.1.

[f] Each positive result shown in the table for cancer risk, chronic hazard index, and acute hazard index represents the receptor location with the maximum modeled health value. The health values at all other modeled receptors would be less than the values in the table.

Figure B3-4. Locations of Maximum Health Impacts Estimated for the Revised Project Relative to the Mitigated Baseline



1. Cancer risk increments labelled "(future)" denote the increment relative to the future baseline. All other increments are relative to the 2014 baseline.
2. Receptors with negative increments are not shown.

The maximum health values for the Revised Project (before subtracting Baseline), Baselines, and Project increments (Revised Project Minus Mitigated Baseline and Revised Project Minus Future Mitigated Baseline) in Table B3-6 do not always occur at the same receptor location. This means that the displayed Revised Project increments are not necessarily equal to the displayed Revised Project results minus the displayed Baseline results, although all displayed values are correct. Instead, an increment must be

calculated at each of the hundreds of modeled receptors, and the receptor with the highest increment is presented in the table. The following example shows how the maximum "Revised Project Minus Mitigated Baseline" increment for cancer risk at a residential receptor, shown in the first row of results in Table B3-6, was determined. The value of 23.1 in a million is predicted to occur at modeled Receptor No. 1888, in San Pedro, west of Harbor Boulevard, near the southwest terminal boundary.

Example—Determine "Revised Project Minus Mitigated Baseline" Increment at Receptor No. 1888:

- "Revised Project" cancer risk, Receptor No. 1888 = 48.2 in a million (shown in the Table B3-6 because this receptor is also the location of the maximum Revised Project cancer risk before subtracting Baseline)
- "Mitigated Baseline" cancer risk, Receptor No. 1888 = 25.1 in a million (not shown in the table because this receptor is not the location of the maximum Mitigated Baseline cancer risk)
- "Revised Project Minus Mitigated Baseline" increment, Receptor No. 1888 = 48.2 – 25.1 = 23.1 in a million (shown in the table)

After performing an increment calculation similar to the above example at every modeled receptor, it was determined that Receptor No. 1888 has the highest Revised Project increment of any residential receptor. Therefore, its value of 23.1 in a million is presented in Table B3-6. In this example, Receptor 1888 also happens to be the maximum residential receptor for the "Revised Project" before subtracting Baseline (hence, its value of 48.2 in a million is also presented in Table B3-6). However, Receptor 1888 is *not* the maximum residential receptor for the "Mitigated Baseline"; its maximum of 50.4 in a million (shown in the table) occurs at Receptor No. 874. The Project increment at Receptor No. 874 is -5.6 in a million (a risk reduction), less than the maximum increment of 23.1 in a million at Receptor No. 1888.

Although the above example shows the cancer risk increment calculation at just one modeled receptor, the complete determination of the maximum increment involves this same type of calculation at more than 2,600 modeled receptors prior to selection of the maximum receptor. All of the increments for individual cancer risk, chronic hazard index, and acute hazard index for all scenarios are determined in a similar way.

Table B3-6 shows that the Revised Project would produce the following health risk impacts relative to the Mitigated Baseline and Future Mitigated Baseline:

6.1.1 Individual Cancer Risk

In relation to the Mitigated Baseline, the individual cancer risk is predicted to be greater than the significance threshold at the maximally exposed residential and sensitive receptors. As noted in the above risk calculation example, the maximum risk of 23.1 in a million at a residential receptor is predicted to occur in San Pedro, west of Harbor Boulevard, near the southwest terminal boundary. The maximum risk of 20.5 in a million at a sensitive receptor is predicted to occur in a recreational area, on the San Pedro waterfront, south of the terminal. The maximum risk at an occupational receptor would be less than the significance threshold.

In relation to the Future Mitigated Baseline, the individual cancer risk is predicted to be greater than the significance threshold at the maximally exposed residential, occupational, and sensitive receptors. The maximum risk of 28.2 in a million at a residential receptor is predicted to occur in San Pedro, west of Harbor Boulevard, near the southwest terminal boundary. The maximum risk of 10.6 in a million at an occupational receptor is predicted to occur along the southern terminal boundary. The maximum risk of 22.6 in a million at a sensitive receptor is predicted to occur in a recreational area, on the San Pedro waterfront, south of the terminal.

Table B3-7 shows the emission source contributions to cancer risk from the Revised Project at the residential, occupational, and sensitive receptor locations with the highest predicted cancer risk increments relative to the Future Mitigated Baseline. The highest source contributor is CHE, which would contribute 68 to 91 percent of the risk, depending on the receptor. The second highest source contributor is trucks (both on- and off-terminal), which would contribute 5 to 18 percent.

