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 construction and operation of a new dry bulk processing facility at Berth 191 and on the backlands adjacent to Berth 192-194 in the East Basin of the Port. TACs are compounds that are known or suspected to cause adverse health effects after short-term (acute) or long-term (cancer and chronic non-cancer) exposure. The Proposed Project would import raw materials by ship and truck, produce a low-carbon intensity binder (ground granulated blast furnace slag [GGBFS]) for use as an alternative to cement in a processing facility on site, and load third-party trucks that would transport the GGBFS to local consumers.

The following scenarios were analyzed:

- **Proposed Project:** this scenario represents construction of GGBFS processing facility on the backlands behind Berths 192-194, repairs to the wharf at Berth 191, and operation of the facility (see Section 2.5 for more detail). Effects of specific regulations (described in Table B1-3 of Appendix B1) related to various emission sources and future natural turnover of equipment are considered in the analysis.
- **Alternative 1 – No Project Alternative:** Under this alternative, the Project site would remain largely unused at the backlands of Berth 192-194 as there would be no construction of a new facility. The activities under the No Project Alternative (Alternative 1) are considered negligible in the foreseeable future as no future development has been permitted or approved. Therefore, this alternative was not quantitatively evaluated in the HRA.
- **Alternative 2 – Reduced Project Alternative:** this scenario represents activity associated with all of the elements of the Proposed Project described above but with reduced capacity of the facility to produce GGBFS (see Section 2.7.1.2 for more detail). Effects of regulations related to various emission sources and future natural turnover of equipment are considered in the analysis.
- **Alternative 3 – Product Import Terminal Alternative:** this scenario assumes that there would not be any processing of raw materials and the finished product would come from overseas by vessel. The operations would be essentially the import of the product, storage, and the loading of customer trucks (see Section 2.7.1.3 for more detail). Effects of regulations related to various emission sources and future natural turnover of equipment are considered in the analysis.

To determine whether the Proposed Project would have significant and unavoidable impacts on the environment, impacts resulting from implementation of the Proposed Project and project alternatives are compared to a baseline condition. The difference between the Proposed Project, or an alternative versus the baseline, is then compared to a threshold to determine if the difference between the two is significant. For purposes of defining the California Environmental Quality Act (CEQA) baseline for impact analysis, the Los Angeles Harbor Department (LAHD)'s normal practice is to define the baseline as the conditions in the first full year calendar year preceding publication of the Notice of Preparation (NOP), which was in 2021. However, annual activities at the Project site during 2021 were negligible, resulting in a baseline of zero emissions. Therefore, the health effects of the Proposed Project and alternatives were evaluated by comparing directly to the significance thresholds without subtracting a baseline.

Details of the Proposed Project and alternatives are provided in Chapter 2 of the Environmental Impact Report (EIR), information about emission sources and their estimation methods are summarized in Appendix B1, and information about dispersion modeling methodology are included in Appendix B2.

The Health Risk Assessment (HRA) was prepared in accordance with the California Office of Environmental Health Hazard Assessment (OEHHA)'s Guidance Manual for Preparation of Health Risk Assessments (OEHHA 2015) and the South Coast Air Quality Management District's (SCAQMD) Supplemental Guidelines for Preparing Risk Assessments for the Air Toxics "Hot Spots" Information and Assessment Act (SCAQMD 2020). The HRA includes an evaluation of four different types of health effects: individual excess lifetime cancer risk,[1] population cancer burden, chronic non-cancer hazard index (HI), and acute non-cancer HI.

- Individual excess lifetime 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,[2] and 25 years for an off-site worker). An estimated cancer risk below 10 in 1 million indicates that significant carcinogenic health effects are not expected.
- Population cancer burden is the expected number of additional cancer cases in the population in areas where the maximum cancer risk for residential receptors is greater than or equal to 1 in a million (the "impact zone") from the Proposed Project or the alternative scenarios based on 70-year residential cancer risk estimates. An estimated cancer burden below 0.5 excess cancer cases indicates that the significant population cancer burden is not expected.
- The chronic hazard indices (HI) evaluates the potential for long-term non-cancer adverse health impacts determined by dividing the annual average airborne concentration at the receptor by the chronic reference exposure level (REL, defined as the concentration at which no adverse noncancer health effects are anticipated even in sensitive members of the general population under specified exposure scenarios) for a TAC. A chronic HI below 1.0 indicates that significant adverse non-cancer health effects from long-term exposure are not expected.
- The acute HI is a ratio of maximum 1-hour average concentrations of TACs in the air to established acute RELs. An acute HI below 1.0 indicates that significant adverse non-cancer health effects from short-term exposure are not expected.

The OEHHA HRA guidelines also provide a methodology for determining an 8-hour chronic HI, which evaluates repeated 8-hour exposures over a significant fraction of an individual's lifetime when the Project emits during only a portion of the day (OEHHA 2015). This health risk evaluation is applicable primarily to off-site workers with work schedules that align with the emitting facility's operational schedule. Because the facility

[1] An estimated increased excess lifetime cancer risk is not a specific estimate of the number of expected cancer cases. Rather, it is a plausible upper bound estimate of the probability that a person may develop cancer sometime in his or her lifetime following exposure to the toxic air contaminants evaluated in the HRA.

[2] Other non-residential sensitive receptor types (e.g., schools, child care centers, hospitals, elder cares, and recreational areas, etc.) are expected to have lower exposures than a resident, and were conservatively evaluated under the continuous 30-year residential exposure scenario in this analysis, except for the two nearest non-residential sensitive receptors to the proposed Facility, USC Boathouse and Banning's Landing Community Center, where site-specific exposure assumptions are used in the risk analysis.

is anticipated to operate 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 HI. Moreover, the toxicity factors for the 8-hour chronic HI are less stringent and apply to fewer TACs than the toxicity factors for the chronic HI. As a result, the 8-hour chronic hazard indices associated with the Proposed Project and alternatives would be less than the chronic HIs. 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 United States Environmental Protection Agency (USEPA) dispersion model AERMOD, version 22112 (USEPA 2022), was used to develop dispersion factors (i.e., predicted concentrations per unit of emission) for each source of emissions for annual average and hourly maximum averaging periods outside the Project site. The HRA was conducted in accordance with the guideline from OEHHA (OEHHA 2015) and SCAQMD (SCAQMD 2020) based on output from the AERMOD dispersion model. There would be multi-pathway chemicals as defined by OEHHA (2015)3 emitted from the Project. These multi-pathway chemicals are a small subset of TACs that need to be evaluated by the appropriate non-inhalation pathways, as well as by the inhalation pathway. The Hotspots Analysis and Reporting Program (HARP2) Risk Assessment Standalone Tool (RAST), version 22118 (CARB 2022), was used to perform the health risk calculations for the non-inhalation pathways for the multi-pathway chemicals.

The HRA was developed using a four-step process to estimate the health impacts described above: (1) quantify construction emissions and operational emissions for the Proposed Project and alternatives; (2) identify ground-level receptor locations that may be affected by emissions, including a regular receptor grid as well as specific discrete non-residential sensitive receptor locations nearby such as schools, child care centers, hospitals, elder cares, and recreational areas; (3) perform dispersion modeling analyses to estimate dispersion factors for each modeled source at each receptor location; and (4) estimate the ambient TAC concentrations and characterize the potential health impacts at each receptor location posed by the Proposed Project and alternative scenarios. The following sections provide additional details on the methods used to complete the HRA.

[3] In addition to the inhalation pathway, a small subset of TACs is subject to deposition onto soil, plants, and/or water bodies, and therefore need to be evaluated by the appropriate noninhalation pathways. Such substances are referred to as the multipathway chemicals (See section 5.2 and Table 5.1 of the OEHHA Hot Spot Guidance).

2.0 Emission Estimation Approach

The following on-site construction emission sources were included in the HRA:

- Engine exhaust emissions from off-road construction diesel equipment;
- Engine exhaust emissions from diesel hauling and delivery trucks while driving and idling on-site;
- Engine exhaust emissions from gasoline work vehicles driving and idling within the site during construction; and
- Engine exhaust emission from harbor craft used to support wharf repairs.

In accordance with SCAQMD guidance (SCAQMD 2005), for the construction emissions, only the onsite portion of construction emission were evaluated for health risk impacts. Therefore, off-site driving emissions for vehicles involved in construction were excluded. Emissions from harbor craft while operating in waters immediately adjacent to the Berth 191 were considered on-site and therefore included. Onsite fugitive dust from earth moving activities, wind erosion, or road dust during construction are not included in the health risk per SCAQMD guidance.