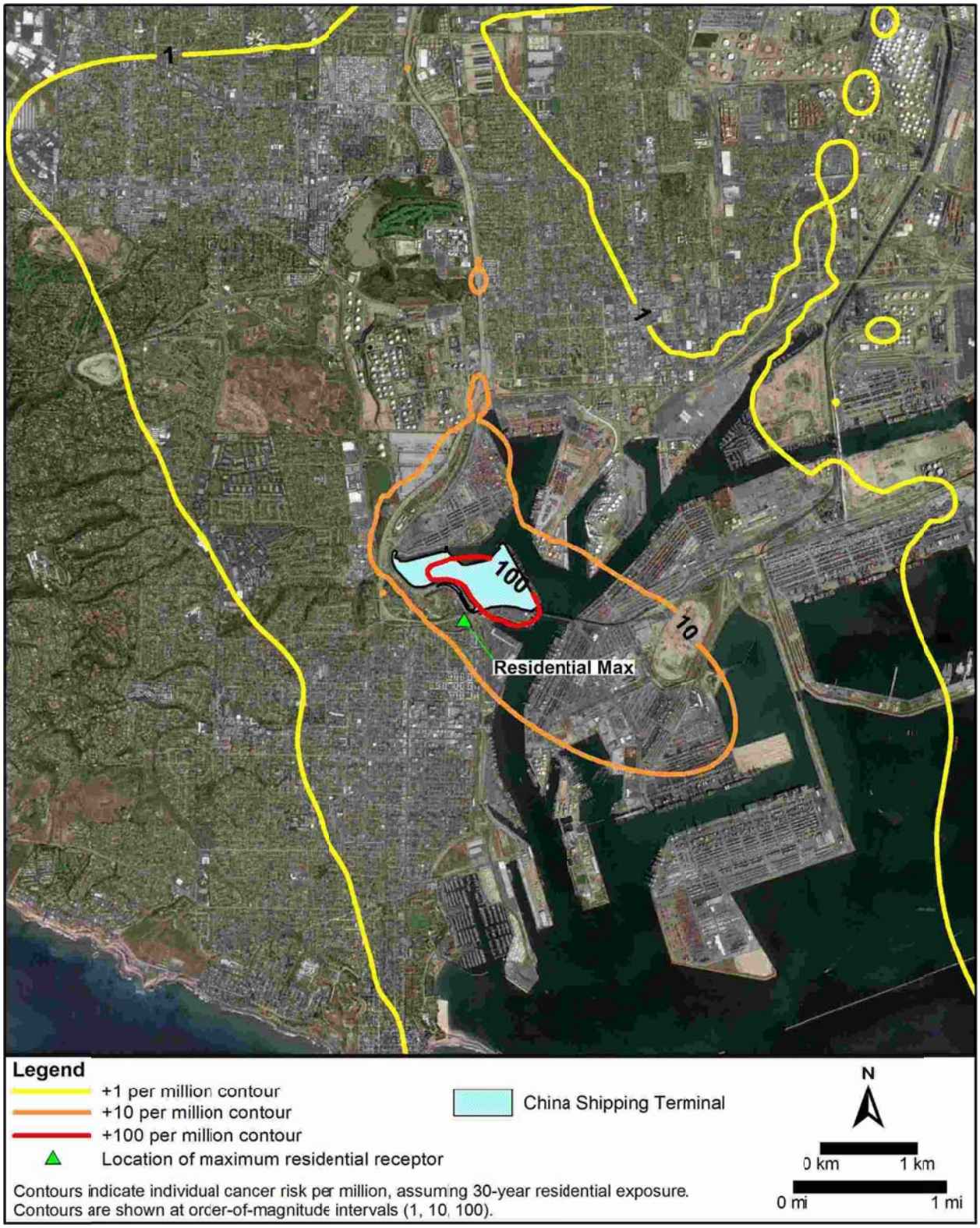
Table B3-7. Source Contributions to Cancer Risk at the Maximum Increment Receptors for the Revised Project

Source Category	Maximum Residential Receptor	Maximum Occupational Receptor	Maximum Sensitive Receptor
Ships in Transit	2.4%	0.9%	0.8%
Ships at Berth	3.2%	0.9%	1.3%
Ships at Anchorage	0.8%	0.1%	0.3%
Tugboats	1.5%	0.5%	0.9%
Trucks at Gates and On-Terminal	4.8%	4.1%	3.8%
Trucks Driving Off-Terminal	13.4%	0.9%	1.3%
Switch Locomotives	1.8%	0.2%	0.3%
Line Haul Locomotives	3.8%	1.0%	1.6%
Cargo Handling Equipment	67.7%	91.4%	89.6%
Worker Vehicles	0.6%	0.0%	0.1%

Note: Contributions are from Revised Project sources prior to subtracting baseline.

Figure B3-5 shows individual cancer risk contours of the Revised Project Minus Future Mitigated Baseline, assuming residential (30-year) exposure parameters. Incremental risks relative to the Future Mitigated Baseline would always be greater than those relative to the Mitigated Baseline, so only the increments relative to the Future Mitigated Baseline are shown in the figure. The location of the residential receptor with the highest individual cancer risk increment of 28.2 in a million is also shown in the figure.

Figure B3-5. Isopleths of 30-Year Residential Cancer Risk for the Revised Project Minus Future Mitigated Baseline



6.1.2 Population Cancer Burden

The cancer burden increments for the Revised Project are predicted to be less than the significance threshold relative to both the Mitigated Baseline and Future Mitigated Baseline.

6.1.3 Chronic and Acute Hazard Indices

The maximum chronic and acute hazard index increments are predicted to be less than the significance threshold for all receptor types.

6.2 Revised Project Relative to the Unmitigated Baseline

Table B3-8 presents the maximum predicted health impacts of the Revised Project relative to the Unmitigated Baseline. The table includes estimates of individual cancer risk, chronic noncancer hazard index, and acute noncancer hazard index at the maximally exposed residential, occupational, and sensitive receptors. Results are presented for the Revised Project (before subtracting baseline), Unmitigated Baseline, Revised Project Minus Unmitigated Baseline increment, Future Unmitigated Baseline, and the Revised Project Minus Future Unmitigated Baseline increment (the latter two categories are applicable only to cancer risk). The table also presents the population cancer burden increments for the Revised Project relative to the Unmitigated Baseline and Future Unmitigated Baseline.

Figures B3-6a and 6b show the locations of the maximum predicted individual cancer risk, chronic hazard index, and acute hazard index increments for the Revised Project relative to the Unmitigated Baseline and Future Unmitigated Baseline (locations with negative increments are not shown).

Table B3-8. Maximum Health Impacts Estimated for the Revised Project Relative to the Unmitigated Baseline

Health Impact	Receptor Type	Revised Project [b]	Unmitigated Baseline	Revised Project Minus Unmitigated Baseline [c,d]	Future Unmitigated Baseline	Revised Project Minus Future Unmitigated Baseline [c]	Significance Threshold	Threshold Exceeded? [a]
Individual Cancer Risk	Residential	48.2 × 10-6 48.2 in a million	67.2 × 10-6 67.2 in a million	0.07 × 10-6 0.07 in a million	59.4 × 10-6 59.4 in a million	0.1 × 10-6 0.1 in a million	10×10^{-6} 10 in a million	No
	Occupational	19.0 × 10-6 19.0 in a million	50.1 × 10-6 50.1 in a million	0.02 × 10-6 0.02 in a million	35.6 × 10-6 35.6 in a million	0.4 × 10-6 0.4 in a million		No
	Sensitive	31.2 × 10-6 31.2 in a million	51.8 × 10-6 51.8 in a million	0.02 × 10-6 0.02 in a million	48.3 × 10-6 48.3 in a million	0.03 × 10-6 0.03 in a million		No
Chronic	Residential	0.11	0.14	< 0	n/a [e]	n/a [e]	1.0	No

Health Impact	Receptor Type	Revised Project [b]	Unmitigated Baseline	Revised Project Minus Unmitigated Baseline [c,d]	Future Unmitigated Baseline	Revised Project Minus Future Unmitigated Baseline [c]	Significance Threshold	Threshold Exceeded? [a]
Hazard Index	Occupational	0.35	0.75	0.002	n/a	n/a		No
	Sensitive	0.22	0.44	< 0	n/a	n/a		No
Acute Hazard Index	Residential	0.18	0.16	0.02	n/a	n/a	1.0	No
	Occupational	0.31	0.38	0.05	n/a	n/a		No
	Sensitive	0.22	0.24	0.02	n/a	n/a		No
Population Cancer Burden			Revised Project Minus Unmitigated Baseline		Revised Project Minus Future Unmitigated Baseline		0.5	No
			0.0		0.0			

Notes:

[a] The significance thresholds apply only to the two Project increments: "Revised Project Minus Unmitigated Baseline" and, for cancer risk and cancer burden, "Revised Project Minus Future Unmitigated Baseline".

[b] The "Revised Project" column represents the maximum Revised Project health values prior to subtracting baseline.

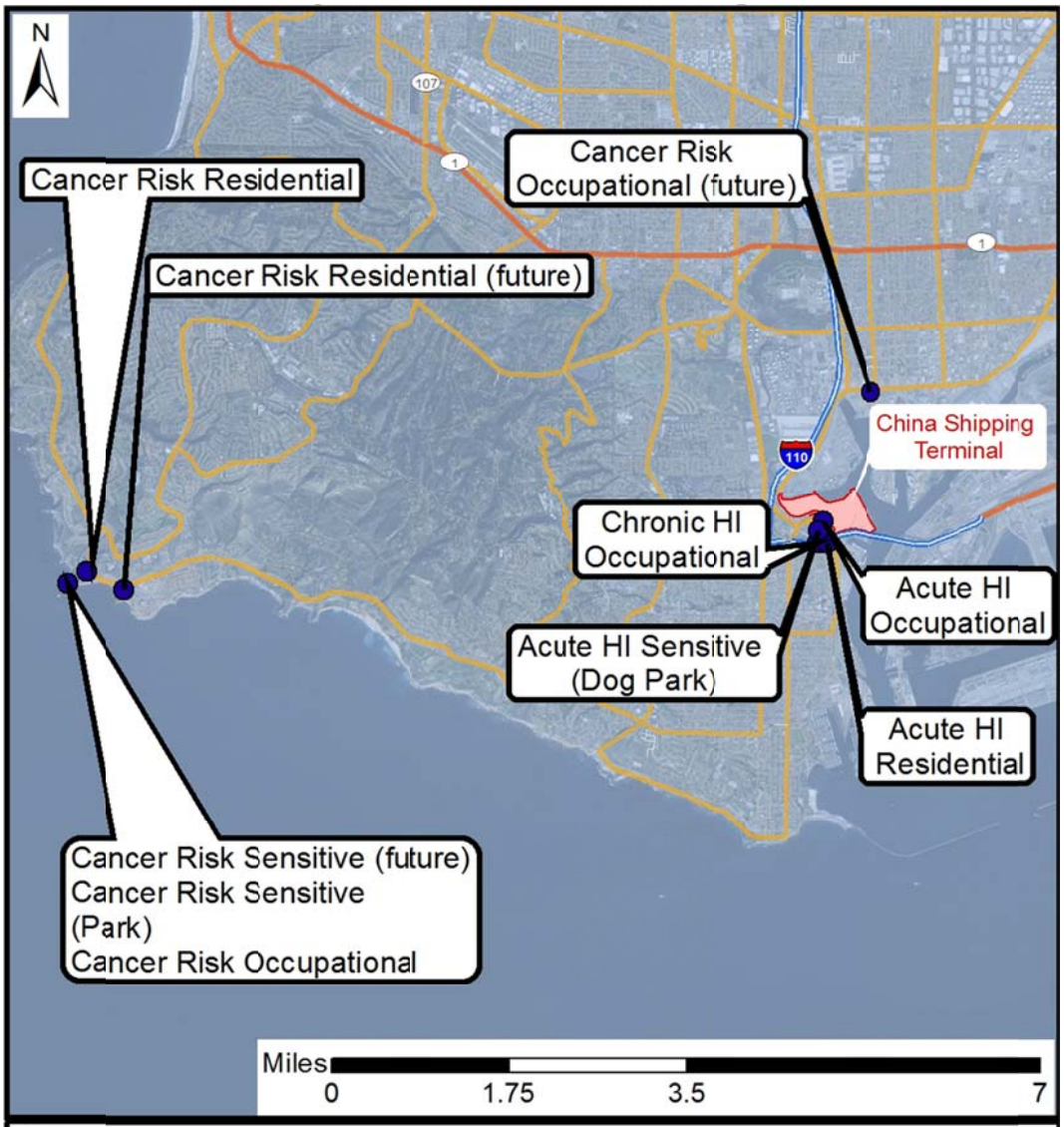
[c] The maximum health values for the "Revised Project", "Unmitigated Baseline", and "Revised Project Minus Unmitigated Baseline" shown in the table may not occur at the same receptor location. Therefore, the maximum health values for the "Revised Project" and "Unmitigated Baseline" may not necessarily subtract to equal the maximum health value for the "Revised Project Minus Unmitigated Baseline". The same is true for the "Revised Project", "Future Unmitigated Baseline", and "Revised Project Minus Future Unmitigated Baseline" maximum health values. The example given in the text provides more explanation on the determination of maximum health values.

[d] A maximum health value increment less than zero means that the Project health value would be less than the Baseline health value at every modeled receptor.

[e] Future Unmitigated Baseline health values are not applicable to chronic and acute hazard indices, as explained in Section 2.1.