The following operational emission sources were included in the HRA:

- Bulk vessels (ships) transiting between the SCAB overwater boundary and the terminal (about 40 nautical miles), maneuvering within harbor, hoteling while at berth, and anchoring when necessary while waiting for an available berth. Ship exhaust emission sources include marine gasoil (MGO)-fueled propulsion engines and auxiliary engines. Based on information from Ecocem, the dry bulk vessels would have small electric boilers; hence, boiler emissions were not modeled.
- Tugboats (harbor craft) used to assist ships while arriving and departing the Port. Assist tugboat activity is assumed to take place within the harbor transit and during vessel maneuvering (in the precautionary zone). Tugboat emission sources include propulsion and auxiliary diesel engines. In addition, this Project features harbor craft (work tugboats) needed to install and remove Yokahama fenders between vessel visits (see Appendix B1 Section 5.2).
- Off-road equipment working on the backlands of Berths 192-194 are used to manage storage piles. Off-road equipment emission sources include diesel engine exhaust.
- Heavy duty trucks hauling raw materials to the site and product from the site. Among the operation modes are on-terminal idling; driving on-terminal; and driving off-terminal along the primary truck routes. Truck emission sources include diesel engine exhaust, tire wear, brake wear, and fugitive dust to account for emissions associated with transportation and handling of cementitious material. The fugitive road dust from operational truck transit off-site does not include TACs; therefore is not evaluated in the health risk analysis.
- Stationary sources that are part of the Orcem manufacturing facility being proposed at the Berths 191-194. These sources would include a natural gas combustion dryer and fugitive dust from material handling of raw materials (granulated blast furnace slag [GBFS] and gypsum) and product (GGBFS) at various drop points on site such as the mill, transfer points in the conveyor system, stockpiles, lifted by on-site mobile sources, etc.

- Based on the chemical composition from test samples for raw materials GBFS and gypsum (see Table 2-1 in Chapter 2), speciation profiles were developed to characterize the TACs in fugitive dust emissions related to handling of GBFS and gypsum during operations. Although TACs were not detected in the GGBFS composition sample test provided by Ecocem, a speciation profile was developed for GGBFS from the mixture of GBFS and gypsum tests (in a ratio of 96% GBFS and 4% gypsum) using the composition of those individual raw materials (AWS Consulting 2014).[4] This speciation profile was conservatively used to represent GGBFS and estimate the TAC emissions in the fugitive dust from material handling of the GGBFS product in the HRA. It should be noted that TACs identified in the chemical tests for GBFS and gypsum are non-carcinogenic chemicals and therefore would only affect the non-cancer hazard indices, but not the cancer risk analysis in this HRA.
- The Proposed Project is estimated to support a total of 242 direct jobs at full operation, 26 of them on-site operating the facility and the remainder in related activities such as trucking., Therefore, worker gasoline light duty vehicles were considered de minimis sources and were not modeled since there would be only 26 facility workers during operations.

2.1 Emissions Used for Cancer Risk

To estimate cancer risk impacts for the construction and operation of the Proposed Project and alternatives, annual volatile organic compound (VOC) and particulate matter (PM) less than 10 micron (PM10) emissions associated with terminal construction and operation were estimated for each year of several long-term exposure periods and speciated into their TAC components as necessary for the HRA analysis (see Section 2.3). The cancer risk exposure periods were 30 years for residents and other types of non-residential sensitive receptors such as schools, child care centers, hospitals, elder cares, and recreational areas,[5] 25 years for occupational receptors, and 70 years for the population cancer burden analysis. The initial year of each Project and alternatives scenarios' exposure period was assumed to be 2024, the start of construction. For example, the 30-year residential exposure period for the Proposed Project scenario was assumed to occur during the years 2024-2054. The magnitude of diesel exhaust emissions from the construction activities taking place on-site, and therefore, closer to the key receptors, are comparable to those from the on-site operational sources when the project throughput peaks in 2027. Because the majority of the mass annual operational emissions, such as those related to vessel transit and harbor craft transit emissions, would occur off-site, towards the ocean, and far away from the receptors it is more conservative to begin the exposure period when emissions would occur nearest to the sensitive receptors, such as those when construction takes place. Therefore, setting the starting year of the HRA to 2024 would account for the health impact from the construction while still yielding conservative risk estimates for the risk assessment.

Annual VOC and PM10 emissions were estimated using the methodology and assumptions described in Appendix B1. Construction emissions were analyzed for construction years 2024 and 2025. Operational emissions were analyzed for the years

[4] The proposed facility would produce the GGBFS product by grinding GBFS and combining it with natural gypsum minerals in the proportions of approximately 95-97% GBFS and 3-5% gypsum (AWS Consulting 2014).

[5] Except for the two nearest non-residential sensitive receptors from the proposed Facility, Banning's Landing and the USC Boathouse, where facility-specific exposure assumptions were used to evaluate the health risks for the non-residential sensitive receptors at these two locations.

2025, 2027, and 2049. Annual emissions for analysis years of 2024, 2025, 2027, and 2049 were modeled to estimate TAC concentrations, and concentrations for the interim years were estimated via linear interpolation using the concentrations of each modeled analysis year. In the case of the 30-year individual residential cancer risk and the 70-year cancer burden calculations, 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 assumed to remain constant at their 2045 values.

2.2 Emissions Used for Non-Cancer Hazard Indices

To estimate chronic and acute non-cancer hazard indices for Proposed Project and alternatives, annual and peak hour construction emissions of VOC and PM10 were calculated for each year of construction, 2024 and 2025; and for the operational analysis years 2025, 2027, and 2049. The emissions were estimated using the methodology and assumptions described in Appendix B1. Because prior Port projects have shown that the chronic and acute HIs are unlikely to exceed the significance thresholds, a conservative screening approach was used where each AERMOD construction and operational emission source was modeled with its maximum annual or hourly emissions even if the emissions would not occur at the same time as the maximum emissions from other sources.

2.3 TAC Speciation

Diesel internal combustion (IC) engines represent the biggest source of TAC emissions associated with the Proposed Project and the Alternatives scenarios in terms of their contribution to cancer and chronic non-cancer health values. Diesel combustion sources include bulk vessel propulsion and auxiliary engines, tugboats, diesel off-road equipment, and diesel heavy-duty trucks. In addition, point and fugitive particulate TAC emissions from facility processes such as material storage, material handling, grinding, and drying of GBFS and gypsum are expected. Based on the chemical profiles for GBFS, TACs include chlorine, manganese, selenium, and silica quartz, The TAC speciation profile for gypsum includes chlorine, manganese, silica quartz, and sulfate. Also, TAC emissions from stationary combustion sources such as the natural gas fired dryer are expected. Although the sample composition tests for GGBFS did not show detectable levels of TACs the speciation profile for the mixture assuming 96% GBFS and 4% gypsum was conservatively used to estimate the TAC emissions for GGBFS fugitive dust.

For the determination of cancer risk and chronic hazard indices, the annual PM10 emissions from the diesel combustion sources were evaluated as a surrogate for diesel exhaust emissions, in accordance with OEHHA's recommendation in the Hot Spots Guidance (2015). The cancer and chronic non-cancer toxicity values for diesel PM10 (DPM) established by OEHHA and CARB (CARB 2023) are representative of whole diesel IC engine exhaust. Therefore, it was not necessary in this analysis to speciate diesel IC engine exhaust into its chemical components for the determination of cancer risk and chronic non-cancer hazard indices. OEHHA and CARB have not established an acute toxicity factors for DPM. Therefore, peak hour VOC and PM10 emissions from all sources, including diesel IC engines, were speciated into their individual TAC components for the determination of acute hazard indices.

HRA sources other than diesel IC engines include natural gas combustion (from dryer), trucks tire and brake wear, and fugitive dust from process equipment and material handling GBFS and gypsum raw materials, as well as the product (GGBFS). For these sources, VOC (where applicable) and PM10 emissions were speciated into their individual TAC components for the determination of cancer risk, chronic hazard indices, and acute hazard indices. The speciation profiles used in the HRA were developed by CARB (2020b). Table B3-1 presents the speciation profiles that were used to convert PM10 emissions and total organic gas (TOG) emissions into individual TACs for all emission sources except for the fugitive PM10 emissions from handling GBFS and gypsum raw materials. Prior to speciation, VOC emissions were converted to TOG using factors provided by CARB (2020b).