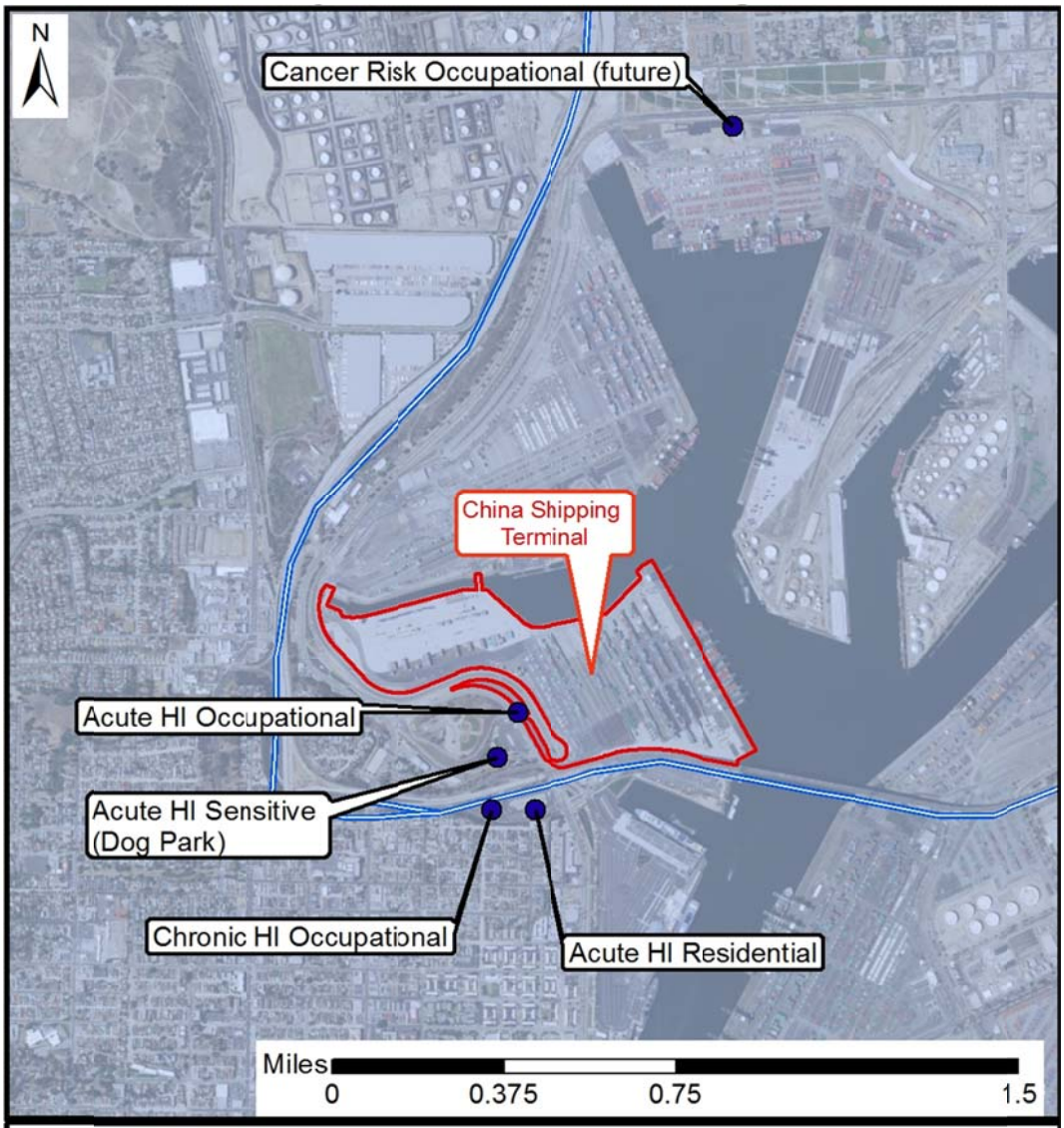
[f] Each positive result shown in the table for cancer risk, chronic hazard index, and acute hazard index represents the receptor location with the maximum modeled health value. The health values at all other modeled receptors would be less than the values in the table.

Figure B3-6a. Locations of Maximum Health Impacts Estimated for the Revised Project Relative to the Unmitigated Baseline (see Fig. B3-6b for detail of locations near China Shipping Terminal)



1. Cancer risk increments labelled "(future)" denote the increment relative to the future baseline. All other increments are relative to the 2014 baseline.
2. Receptors with negative increments are not shown.

Figure B3-6b. Locations of Maximum Health Impacts Estimated for the Revised Project Relative to the Unmitigated Baseline – locations in vicinity of China Shipping Terminal



1. Cancer risk increments labelled "(future)" denote the increment relative to the future baseline. All other increments are relative to the 2014 baseline.
2. Receptors with negative increments are not shown.

Table B3-8 shows that the Revised Project would produce the following health risk impacts relative to the Unmitigated Baseline and Future Unmitigated Baseline:

6.2.1 Individual Cancer Risk

The maximum individual cancer risk increments for the Revised Project are predicted to be less than the significance threshold for all receptor types, relative to both the Unmitigated Baseline and Future Unmitigated Baseline.

6.2.2 Population Cancer Burden

The cancer burden increments for the Revised Project would be zero relative to both the Unmitigated Baseline and Future Unmitigated Baseline, because no census block with a residential population would be exposed to a 70-year cancer risk increment of 1 in a million or greater.

6.2.3 Chronic and Acute Hazard Indices

The maximum chronic and acute hazard index increments are predicted to be less than the significance threshold for all receptor types.

6.3 FEIR Mitigated Project Relative to the Mitigated Baseline

Table B3-9 presents the maximum predicted health impacts of the FEIR Mitigated Project relative to the Mitigated Baseline. The table includes estimates of individual cancer risk, chronic noncancer hazard index, and acute noncancer hazard index at the maximally exposed residential, occupational, and sensitive receptors. Results are presented for the FEIR Mitigated Project (before subtracting baseline), Mitigated Baseline, FEIR Mitigated Project Minus Mitigated Baseline increment, Future Mitigated Baseline, and the FEIR Mitigated Project Minus Future Mitigated Baseline increment (the latter two categories are applicable only to cancer risk). The table also presents the population cancer burden increments for the FEIR Mitigated Project relative to the Mitigated Baseline and Future Mitigated Baseline.

Figure B3-7 shows the locations of the maximum predicted individual cancer risk, chronic hazard index, and acute hazard index increments for the FEIR Mitigated Project relative to the Mitigated Baseline and Future Mitigated Baseline (locations with negative increments are not shown).

Table B3-9. Maximum Health Impacts Estimated for the FEIR Mitigated Project Relative to the Mitigated Baseline

Health Impact	Receptor Type	FEIR Mitigated Project [b]	Mitigated Baseline	FEIR Mitigated Project Minus Mitigated Baseline [c,d]	Future Mitigated Baseline	FEIR Mitigated Project Minus Future Mitigated Baseline [c]	Significance Threshold	Threshold Exceeded? [a]
Individual Cancer Risk	Residential	39.5 × 10-6 39.5 in a million	50.4 × 10-6 50.4 in a million	0.2 × 10-6 0.2 in a million	39.4 × 10-6 39.4 in a million	3.4 × 10-6 3.4 in a million	10×10^{-6} 10 in a million	No
	Occupational	11.7 × 10-6 11.7 in a million	20.1 × 10-6 20.1 in a million	0.6 × 10-6 0.6 in a million	11.1 × 10-6 11.1 in a million	2.5 × 10-6 2.5 in a million		No
	Sensitive	25.8 × 10-6 25.8 in a million	32.7 × 10-6 32.7 in a million	0.2 × 10-6 0.2 in a million	25.8 × 10-6 25.8 in a million	1.3 × 10-6 1.3 in a million		No
Chronic Hazard Index	Residential	0.10	0.14	< 0	n/a [e]	n/a [e]	1.0	No
	Occupational	0.35	0.64	< 0	n/a	n/a		No
	Sensitive	0.22	0.38	< 0	n/a	n/a		No
Acute Hazard Index	Residential	0.12	0.14	0.002	n/a	n/a	1.0	No
	Occupational	0.27	0.33	0.002	n/a	n/a		No
	Sensitive	0.18	0.21	0.002	n/a	n/a		No
Population Cancer Burden			FEIR Mitigated Project Minus Mitigated Baseline		FEIR Mitigated Project Minus Future Mitigated Baseline		0.5	No
			0.0		0.006			

Notes:

[a] The significance thresholds apply only to the two Project increments: "FEIR Mitigated Project Minus Mitigated Baseline" and, for cancer risk and cancer burden, "FEIR Mitigated Project Minus Future Mitigated Baseline".

[b] The "FEIR Mitigated Project" column represents the maximum FEIR Mitigated Project health values prior to subtracting baseline.

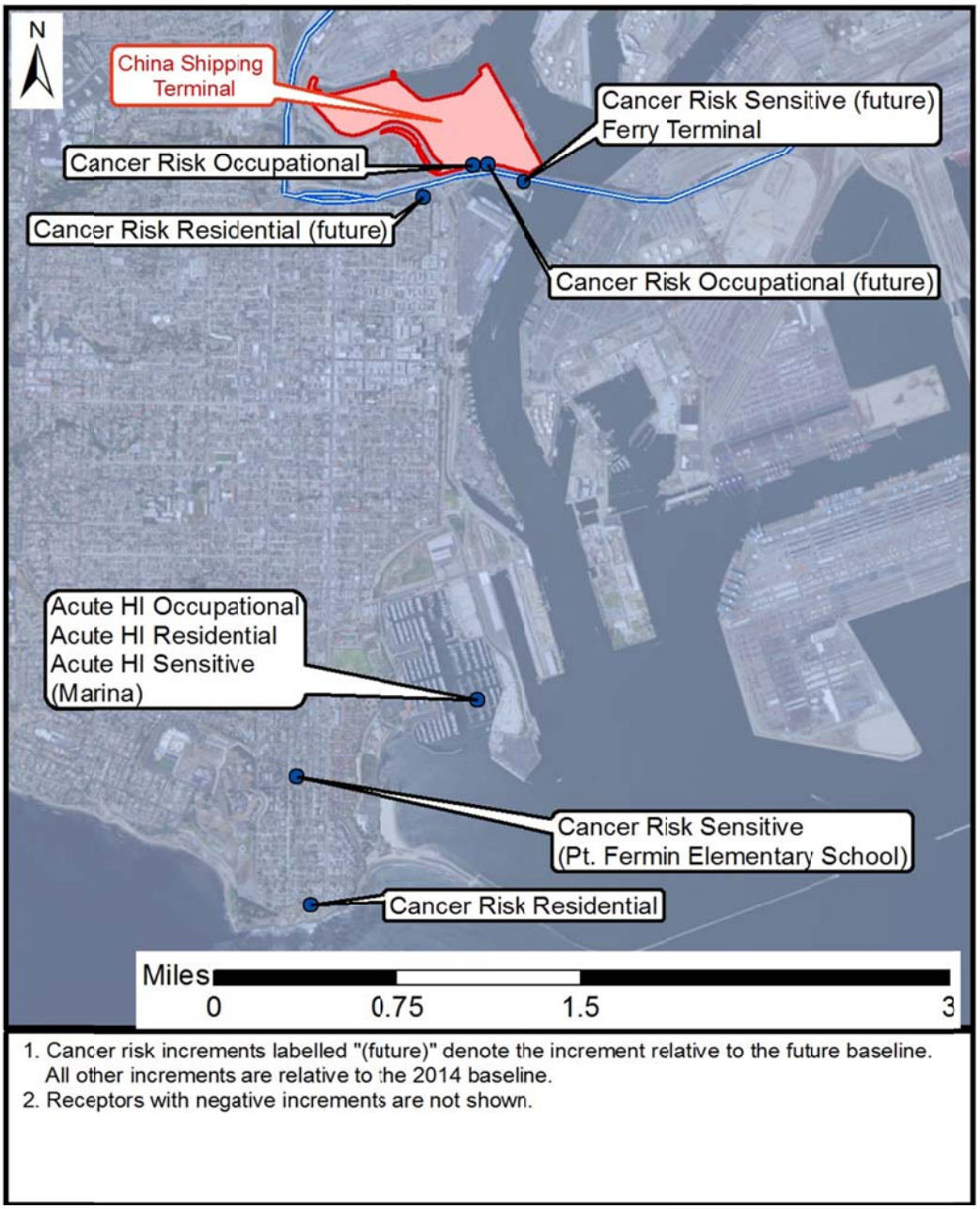
[c] The maximum health values for the "FEIR Mitigated Project", "Mitigated Baseline", and "FEIR Mitigated Project Minus Mitigated Baseline" shown in the table may not occur at the same receptor location. Therefore, the maximum health values for the "FEIR Mitigated Project" and "Mitigated Baseline" may not necessarily subtract to equal the maximum health value for the "FEIR Mitigated Project Minus Mitigated Baseline". The same is true for the "FEIR Mitigated Project", "Future Mitigated Baseline", and "FEIR Mitigated Project Minus Future Mitigated Baseline" maximum health values. The example given in the text provides more explanation on the determination of maximum health values.

[d] A maximum health value increment less than zero means that the Project health value would be less than the Baseline health value at every modeled receptor.

[e] Future Mitigated Baseline health values are not applicable to chronic and acute hazard indices, as explained in Section 2.1.

[f] Each positive result shown in the table for cancer risk, chronic hazard index, and acute hazard index represents the receptor location with the maximum modeled health value. The health values at all other modeled receptors would be less than the values in the table.

Figure B3-7. Locations of Maximum Health Impacts Estimated for the FEIR Mitigated Project Relative to the Mitigated Baseline



1. Cancer risk increments labelled "(future)" denote the increment relative to the future baseline. All other increments are relative to the 2014 baseline.
2. Receptors with negative increments are not shown.

Table B3-9 shows that the FEIR Mitigated Project would produce the following health risk impacts relative to the Mitigated Baseline and Future Mitigated Baseline:

6.3.1 Individual Cancer Risk

The maximum individual cancer risk increments for the FEIR Mitigated Project are predicted to be less than the significance threshold for all receptor types, relative to both the Mitigated Baseline and Future Mitigated Baseline.