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

		Weight Fraction of PM_{10}								Weight Fraction of TOG[a]		
Toxic Air Contaminant [b]	HARP TAC ID	Profile 9901: Diesel IC Engine Exhaust [c]	Profile 4251: Marine Vessels - MGO (0.1 PCT S) [d]	Profile 6239: 2023 Offroad Diesel Vehicle Exht [c,d,e]	Profile 7231: 2023 Heavy-Duty Diesel Truck-idle [c,d,e]	Profile 7233: 2023 Heavy-Duty Diesel Truck-transient [c,d,e]	Profile 472: Tire Wear [c]	Profile 473: Brake Wear [c]	Profile 400: Gasoline Vehicles	Profile 2303: Gasoline Vehicles	Profile 719: Natural Gas IC Engines	Profile 818: Diesel IC Engine Exhaust [d]
DPM	9901	1	0	0	0	0	0	0	0	0	0	0
Arsenic	7440382	0	0	0.000002	0	0	0	0.00001	0	0	0	0
Beryllium	7440417	0	0	0	0	0	0	0	0	0	0	0
Bromine	7726956	0	0	0	0	0	0.000015	0.00004	0.0005	0	0	0
Cadmium	7440439	0	0	0.000026	0	0	0	0	0	0	0	0
Chlorine	7782505	0	0	0.000029	0.000073	0.00018	0.0078	0.0015	0.07	0	0	0
Chromium III	16065831	0	0	0.000077	0.000059	0.00017	0.000029	0.0011	0	0	0	0
Chromium VI	18540299	0	0	0.0000041	0.0000031	0.0000090	0.0000015	0.00006	0.000025	0	0	0
Cobalt	1216	0	0	0.000005	0	0	0	0	0	0	0	0
Copper	7440508	0	0	0.000094	0.000031	0.00015	0.00049	0.011	0.0005	0	0	0
Lead	7439921	0	0	0.000011	0.000001	0.000054	0.00016	0.00005	0	0	0	0
Manganese	7439965	0	0	0.000047	0.000024	0.000064	0.0001	0.0017	0.0005	0	0	0
Mercury	7439976	0	0	0.000008	0	0.000001	0	0	0	0	0	0
Nickel	7440020	0	0	0.000009	0.000023	0.00007	0.00005	0.00066	0.0005	0	0	0
Selenium	7782492	0	0	0.000009	0.000002	0.000006	0.00002	0.00002	0	0	0	0
Sulfates	9960	0	0.08	0.050	0.026	0.098	0.0025	0.033	0.45	0	0	0
Vanadium	7440622	0	0	0.000001	0	0.000005	0	0.00066	0	0	0	0
1,3-Butadiene	106990	0	0	0	0	0	0	0	0	0.0024	0	0.0022
Acetaldehyde	75070	0	0	0	0	0	0	0	0	0.0090	0.0003	0.084
Acrolein	107028	0	0	0	0	0	0	0	0	0.000014	0	0
Benzene	71432	0	0	0	0	0	0	0	0	0.039	0.0011	0.023
Chlorobenzene	108907	0	0	0	0	0	0	0	0	0	0	0
Ethyl Benzene	100414	0	0	0	0	0	0	0	0	0.011	0.0001	0.0035
Formaldehyde	50000	0	0	0	0	0	0	0	0	0.021	0.0081	0.17
Hexane	110543	0	0	0	0	0	0	0	0	0.0078	0.0002	0.0018
Methanol	67561	0	0	0	0	0	0	0	0	0.00020	0	0.00034
Methyl tert-butyl ether	1634044	0	0	0	0	0	0	0	0	0.0047	0	0
Methyl Ethyl Ketone	78933	0	0	0	0	0	0	0	0	0.0015	0	0.017
Naphthalene	91203	0	0	0	0	0	0	0	0	0.0037	0	0.00097
Propylene	115071	0	0	0	0	0	0	0	0	0.022	0.017	0.030
Styrene	100425	0	0	0	0	0	0	0	0	0.0022	0	0.00066
Toluene	108883	0	0	0	0	0	0	0	0	0.048	0.00040	0.017

	Weight Fraction of PM_{10}								Weight Fraction of TOG[a]		
Toxic Air Contaminant [b]	**HARP TAC ID**	**Profile 9901: Diesel IC Engine Exhaust** [c]	**Profile 4251: Marine Vessels - MGO (0.1 PCT S)** [d]	**Profile 6239: 2023 Offroad Diesel Vehicle Exht** [c,d,e]	**Profile 7231: 2023 Heavy-Duty Diesel Truck-idle** [c,d,e]	**Profile 7233: 2023 Heavy-Duty Diesel Truck-transient** [c,d,e]	**Profile 472: Tire Wear** [c]	**Profile 473: Brake Wear** [c]	**Profile 400: Gasoline Vehicles**	**Profile 2303: Gasoline Vehicles**	**Profile 719: Natural Gas IC Engines**	**Profile 818: Diesel IC Engine Exhaust** [d]
Xylenes	1330207	0	0	0	0	0	0	0	0	0	0.00040	0.012
Applicable Sources		All diesel IC engines - harbor craft, marine vessel, truck, offroad equipment (CANCER/ CHRONIC)	Ship main & auxiliary engines (ACUTE ONLY[f])	Construction equipment, onsite mobile equipment, harbor craft (ACUTE ONLY[f])	Diesel truck idling exhaust (ACUTE ONLY[f])	Diesel truck driving exhaust (ACUTE ONLY[f])	Tire wear (CANCER/ CHRONIC/ ACUTE)	Brake wear (CANCER/ CHRONIC/ ACUTE)	Onroad operative and pickup trucks (CANCER/ CHRONIC/ ACUTE)	Onroad operative and pickup trucks (CANCER/CHRONI C/ACUTE)	Dryer Combustion (CANCER/CHRONI C/ACUTE)	All diesel IC engines (ACUTE ONLY[f])

Source for speciation profiles except #9901: Speciation Profiles Used in ARB Modeling. Available: https://ww2.arb.ca.gov/speciation-profiles-used-carb-modeling. Accessed July 2022. See notes for Profiles #9901.
Notes:

[a] TOG speciation profiles were converted to VOC by dividing by the following VOC/TOG ratios: 0.8785 for Profile 818; 0.7276 for Profile 2303; and 0.0931 for Profile 719.
[b] Only TACs that have OEHHA/CARB toxicity factors are shown in the table.
[c] Profile 9901 represents diesel particulate matter (DPM) emissions from diesel internal combustion engines. This profile was used for the determination of cancer risk and the chronic hazard index because the health values for DPM are representative of whole diesel IC engine exhaust.
[d] Profiles No. 4251, 6239, 7231, 7233, and 818 are associated with diesel IC engines and therefore were only used for the determination of the acute hazard index.
[e] Where indicated, hexavalent chromium was assumed to be 5 percent of total chromium, according to CARB's AB2588 Technical Support Document (CARB 1989), page 57. CARB 1989. Technical Guidance Document for the Emission Inventory Criteria and Guidelines Regulation for AB 2588. Technical Support Division. August. Available: https://ww3.arb.ca.gov/ab2588/tgd1989.pdf. The other 95 percent was assumed to be trivalent chromium.
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[f] Profiles for the diesel or diesel-like marine vessel MGO sources were used to speciate the one-hour maximum emissions from these sources for the acute HI evaluations only.

Table B3-2 presents the speciation profiles that were used to convert fugitive PM10 emissions from handling GBFS and gypsum raw materials. The speciation of the raw materials GBFS and gypsum is based on the composition information from the laboratory analyses for these materials provided by Ecocem (Nippon Kaiji Kwntwi Kyokai 2022; Georgia Pacific 2023, AWN Consulting Ltd. 2013). Even though laboratory analysis for GGBFS showed non-detectable level of toxics, fugitive dust related to GGBFS was included using the profile for mixture as shown in Table B3-2 in the health risk analysis.

Table B3-2. Speciation Profiles for Fugitive PM_{10} from Handling GBFS and Gypsum Raw Materials

Toxic Air Contaminant	HARP TAC ID	Weight Fraction of Fugitive PM_{10}		
		Profile GBFS	Profile GYPSUM	Profile Mixture [a]
Chlorine	7782505	0.0001	0.0000013	0.000096
Manganese	7439965	0.002	0.00001	0.00192
Selenium	7782492	0.006	0.0000013	0.00576
Silica quartz	14808607	0.0001	0.0000013	0.000096
Total Sulfate as S	9960	0	0.015	0.00636
Applicable Sources		GBFS storage piles, excavator and FEL fugitive dust, storage silos/ loading silos, material handling (CANCER/ CHRONIC/ ACUTE) [b]	Gypsum storage pile, material handling (CANCER/ CHRONIC/ ACUTE) [b]	Mill, material handling (CANCER/ CHRONIC/ ACUTE) [b]

Notes:
[a] The mixture has a composition of 96% GBFS and 4% gypsum. The speciation for the mixture is used for speciating the fugitive dust emissions for GGBFS.
[b] The TACs listed in this Table were the detected constituents in the laboratory analysis for GBFS or gypsum materials.

3.0 Air Dispersion Modeling

3.1 Model Selection

The air dispersion modeling was performed using the USEPA AERMOD dispersion model, version 22112 (USEPA 2022), based on the Guideline on Air Quality Models (U.S.EPA 2017). The emission source parameters, meteorological data, model options, and temporal distribution assumptions used in the HRA are the same as described in Appendix B2. Sources were grouped into source groups in AERMOD based on those with common speciation profiles.

3.2 Receptors

The HRA modeled TAC concentrations and health effects at 3,331 locations (including 2,332 regular offsite receptors excluding 47 fenceline (or near-fenceline) receptors, 922 receptors on the waterbodies, and 30 receptors on the highways) throughout the Project area. The 2,332 regular offsite receptors include locations of potentially exposed residents, offsite workers (i.e., occupational receptors), and other non-residential sensitive receptors of the local population and were evaluated for the long-ter health risks at these receptors. The 1-hour acute health effects were conservatively evaluated at all 3,331 modelled locations assuming the acute exposure could occur everywhere within the modeling domain including receptor locations on the fenceline, waterbody, and highway. On-site locations were not included in the list of receptors, and health impacts were not presented at receptors located on the marinas except for the areas where live-aboards and recreational areas may be present. Sensitive receptor groups include residents, children, the elderly, and the acutely and chronically ill. The locations of sensitive receptor groups include residencies, schools, childcare centers, hospitals, elder cares, and recreational areas. For health risk assessment purposes, LAHD also treats recreational areas, such as parks, marinas, and public waterfront areas, as sensitive receptor locations (LAHD 2017). For the purposes of this HRA, non-residential sensitive receptors were identified and included in the model. For simplification, the non-residential sensitive receptors were conservatively evaluated using the default residential exposure assumptions assuming 30 years' continuous exposure, except for the two nearest non-residential sensitive receptors to the Project site, Banning's Landing Community Center and the University of Southern California (USC) Boathouse where the health risks were evaluated based on facility-specific exposure assumptions (see details in Section 4.2). This assumption (i.e., using residential exposure assumptions) is conservative and overestimates cancer risk for non-residential sensitive receptors.

Cartesian coordinate receptor grids were used to provide adequate spatial coverage surrounding the Project area to assess ground-level TAC concentrations, identify the extent of impacts, and identify maximum impact locations. AERMOD modeling was conducted with a 50 by 50 meter (m) grid up to 500 m from the facility fence line, a 100 by 100 m grid from 500 m to 1 kilometer (km) from the facility fence line, a 250 by 250 m grid from 1 km to 5 km from the facility fence line, and a 500 by 500 m grid from 5 km to 10 km from the facility fence line.

In addition to the gridded receptor sets, previously identified non-residential sensitive receptors near the Berths 191-194 facility were also included. These receptors included schools, childcare centers, hospitals, elder cares, and recreational areas. Receptors were also located at 20-m spacing along the Berths 191-194 facility fence line.

Figures B3-1 and B3-2 show the full set of receptor points modeled in the HRA. The far field view shows the full extent of on-land receptors modeled, and the near field shows a closer view of the terminal with more densely spaced receptors in areas near sources. Figure B3-3 shows only the non-residential sensitive receptors modeled in the HRA; the figure is paired with Table B3-3, which provides descriptions and addresses of the non-residential sensitive receptors.

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

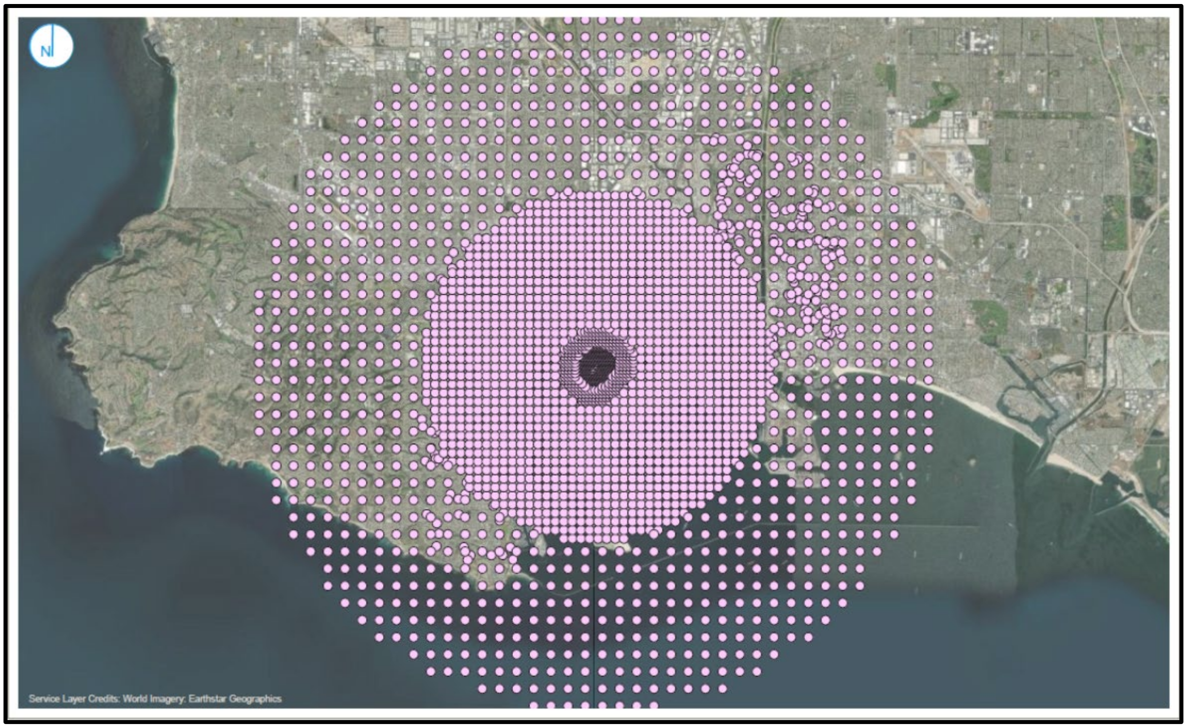

Figure B3-2. HRA Modeled Receptor Locations (Near Field)