Figure B3-8 shows individual cancer risk contours of the FEIR Mitigated Project Minus Future Mitigated Baseline, assuming residential (30-year) exposure parameters. Incremental risks relative to the Future Mitigated Baseline would always be greater than those relative to the Mitigated Baseline, so only the increments relative to the Future Mitigated Baseline are shown in the figure. The location of the residential receptor with the highest individual cancer risk increment of 3.4 in a million is also shown in the figure.

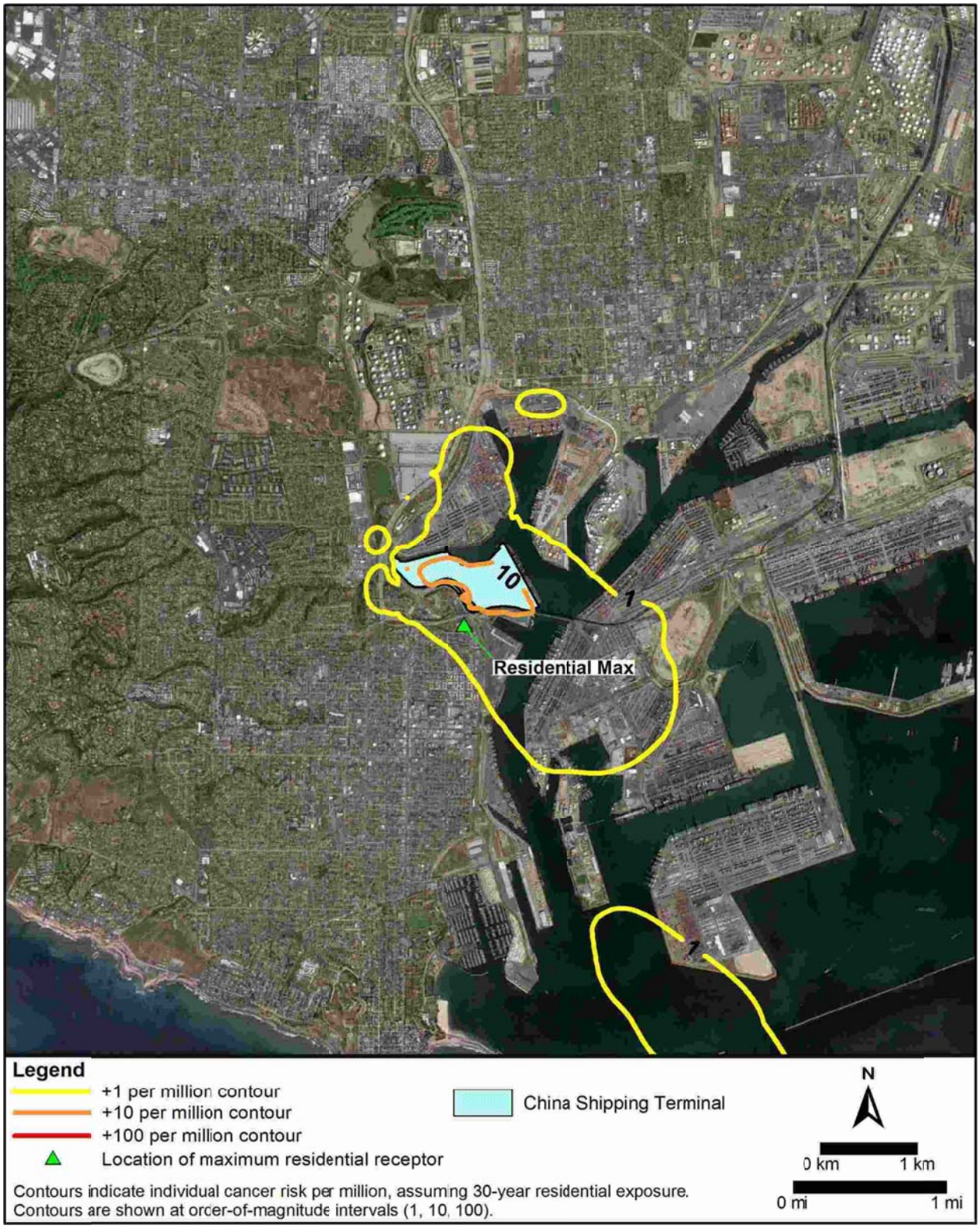
6.3.2 Population Cancer Burden

The cancer burden increments for the FEIR Mitigated Project are predicted to be less than the significance threshold relative to both the Mitigated Baseline and Future Mitigated Baseline.

6.3.3 Chronic and Acute Hazard Indices

The maximum chronic and acute hazard index increments are predicted to be less than the significance threshold for all receptor types.

Figure B3-8. Isopleths of 30-Year Residential Cancer Risk for the FEIR Mitigated Project Minus Future Mitigated Baseline



6.4 FEIR Mitigated Project Relative to the Unmitigated Baseline

Table B3-10 presents the maximum predicted health impacts of the FEIR Mitigated Project relative to the Unmitigated Baseline. The table includes estimates of individual cancer risk, chronic noncancer hazard index, and acute noncancer hazard index at the maximally exposed residential, occupational, and sensitive receptors. Results are presented for the FEIR Mitigated Project (before subtracting baseline), Unmitigated Baseline, FEIR Mitigated Project Minus Unmitigated Baseline increment, Future Unmitigated Baseline, and the FEIR Mitigated Project Minus Future Unmitigated Baseline increment (the latter two categories are applicable only to cancer risk). The table also presents the population cancer burden increments for the FEIR Mitigated Project relative to the Unmitigated Baseline and Future Unmitigated Baseline.

Figure B3-9 shows the locations of the maximum predicted individual cancer risk, chronic hazard index, and acute hazard index increments for the FEIR Mitigated Project relative to the Unmitigated Baseline and Future Unmitigated Baseline (locations with negative increments are not shown).