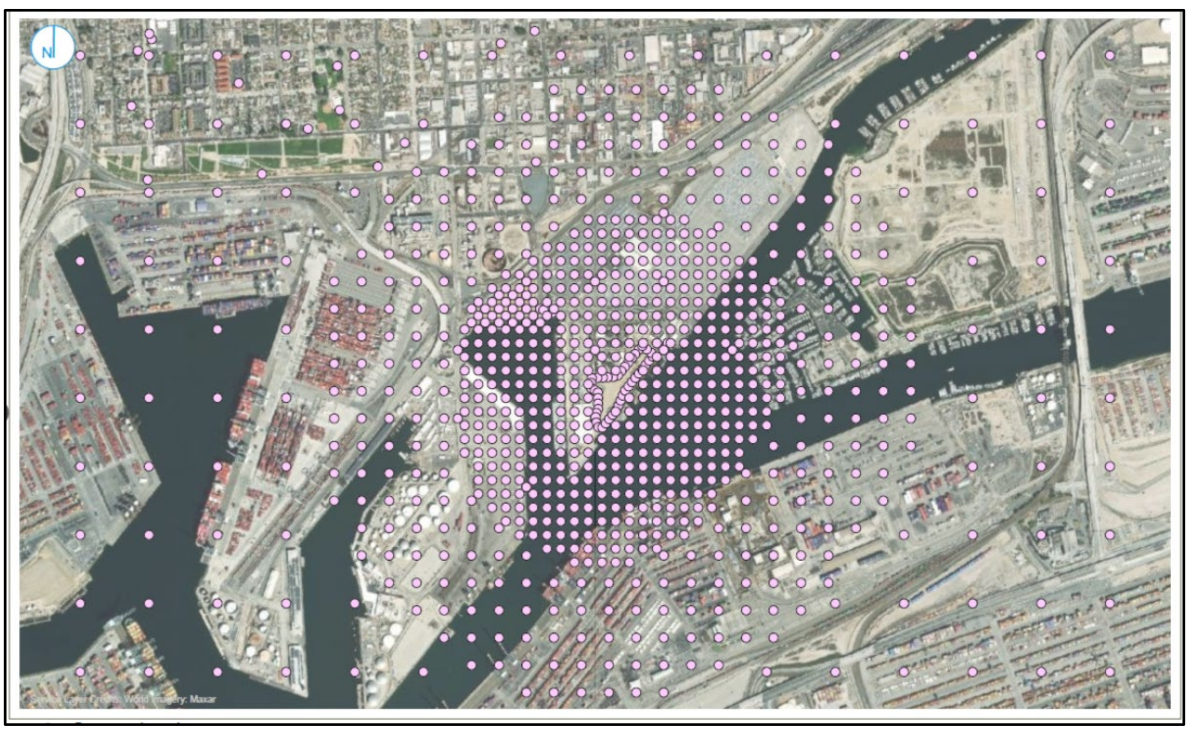

Figure B3-3. HRA Modeled Non-Residential Sensitive Receptors Near Berth 191-194

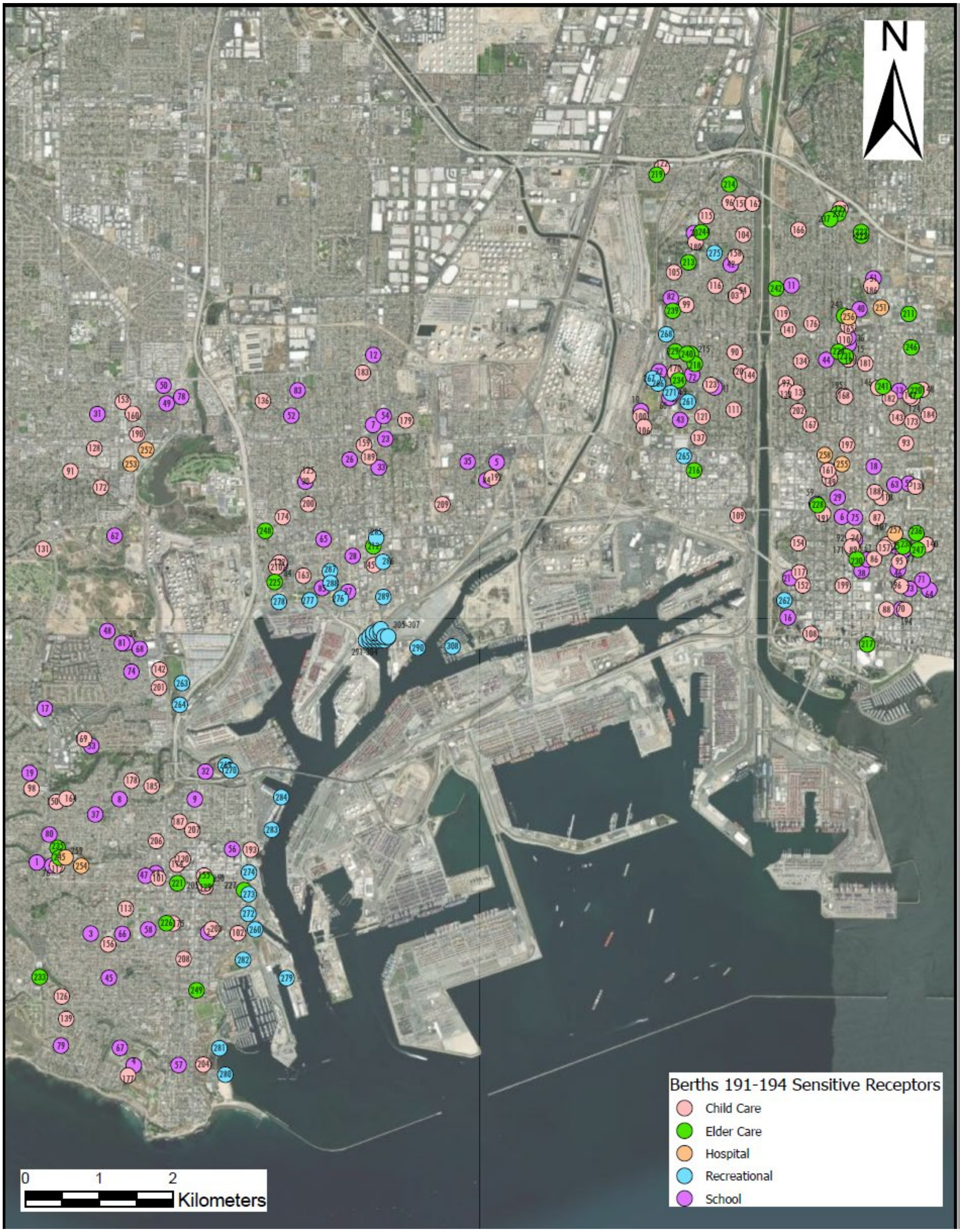

Table B3-3. Non-Residential Sensitive Receptor Descriptions[a]

No.[b]	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

No.[b]	Receptor Description	Street Address	City, State, Zip	Category
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
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

No.[b]	Receptor Description	Street Address	City, State, Zip	Category
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	Learn4Life Wilmington Assurance Learning Academy	707 W C St	Wilmington, CA 90744	School
86	8th Street Early Head Start	820 Long Beach Blvd	Long Beach, CA 90813	Child Care
87	12th Street Head Start	1212 Long Beach Blvd	Long Beach, CA 90806	Child Care
88	A Love 4 Learning Academy	306 Elm Ave	Long Beach, CA 90802	Child Care
89	ABC 123 Long Beach Learning Center	909 Pine Ave	Long Beach, CA 90813	Child Care
90	Agu Family Child Care	4400 Boyar Ave	Long Beach, CA 90807	Child Care
91	Armstrong Academy	1682 Anaheim St	Harbor City, CA 90710	Child Care
92	Aspiranet Foster Family Agency	1043 Pine Ave	Long Beach, CA 90813	Child Care
93	Atlantic Headstart	1862 Atlantic Ave	Long Beach, CA 90806	Child Care
94	Babineaux Family Child Care	2881 Delta Ave	Long Beach, CA 90810	Child Care
95	Benford Family Child Care	530 E 8th St	Long Beach, CA 90813	Child Care
96	Bobo Family Daycare	3532 Delta Ave	Long Beach, CA 90810	Child Care
97	Briggs Family Child Care	Golden Ave	Long Beach, CA 90806	Child Care
98	Brighter Days Montessori	1903 W. Summerland St	San Pedro, CA 90732	Child Care
99	Brown Family Child Care	1831 W Jeanette Pl	Long Beach, CA 90810	Child Care
100	Cabrillo Child Development Center	2205 San Gabriel Ave	Long Beach, CA 90810	Child Care
101	Cabrillo Early Education Center	741 W. 8th St	San Pedro, CA 90731	Child Care
102	Carmen's Cry Baby Care	1509 S. Palos Verdes St	San Pedro, CA 90731	Child Care
103	Carol Daycare	2842 Easy Ave	Long Beach, CA 90810	Child Care
104	Casian Family Child Care	3256 Fashion Ave	Long Beach, CA 90810	Child Care
105	Ceja Family Child Care	2030 W Spring St	Long Beach, CA 90810	Child Care
106	Century Villages at Cabrillo Homeless Housing Community	2001 River Ave	Long Beach, CA 90810	Child Care
107	Child Care Center At St Mary Medical Center	930 Elm Ave	Long Beach, CA 90813	Child Care
108	Childtime Learning Center	1 World Trade Ctr # 199	Long Beach, CA 90813	Child Care
109	City of Long Beach Multi-Service Center; The Play House	1301 W 12th St	Long Beach, CA 90813	Child Care
110	Comprehensive Child Development	2565 Pacific Ave.	Long Beach, CA 90806	Child Care
111	Costa Family Child Care	2085 Easy Ave	Long Beach, CA 90810	Child Care
112	Dahlquist Preschool	1420 W. 7th St	San Pedro, CA 90731	Child Care
113	Davis Family Child Care	957 W 12th St	San Pedro, CA 90731	Child Care
114	Day Star Early Learning Center	631 W. 6th St	San Pedro, CA 90731	Child Care
115	Delgado Family Child Care	3383 Adriatic Ave	Long Beach, CA 90810	Child Care
116	Duran, Ramona Family Day Care	2935 Baltic Ave	Long Beach, CA 90810	Child Care

No.[b]	Receptor Description	Street Address	City, State, Zip	Category
117	Edison Child Development Center	640 W 7th St	Long Beach, CA 90813	Child Care
118	Elm Street Head Start	1425 & 1429 Elm Ave	Long Beach, CA 90806	Child Care
119	Fords Family Day Care	2726 San Francisco Ave	Long Beach, CA 90806	Child Care
120	Franklin Day Care Center	2333 Fashion Ave	Carson, CA 90810	Child Care
121	Gallegos Family Child Care	2024 Adriatic Ave	Long Beach, CA 90810	Child Care
122	Garcia Family Child Care	2145 Wardlow Rd	Long Beach, CA 90810	Child Care
123	Garfield Head Start	2240 Baltic Ave	Long Beach, CA 90810	Child Care
124	Garibay Family Child Care	2172 Lime Ave	Long Beach, CA 90806	Child Care
125	Gomez Family Child Care	1156 Ronan Ave	Wilmington, CA 90744	Child Care
126	Good Shepherd Preschool and Infant Center	1350 W 25th St	San Pedro, CA 90732	Child Care
127	Grace Lutheran Preschool	245 W Wardlow Rd	Long Beach, CA 90807	Child Care
128	Happy Tots Montessori School & Infant Center	1518 Pacific Coast Hwy	Harbor City, CA 90710	Child Care
129	Harbor Area YWCA	437 W 9th St	San Pedro, CA 90731	Child Care
130	Harbor Day Preschool	580 W 6th St	San Pedro, CA 90731	Child Care
131	Harbor Hills Early Education Center	1874 Palos Verdes Dr N	Lomita, CA 90717	Child Care
132	Hawaiian Avenue Children’s Center	909 W. D St	Wilmington, CA 90744	Child Care
133	Hernandez Family Child Care	2200 Golden Ave	Long Beach, CA 90806	Child Care
134	Hernandez Family Child Care	5322 Elm Ave	Long Beach, CA 90805	Child Care
135	Herrera Family Child Care	737 W Hill St	Long Beach, CA 90806	Child Care
136	Jardin De Ninos Home Child Care	1319 W Lowen St	Wilmington, CA 90744	Child Care
137	Job Corps Head Start – Daycare and Nursery	1903 Santa Fe Ave	Long Beach, CA 90810	Child Care
138	Jones Family Child Care	2275 Baltic Ave	Long Beach, CA 90810	Child Care
139	Just Like Home	1346 W 27th St	San Pedro, CA 90731	Child Care
140	Kelly’s Care	943 N Washington Pl	Long Beach, CA 90813	Child Care
141	Kelly’s Kids Daycare Center	855 W Willow St	Long Beach, CA 90806	Child Care
142	Kidazzle Preschool	1921 N Gaffey St	San Pedro, CA 90731	Child Care
143	Kim Family Child Care	2035 Linden Ave	Long Beach, CA 90806	Child Care
144	Lara Family Day Care	1303 W 253rd St	Harbor City, CA 90710	Child Care
145	Lil Cowpoke Preschool	445 N Avalon Blvd	Wilmington, CA 90744	Child Care
146	Long Beach Blvd Head Start	2236 Long Beach Blvd	Long Beach, CA 90806	Child Care
147	Long Beach Center for Child Development	622 E. Hill St	Long Beach, CA 90806	Child Care
148	Long Beach Child Development Center	2222 Olive Ave	Long Beach, CA 90806	Child Care
149	Long Beach Day Nursery – West Branch	1548 Chestnut Ave	Long Beach, CA 90813	Child Care
150	Look Who’s Learning Pre-School	1491 W O’Farrell St	San Pedro, CA 90732	Child Care
151	Lopez Family Child Care	3500 Fashion Ave	Long Beach, CA 90810	Child Care
152	Loves Family Child Care	527 Daisy Ave	Long Beach, CA 90802	Child Care
153	Loving Day Care	1303 253rd St	Harbor City, CA 90710	Child Care
154	Lucy’s Baby Care	940 Maine Ave	Long Beach, CA 90813	Child Care
155	Merry Go Round Nursery School	446 W 8th St	San Pedro, CA 90731	Child Care
156	Mills Family Daycare	1061 W 17th St	San Pedro, CA 90731	Child Care