Table B3-10. Maximum Health Impacts Estimated for the FEIR Mitigated Project Relative to the Unmitigated Baseline

Health Impact	Receptor Type	FEIR Mitigated Project [b]	Unmitigated Baseline	FEIR Mitigated Project Minus Unmitigated Baseline [c,d]	Future Unmitigated Baseline	FEIR Mitigated Project Minus Future Unmitigated Baseline [c,d]	Significance Threshold	Threshold Exceeded? [a]
Individual Cancer Risk	Residential	39.5 × 10-6 39.5 in a million	67.2 × 10-6 67.2 in a million	< 0	59.4 × 10-6 59.4 in a million	< 0	10×10^{-6} 10 in a million	No
	Occupational	11.7 × 10-6 11.7 in a million	50.1 × 10-6 50.1 in a million	0.01 × 10-6 0.01 in a million	35.6 × 10-6 35.6 in a million	0.2 × 10-6 0.2 in a million		No
	Sensitive	25.8 × 10-6 25.8 in a million	51.8 × 10-6 51.8 in a million	< 0	48.3 × 10-6 48.3 in a million	< 0		No
Chronic Hazard Index	Residential	0.10	0.14	< 0	n/a [e]	n/a [e]	1.0	No
	Occupational	0.35	0.75	< 0	n/a	n/a		No
	Sensitive	0.22	0.44	< 0	n/a	n/a		No
Acute Hazard Index	Residential	0.12	0.16	< 0	n/a	n/a	1.0	No
	Occupational	0.27	0.38	< 0	n/a	n/a		No
	Sensitive	0.18	0.24	< 0	n/a	n/a		No
Population Cancer Burden			FEIR Mitigated Project Minus Unmitigated Baseline		FEIR Mitigated Project Minus Future Unmitigated Baseline		0.5	No
			0.0		0.0			

Notes:

[a] The significance thresholds apply only to the two Project increments: "FEIR Mitigated Project Minus Unmitigated Baseline" and, for cancer risk and cancer burden, "FEIR Mitigated Project Minus Future Unmitigated Baseline".

[b] The "FEIR Mitigated Project" column represents the maximum FEIR Mitigated Project health values prior to subtracting baseline.

[c] The maximum health values for the "FEIR Mitigated Project", "Unmitigated Baseline", and "FEIR Mitigated Project Minus Unmitigated Baseline" shown in the table may not occur at the same receptor location. Therefore, the maximum health values for the "FEIR Mitigated Project" and "Unmitigated Baseline" may not necessarily subtract to equal the maximum health value for the "FEIR Mitigated Project Minus Unmitigated Baseline". The same is true for the "FEIR Mitigated Project", "Future Unmitigated Baseline", and "FEIR Mitigated Project Minus Future Unmitigated Baseline" maximum health values. The example given in the text provides more explanation on the determination of maximum health values.

[d] A maximum health value increment less than zero means that the Project health value would be less than the Baseline health value at every modeled receptor.

[e] Future Unmitigated Baseline health values are not applicable to chronic and acute hazard indices, as explained in Section 2.1.

[f] Each positive result shown in the table for cancer risk, chronic hazard index, and acute hazard index represents the receptor location with the maximum modeled health value. The health values at all other modeled receptors would be less than the values in the table.

Figure B3-9. Locations of Maximum Health Impacts Estimated for the FEIR Mitigated Project Relative to the Unmitigated Baseline

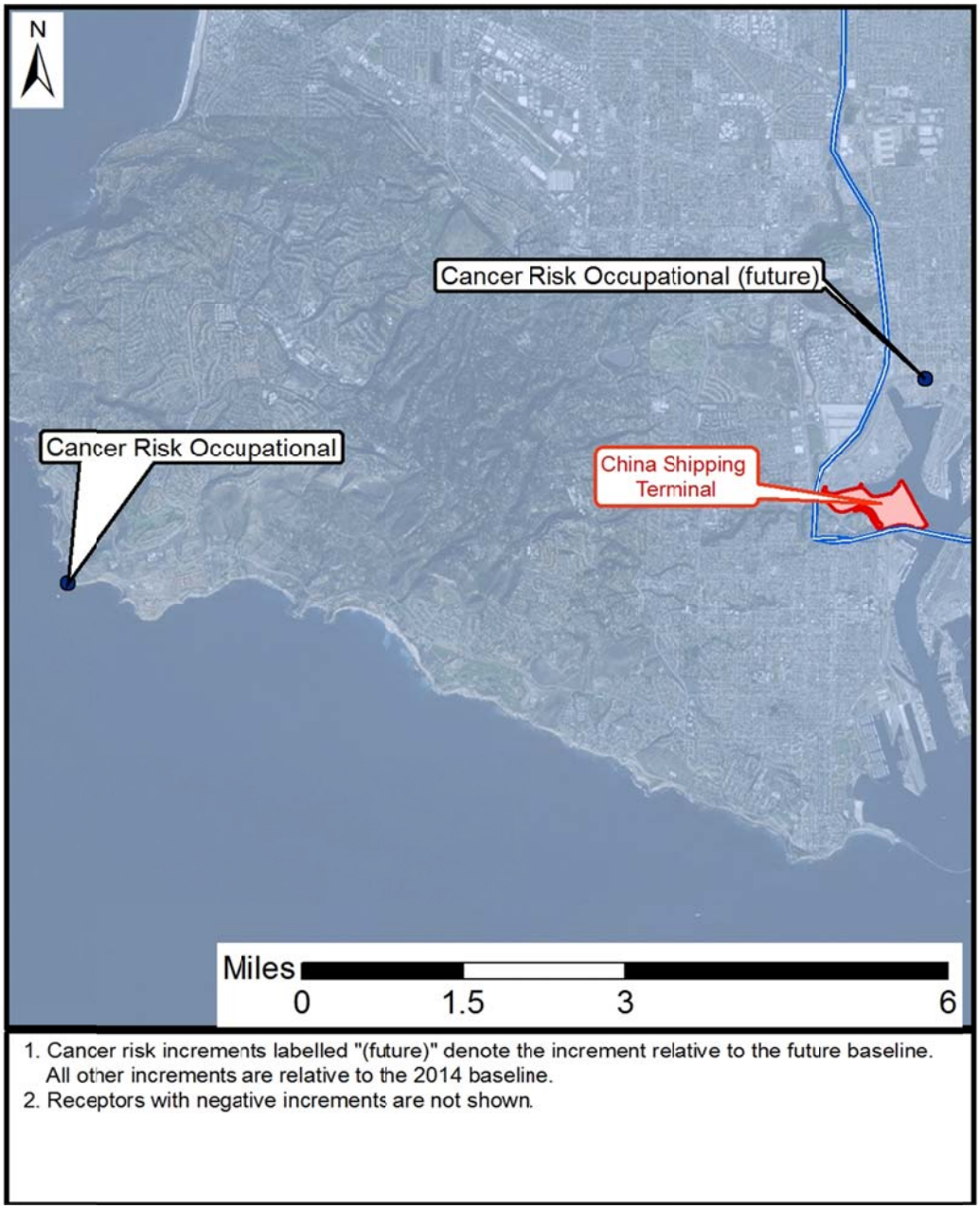


Table B3-10 shows that the FEIR Mitigated Project would produce the following health risk impacts relative to the Unmitigated Baseline and Future Unmitigated Baseline:

6.4.1 Individual Cancer Risk

The maximum individual cancer risk increments for the FEIR Mitigated Project are predicted to be less than the significance threshold for all receptor types, relative to both the Unmitigated Baseline and Future Unmitigated Baseline.