No.[b]	Receptor Description	Street Address	City, State, Zip	Category
157	Montessori On Elm Preschool + Kindergarten	930 Elm Ave	Long Beach, CA 90813	Child Care
158	Muir Child Development Center	3105 Easy Ave	Long Beach, CA 90810	Child Care
159	Munchkin Center	1348 N Marine Ave	Wilmington, CA 90744	Child Care
160	My First School	25405 Normandie Ave	Harbor City, CA 90710	Child Care
161	N 2 Lil Folkz	1624 Chestnut Ave	Long Beach, CA 90813	Child Care
162	Nero-Morrison Family Child Care	3500 Gale Ave	Long Beach, CA 90810	Child Care
163	New Harbor Vista Child Development Center	909 W D St	Wilmington, CA 90744	Child Care
164	Nursery Rhymes Day Care	1410 W. Ofarrell St	San Pedro, CA 90732	Child Care
165	Oakwood Children’s Center	2650 Pacific Ave	Long Beach, CA 90806	Child Care
166	Old King Cole Day Care	3300 Oregon Ave	Long Beach, CA 90806	Child Care
167	P.A.L. Family Day Care	1980 Daisy Ave	Long Beach, CA 90806	Child Care
168	Pacific Head Start	2179 Pacific Ave	Long Beach, CA 90806	Child Care
169	Park Western Place Children’s Center	1220 Park Western Pl	San Pedro, CA 90732	Child Care
170	Patterson Family Child Care	2133 Canal Ave	Long Beach, CA 90810	Child Care
171	Pine Head Start	927 Pine Ave	Long Beach, CA 90813	Child Care
172	Pines Christian Preschool	1516 W Anaheim St	Harbor City, CA 90710	Child Care
173	Poole Family Child Care	2002 Lime Ave	Long Beach, CA 90806	Child Care
174	Reece Family Day Care	911 King Ave	Wilmington, CA 90744	Child Care
175	Robin’s Nest Day Care	645 W. 14th St	San Pedro, CA 90731	Child Care
176	Ruiz Family Daycare	2670 Daisy Ave	Long Beach, CA 90806	Child Care
177	San Pedro – Wilmington Early Education Center	920 W. 36th St	San Pedro, CA 90731	Child Care
178	San Pedro Child Care	926 W Elberon Ave	San Pedro, CA 90731	Child Care
179	Sanchez Family Child Care	1443 Deepwater Ave	Wilmington, CA 90744	Child Care
180	Sanders Teeny Tiny Preschool	3211 Santa Fe Ave	Long Beach, CA 90810	Child Care
181	Sandford Family Child Care	215 E Burnett St	Long Beach, CA 90806	Child Care
182	Sar Family Child Care	2171 Pasadena Ave	Long Beach, CA 90806	Child Care
183	Small World Learning Center	1749 N Avalon Blvd	Wilmington, CA 90744	Child Care
184	Smart & Manageable	2054 Myrtle Ave	Long Beach, CA 90806	Child Care
185	Smith Family Daycare	787 W Elberon Ave	San Pedro, CA 90731	Child Care
186	Tender Child Care	211 E 29th St	Long Beach, CA 90806	Child Care
187	Toberman Child Care Center	131 N. Grand Ave	San Pedro, CA 90731	Child Care
188	Un Mundo De Amigos Preschool	1480 Long Beach Blvd	Long Beach, CA 90813	Child Care
189	VOA/Cesar Chavez Head Start	1269 N. Avalon St	Wilmington, CA 90744	Child Care
190	Volunteers of America-Parent Child Center	1135 257th St	Harbor City, CA 90710	Child Care
191	West Anaheim Child Care Center	440 W. Anaheim St	Long Beach, CA 90813	Child Care
192	Wilmington Park Children’s Center	1419 E Young St	Wilmington, CA 90744	Child Care
193	World Tots LA Day Care Center	100 W. 5th St	San Pedro, CA 90731	Child Care
194	YMCA GLB Fairfield 3rd Street Preschool	607 E. 3rd St	Long Beach, CA 90802	Child Care
195	YMCA Play & Learn Preschool	2179 Pacific Ave	Long Beach, CA 90806	Child Care
196	Young Horizons Child Development Center	501 Atlantic Ave	Long Beach, CA 90802	Child Care

No.[b]	Receptor Description	Street Address	City, State, Zip	Category
197	Young Horizons Child Development Center	1840 Pacific Ave	Long Beach, CA 90806	Child Care
198	Young Horizons Child Development Center	2418 Pacific Ave	Long Beach, CA 90806	Child Care
199	Young Horizons/El Jardin de la Felicidad	507 Pacific Ave	Long Beach, CA 90813	Child Care
200	Yvette's Daycare	815 W. Opp St	Wilmington, CA 90744	Child Care
201	YWCA Venture Park Pre-School	1921 N. Gaffey St	San Pedro, CA 90731	Child Care
202	Zarate Family Child Care	2496 Oregon Ave	Long Beach, CA 90806	Child Care
203	Rise and Shine WeeCare	388 W 15th St	San Pedro, CA 90731	Child Care
204	Lisas Home Daycare	326 W 33rd St	San Pedro, CA 90731	Child Care
205	Real Family Child Care	444 W 9th St	San Pedro, CA 90731	Child Care
206	CPDC Child Development Center	769 W 3rd St	San Pedro, CA 90731	Child Care
207	Morales Family Childcare	526 W 2nd St	San Pedro, CA 90731	Child Care
208	Heritage Tree Daycare	572 W 19th St	San Pedro, CA 90731	Child Care
209	Pandas Child Care WeeCare	938 McFarland Ave	Wilmington, CA 90744	Child Care
210	Hawaiian Ave Early Education Center	501 Hawaiian Ave	Wilmington, CA 90744	Child Care
211	Akin's Post Acute Rehab Hospital; Atlantic Memorial Healthcare Center	2750 Atlantic Ave	Long Beach, CA 90806	Elder Care
212	American AAA Health Care Center	629 N Avalon Blvd	Wilmington, CA 90744	Elder Care
213	American Gold Star Manor Healthcare	3021 Gold Star Dr	Long Beach, CA 90810	Elder Care
214	Am's Residential Facility-2	3627 Delta Ave	Long Beach, CA 90810	Elder Care
215	Aquarius Home	1765 Aquarius St	Long Beach, CA 90810	Elder Care
216	Bay Breeze Care	1653 Santa Fe Ave	Long Beach, CA 90813	Elder Care
217	Breakers of Long Beach, The	210 E Ocean Blvd	Long Beach, CA 90802	Elder Care
218	Burnett Home Care	1740 W Burnett St	Long Beach, CA 90810	Elder Care
219	Cameron Home	W Cameron St	Long Beach, CA 90810	Elder Care
220	Caruthers Royale Care	2204 Lime Ave	Long Beach, CA 90806	Elder Care
221	Crow Flora Boarding & Care Homes	624 W. 9th St	San Pedro, CA 90731	Elder Care
222	Deluxe Guest Home	3260 Pine Ave	Long Beach, CA 90807	Elder Care
223	Deluxe Guest Home II	3266 Pine Ave	Long Beach, CA 90806	Elder Care
224	Garden, The	2485 Cedar Ave	Long Beach, CA 90806	Elder Care
225	Grandma's House	1218 W D St	Wilmington, CA 90744	Elder Care
226	Harbor Rose Trading Post	1400 S Gaffey St	San Pedro, CA 90731	Elder Care
227	Harbor View House	921 S. Beacon St	San Pedro, CA 90731	Elder Care
228	Harbor View Rehabilitation Center	490 W. 14th Street	Long Beach, CA 90813	Elder Care
229	Hayes Home	2470 Hayes Ave	Long Beach, CA 90810	Elder Care
230	Healthview – Pine Villa Assisted Living	117 E 8th St	Long Beach, CA 90813	Elder Care
231	Heritage Board & Care #2	1509 E 4th St	Long Beach, CA 90802	Elder Care
232	Hillcrest Care Center	3401 Cedar Ave	Long Beach, CA 90807	Elder Care
233	Little Sisters of the Poor	2100 S. Western Ave.	San Pedro, CA 90732	Elder Care
234	Loram Manor	1925 Gemini St	Long Beach, CA 90810	Elder Care
235	Los Palos Convalescent Hospital	1430 W 6th St	San Pedro, CA 90731	Elder Care
236	Olive Tree Home	1035 Olive St	Long Beach, CA 90813	Elder Care

No.[b]	Receptor Description	Street Address	City, State, Zip	Category
237	Pacific Care Nursing Center	3355 Pacific Place	Long Beach, CA 90806	Elder Care
238	Padua House	940 Atlantic Ave	Long Beach, CA 90813	Elder Care
239	Pioneer Homes Of California	2041 W Carolyn Pl	Long Beach, CA 90810	Elder Care
240	Reliable Residential Care	1840 Aquarius St	Long Beach, CA 90810	Elder Care
241	Right At Home	2245 Elm Ave	Long Beach, CA 90806	Elder Care
242	RMR Residential Care Facility, LLC	2900 De Forest Ave	Long Beach, CA 90806	Elder Care
243	Royal Care Skilled Nursing Center	2725 Pacific Avenue	Long Beach, CA 90806	Elder Care
244	Santa Fe Convalescent Hospital	3294 Santa Fe Ave	Long Beach, CA 90810	Elder Care
245	Seacrest Convalescent Hospital	1416 W 6th St	San Pedro, CA 90731	Elder Care
246	Serra Project Long Beach	1043 Elm Ave	Long Beach, CA 90813	Elder Care
247	Villa Maria Care Center	723 E 9th St	Long Beach, CA 90813	Elder Care
248	Wilmington Gardens	1311 W Anaheim St	Wilmington, CA 90744	Elder Care
249	Anew Direction Adult Living	2300 S Pacific Ave	San Pedro, CA 90731	Elder Care
250	Harbor Terrace Retirement Community	435 W 8th St	San Pedro, CA 90731	Elder Care
251	Earl & Lorraine Miller Children’s Hospital; Long Beach Memorial Medical Center and Hospital	2801 Atlantic Ave	Long Beach, CA 90806	Hospital
252	Kaiser Permanente Foundation Hospital	25825 S. Vermont Ave	Harbor City, CA 90710	Hospital
253	Kaiser Permanente South Bay Medical Center	25825 S Vermont Ave	Harbor City, CA 90710	Hospital
254	Little Company of Mary San Pedro Hospital	1300 W. 7th St	San Pedro, CA 90732	Hospital
255	Long Beach Doctors Hospital	1725 Pacific Ave	Long Beach, CA 90813	Hospital
256	Pacific Hospital of Long Beach (Hospital and Convalescent/Nursing Home)	2776 Pacific Ave	Long Beach, CA 90806	Hospital
257	St Mary Medical Center (Hospital and Convalescent/Nursing Home)	1050 Linden Ave	Long Beach, CA 90813	Hospital
258	Tom Redgate Memorial Hospital	1775 Chestnut Ave	Long Beach, CA 90813	Hospital
259	Torrance Memorial Medical Center	3330 Lomita Blvd	Torrance, CA 90505	Hospital
260	Bloch Field	1500 Harbor Blvd	San Pedro, CA 90731	Recreational
261	Admiral Kidd Park	2125 Santa Fe Ave	Long Beach, CA 90810	Recreational
262	Cesar Chavez Park	401 Golden Ave	Long Beach, CA 90802	Recreational
263	Field of Dreams	501 Westmont Drive	San Pedro, CA 90731	Recreational
264	Gaffey Street Community Gardens	1400 N Gaffey Street	San Pedro, CA 90731	Recreational
265	Harbor Japanese Community Cultural Center	1766 Seabright Ave	Long Beach, CA 90813	Recreational
266	Hudson Park	2335 Webster Ave	Long Beach, CA 90810	Recreational
267	Hudson Park Community Garden	2335 Webster Ave	Long Beach, CA 90810	Recreational
268	Khemara Buddhikaram Cambodian Buddhist Temple	2100 W Willow Street	Long Beach, CA 90810	Recreational
269	Knoll Hill Baseball Fields	766 Eastview Little League Drive	San Pedro, CA 90731	Recreational
270	Knoll Hill Dog Park	705-711 N Front Street	San Pedro, CA 90731	Recreational
271	Pramuan Simsriwatna Place of Worship	2015 W Hill Street	Long Beach, CA 90810	Recreational
272	San Pedro Plaza Park	7000 S Beacon Street	San Pedro, CA 90731	Recreational
273	San Pedro Plaza Park	7000 S Beacon Street	San Pedro, CA 90731	Recreational
274	San Pedro Plaza Park	7000 S Beacon Street	San Pedro, CA 90731	Recreational

No.[b]	Receptor Description	Street Address	City, State, Zip	Category
275	Silverado Park Community Center	1545 W 31st Street	Long Beach, CA 90810	Recreational
276	Wilmington Waterfront Park	S. C Street	Wilmington, CA 90744	Recreational
277	Wilmington Waterfront Park	S. C Street	Wilmington, CA 90744	Recreational
278	Wilmington Waterfront Park	S. C Street	Wilmington, CA 90744	Recreational
279	AltaSea	2451 Signal St	San Pedro, CA 90731	Recreational
280	Cabrillo Beach	720 Stephen M. White Dr.	San Pedro, CA 90731	Recreational
281	Cabrillo Beach Youth Waterfront Sports Center	3000 Shoshonean Rd	San Pedro, CA 90731	Recreational
282	22nd Street Park	140 W 22nd St	San Pedro, CA 90731	Recreational
283	Battleship USS Iowa	250 Harbor Blvd	Los Angeles, CA 90731	Recreational
284	Los Angeles World Cruise Center	100 Swinford St	San Pedro, CA 90731	Recreational
285	Wilmington Urgent Care and Family Clinic	714 N Avalon Blvd	Wilmington, CA 90744	Recreational
286	Beacon Light Mission	525 Broad Ave	Wilmington, CA 90744	Recreational
287	Harbor Community Teen Center	612 W E St	Wilmington, CA 90744	Recreational
288	Wilmington Recreation Center	325 N Neptune Ave	Wilmington, CA 90744	Recreational
289	Coastal Comprehensive Treatment Center	117 E Harry Bridges Blvd	Wilmington, CA 90744	Recreational
290	USC Boathouse[c]	400 Yacht St	Wilmington, CA 90744	Recreational
291	Wilmington Waterfront Promenade	S. C Street	Wilmington, CA 90744	Recreational
292	Wilmington Waterfront Promenade	S. C Street	Wilmington, CA 90744	Recreational
293	Wilmington Waterfront Promenade	S. C Street	Wilmington, CA 90744	Recreational
294	Wilmington Waterfront Promenade	S. C Street	Wilmington, CA 90744	Recreational
295	Wilmington Waterfront Promenade	S. C Street	Wilmington, CA 90744	Recreational
296	Wilmington Waterfront Promenade	S. C Street	Wilmington, CA 90744	Recreational
297	Wilmington Waterfront Promenade	S. C Street	Wilmington, CA 90744	Recreational
298	Wilmington Waterfront Promenade	S. C Street	Wilmington, CA 90744	Recreational
299	Wilmington Waterfront Promenade	S. C Street	Wilmington, CA 90744	Recreational
300	Wilmington Waterfront Promenade	S. C Street	Wilmington, CA 90744	Recreational
301	Wilmington Waterfront Promenade	S. C Street	Wilmington, CA 90744	Recreational
302	Wilmington Waterfront Promenade	S. C Street	Wilmington, CA 90744	Recreational
303	Wilmington Waterfront Promenade	S. C Street	Wilmington, CA 90744	Recreational
304	Wilmington Waterfront Promenade	S. C Street	Wilmington, CA 90744	Recreational
305	Banning’s Landing Community Center[c]	100 E Water St	Wilmington, CA 90744	Childcare/Recreational
306	Banning’s Landing Community Center[c]	100 E Water St	Wilmington, CA 90744	Childcare/Recreational
307	Banning’s Landing Community Center[c]	100 E Water St	Wilmington, CA 90744	Childcare/Recreational
308	California Yacht Marina – Wilmington	718 Peninsula Rd Berth 202 #36	Wilmington, CA 90744	Recreational

Notes:

[a] This table summarizes non-residential sensitive receptors.
[b] The receptor numbers correspond to receptor labels in Figure B3-3.
[c] Bannings Landing and the USC Boathouse are the two nearest non-residential sensitive receptors to the proposed facility.

Maximally exposed individual (MEI) locations were selected from the modeled receptor grids for three different receptor types: residential, sensitive (non-residential), and occupational (i.e., the off-site workers). 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.
- The non-residential sensitive MEI was selected from all non-residential sensitive receptors identified near the Proposed Project as shown in Table B3-3 and Figure B3-3 including schools, childcare centers, hospitals, elder cares, and recreational areas such as parks, marinas including areas where live-aboards and recreational users may be present, and public waterfront areas. These non-residential sensitive receptors were treated conservatively with resident exposure.[6]
- The occupational MEI was selected from all industrial/commercial receptors outside the proposed facility boundary that are not located on water or within modeled roadways or railways.