6.4.2 Population Cancer Burden

The cancer burden increments for the FEIR Mitigated Project would be zero relative to both the Unmitigated Baseline and Future Unmitigated Baseline, because no census block with a residential population would be exposed to a 70-year cancer risk increment of 1 in a million or greater.

6.4.3 Chronic and Acute Hazard Indices

The maximum chronic and acute hazard index increments are predicted to be less than the significance threshold for all receptor types.

7.0 Risk Uncertainty

Health risk assessments such as the one presented in this appendix are not intended to provide estimates of the absolute health risk or expected incidence of disease in a population, but instead are conducted to allow comparisons of the potential health impacts of different alternatives to each other and to significance criteria. Consistent with agency guidelines and standard approaches to regulatory risk assessment, this risk assessment used health-protective (conservative) assumptions to provide a margin of safety with respect to human health. OEHHA has provided a discussion of risk uncertainty, which is reiterated here (OEHHA 2015):

OEHHA has striven to use the best science available in developing these risk assessment guidelines. However, there is a great deal of uncertainty associated with the process of risk assessment. The uncertainty arises from lack of data in many areas necessitating the use of assumptions. The assumptions used in these guidelines are designed to err on the side of health protection in order to avoid underestimation of risk to the public. Sources of uncertainty, which may overestimate or underestimate risk, include: 1) extrapolation of toxicity data in animals to humans, 2) uncertainty in the estimation of emissions, 3) uncertainty in the air dispersion models, and 4) uncertainty in the exposure estimates. In addition to uncertainty, there is a natural range or variability in measured parameters defining the exposure scenario. Scientific studies with representative sampling and large enough sample sizes can characterize this variability. In the specific context of a Hot Spots risk assessment, the source of variability with the greatest quantitative impact is variation among the human population in such properties as height, weight, food consumption, breathing rates, and susceptibility to chemical toxicants. OEHHA captures at least some of the variability in exposure by developing data driven distributions of intake rates, where feasible, in the TSD for Exposure Assessment (OEHHA, 2012).

Interactive effects of exposure to more than one carcinogen or toxicant are addressed in the risk assessment with default assumptions of additivity. Cancer risks from all carcinogens addressed in the HRA are added. Similarly, non-cancer hazard quotients for substances impacting the same target organ/system are added to determine the hazard index (HI). Although such effects of multiple chemicals are assumed to be additive by default, several examples of synergism (interactive effects greater than additive) are known. For substances that act synergistically, the HRA could underestimate the risks. Some substances may have antagonistic effects (lessen the toxic effects produced by

another substance). For substances that act antagonistically, the HRA could overestimate the risks.

Other sources of uncertainty, which may underestimate or overestimate risk, can be found in exposure estimates where little or no data are available (e.g., soil half-life and dermal penetration of some substances from a soil matrix).

The differences among species and within human populations usually cannot be easily quantified and incorporated into risk assessments. Factors including metabolism, target site sensitivity, diet, immunological responses, and genetics may influence the response to toxicants. The human population is much more diverse both genetically and culturally (e.g., lifestyle, diet) than inbred experimental animals. The intraspecies variability among humans is expected to be much greater than in laboratory animals. In most cases, cancer potency values have been estimated only for the single most affected tumor site. This represents a source of uncertainty in the cancer risk assessment. Adjustment for tumors at multiple sites induced by some carcinogens may result in a higher potency. Some recent assessments of carcinogens include such adjustments. Other uncertainties arise 1) in the assumptions underlying the dose-response model used, and 2) in extrapolating from large experimental doses, where other toxic effects may compromise the assessment of carcinogenic potential, to usually much smaller environmental doses.

When occupational epidemiological data are used to generate a carcinogenic potency or a health protective level for a non-carcinogen, less uncertainty is involved in the extrapolation from workplace exposures to environmental exposures. When using human data, no interspecies extrapolation is necessary, eliminating a significant source of uncertainty. However, children are a subpopulation whose hematological, nervous, endocrine, and immune systems, for example, are still developing and who may be more sensitive to the effects of toxicants on their developing systems. The worker population and risk estimates based on occupational epidemiological data are more uncertain for children than adults. Current risk assessment guidelines include procedures designed to address the possibly greater sensitivity of infants and children, but there are only a few compounds for which these effects have actually been measured experimentally. In most cases, the adjustment relies on default assumptions which may either underestimate or overestimate the true risks faced by infants and children exposed to toxic substances or carcinogens.

Risk estimates generated by an HRA should not be interpreted as the expected rates of disease in the exposed population but rather as estimates of potential for disease, based on current knowledge and a number of assumptions.

In the Hot Spots program, cancer risk is often expressed as the maximum number of new cases of cancer projected to occur in a population of one million people due to exposure to the cancer-causing substance over a 30-year residential period. However, there is uncertainty associated with the cancer risk estimate. An individual's risk of contracting cancer from exposure to facility emissions may be less or more than the risk calculated in the risk assessment. An individual's risk not only depends on the individual's exposure to a specific chemical but also on his or her genetic background, health, diet, lifestyle choices and other environmental and workplace exposures. OEHHA uses health-protective exposure assumptions to avoid underestimating risk. For example, the risk estimate for airborne exposure to chemical emissions uses the health protective

assumption that the individual has a high breathing rate and exposure began early in life when cancer risk is highest.

A Reference Exposure Level (REL) is the concentration level at or below which no adverse non-cancer health effects are anticipated for the specified exposure duration. RELs are based on the most sensitive, relevant, adverse health effect reported in the medical and toxicological literature. RELs are designed to protect the most sensitive individuals in the population by the inclusion of factors that account for uncertainties as well as individual differences in human susceptibility to chemical exposures. The factors used in the calculation of RELs are meant to err on the side of public health protection in order to avoid underestimation of non-cancer hazards. Exceeding the REL does not automatically indicate an adverse health impact. However, increasing concentrations above the REL value increases the likelihood that the health effect will occur.

Risk assessments under the Hot Spots program are often used to compare one source with another and to prioritize concerns. Consistent approaches to risk assessment are necessary to fulfill this function.

8.0 References

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