4.0 Health Risk Assessment Approach

The HRA was performed based on the modeled TAC concentrations, following methods recommended by OEHHA (OEHHA 2015) and SCAQMD (SCAQMD 2020) with the use of software HARP2 RAST, version 22118 (CARB 2022). Estimates of individual cancer risk, chronic HI, and acute HI at each modeled receptor for the Project and Alternative scenarios were calculated. For each quantitatively evaluated receptor type (i.e., residential, non-residential sensitive, and occupational), the modeled receptor with the highest heath risk estimate was selected for reporting and comparison to the appropriate significance threshold.

4.1 Toxicity Assessment

The toxicity assessment (also referred to as the dose-response assessment) examines the potential for a TAC to cause adverse health effects in exposed individuals. Toxicity values that were used to estimate the likelihood of adverse effects from the TACs listed in Section 2.3 were identified in this component of the HRA process.

Cancer potency factors established by CARB (CARB 2023) were used to evaluate the probability that a person will contract cancer from the continuous exposures of carcinogenic TACs over the evaluated exposure period using the risk assessment methodology defined in OEHHA Hot Spots Guidance (2015).

To assess the potential for non-cancer health effects resulting from chronic and acute inhalation exposure, OEHHA has established chronic and acute RELs for evaluating the adverse health effects for TACs through the inhalation pathway and oral reference doses (RfDs) for the multi-pathway TACs through the non-inhalation pathway exposures

[6] Except for the two nearest non-residential sensitive receptors to the proposed Facility, USC Boathouse and Banning's Landing, where site-specific exposure assumptions are used in the risk analysis.

(CARB 2023) (see further discussions on the exposure pathways in section 4.2). An REL is an estimate of the continuous inhalation exposure concentration to which the human population (including sensitive subgroups such as children, pregnant and nursing women, and the elderly) may be exposed without appreciable risk of experiencing adverse non-cancer effects. The RfD is an estimate of a daily exposure to the human population (including sensitive subgroups) that is likely to be without an appreciable risk of deleterious effects during a lifetime through the non-inhalation pathways. The chronic HI is the sum of the chemical-specific chronic hazard quotients (HQs) affecting a particular target organ. The acute HI is the sum of the chemical-specific acute HQs affecting a particular target organ (e.g., respiratory system, central nervous system, etc.). An HQ is a chemical's predicted concentration divided by its REL for the inhalation pathway, and/or the chemical's calculated daily average dose divided by its RfD for the inhalation pathways. A separate HI is calculated for each target organ affected by the TACs because not all TACs affect the same target organ. A HI below 1.0 for all affected target organs indicates that adverse non-cancer health effects are not expected.

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

Table B3-4. Toxicity Values Used In the HRA

Toxic Air Contaminant	CASRN	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]	Multipath Chemicals [c]
Acetaldehyde	75-07-0	0.01	140	I	470	D,I	No
Acrolein	107-02-8	--	0.35	I	2.5	D,I	No
Arsenic [a]	7440-38-2	12	0.015	B,C,G,I,J	0.2	B,C,G	Yes
Benzene	71-43-2	0.1	3	E	27	C,E,F	No
1,3-Butadiene	106-99-0	0.6	2	C	660	C	No
Cadmium [a]	7440-43-9	15	0.02	I,M	--	--	Yes
Chlorine	7782-50-5	--	0.2	I	210	D,I	No
Chromium III	16065-83-1	--	0.06	--	0.48	--	No
Cobalt	1-21-6	27	--	--	--	--	No
Copper	7440-50-8	--	--	--	100	I	No
DPM	9-90-1	1.1	5	I	--	--	No
Ethyl benzene	100-41-4	0.0087	2,000	A,C,L,M	--	--	No
Formaldehyde	50-00-0	0.021	9	I	55	D	No
Hexane	110-54-3	--	7,000	G	--	--	No
Hexavalent Chromium [a]	18540-29-9	510	0.2	E,I	--	--	Yes
Lead [a]	7439-92-1	0.042	--	--	--	--	Yes
Manganese	7439-96-5	--	0.09	G	--	--	No
Mercury	7439-97-6	--	0.03	--	0.6	--	Yes
Methanol	67-56-1	--	4,000	C	28,000	G	No
Methyl ethyl ketone	78-93-3	--	--	--	13,000	D,I	No
Methyl tert-butyl ether	1634-04-4	0.0018	8000	A, D, M	--	--	No
Naphthalene	91-20-3	0.12	9	I	--	--	No
Nickel [a]	7440-02-0	0.91	0.014	C,E,I	0.2	F	Yes
Propylene	115-07-1	--	3,000	I	--	--	No
Selenium [a]	7782-49-2	--	20	A,B,G	--	--	No
Silica quartz	14808-60-7	--	3	--	--	--	No

Toxic Air Contaminant	CASRN	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]	Multipath Chemicals [c]
Styrene	100-42-5	--	900	G	21,000	C,D,I	No
Sulfates	9-96-0	--	--	--	120	I	No
Toluene	108-88-3	--	300	C,G,I	37,000	C,D,G,I	No
Vanadium	7440-62-2	--	--	--	30	D,I	No
Xylenes	1330-20-7	--	700	D,G,I	22,000	D,G,I	No

Source: ARB 2022a. Consolidated Table of OEHHA/ARB Approved Risk Assessment Health Values. October 2

Notes:
-- = not available
CASRN = Chemical Abstract Services Registry Number
[a] Arsenic, cadmium, hexavalent chromium, lead, mercury and nickel were evaluated for non-inhalation 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.
[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

[c] Based on the multipath chemicals recommended by OEHHA (2015) for evaluation of health impacts through the non-inhalation pathways.

4.2 Exposure Assessment

Potentially Exposed Populations: As discussed in Section 1, this analysis conservatively evaluated following receptor types:

- Residents;
- Non-residential sensitive receptors (conservatively evaluated with residential exposure assumptions); and
- Occupational receptors (i.e., Off-site workers).

The residential exposure assumptions were conservative for other non-residential sensitive receptor types (i.e., schools, child care centers, hospitals, elder cares, and recreational areas) as residential uses have the longest exposure time, exposure duration and highest exposure frequency. A conservative approach of evaluating all non-residential sensitive receptors using residential exposure assumptions was used in this HRA, except for Banning's Landing and the USC Boathouse, where the two nearest non-residential sensitive receptors are located. Banning's Landing currently is not hosting events or activities; it was conservatively assumed that children who may be present at Banning's Landing in a future afterschool program could be exposed up to 12 hours/day, 180 days/year, for 12 years, starting at age 5 based on historic use and anticipated future use of this facility. USC Boathouse students training at the facility are assumed to be exposed 4 hours/day, 6 days/week, from January to May, and August to November per year for a total of five years based on site-specific information. The live-aboard residents at the California Yacht Marina were classified as sensitive receptors and evaluated using residential assumptions.

Exposure Pathways and Assumptions: When there are multi-pathway chemicals identified in the TACs to evaluate in the HRA, OEHHA Hot Spots Guidance (OEHHA 2015) requires the evaluation of both inhalation and non-inhalation exposure pathways,7 the latter is also referred to as a multi-pathway analysis, for selected multi-pathway chemicals and land use designations in the area being evaluated. Arsenic, cadmium, hexavalent chromium, lead, mercury, and nickel are multi-pathway chemicals as defined by OEHHA (2015).8 Consistent with the recommendations of the OEHHA (OEHHA 2015) and SCAQMD (2020) for conducting a multi-pathway analysis, in addition to the inhalation, several non-inhalation exposure pathways were also evaluated in the HRA, including dermal contact with soil, soil ingestion, home-grown produce ingestion, and mother's milk ingestion (the latter two pathways were only evaluated for the residential exposure scenario).

The exposure parameters used to estimate cancer risks for the inhalation pathway for residents and occupational receptors (i.e., workers) were obtained using risk assessment guidelines from OEHHA (2015) and SCAQMD (2020) and are presented in Table B3-5. Ramboll conducted the multi-pathway analysis using the HARP2 RAST software (CARB 2022), which incorporates the OEHHA 2015 guidelines using exposure assumptions under the OEHHA derived method in RAST software.

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[7] In addition to the inhalation pathway that evaluates the health impacts due to exposures to airborne TACs in the air through inhalation, a small subset of TACs is subject to deposition onto soil, plants, and/or water bodies, and therefore need to be evaluated by the appropriate non-inhalation pathways.

[8] See section 5.2 and Table 5.1 of the OEHHA Hot Spot Guidance.

Calculation of Intake: The dose estimated for each exposure pathway is a function of the concentration of a chemical and the intake of that chemical. The intake factor for inhalation (IFinh) was calculated as follows:

$$IF_{inh} = \frac{DBR * ET * EF * ED * FAH * CF}{AT}$$

Where:

IF_{inh}	=	Intake Factor for Inhalation (m^3/kg-day)
DBR	=	Daily Breathing Rate (L/kg-day)
ET	=	Exposure Time (hours/24 hours)
EF	=	Exposure Frequency (days/year)
ED	=	Exposure Duration (years)
AT	=	Averaging Time (days)
FAH	=	Fraction of Time at Home
CF	=	Conversion Factor, 0.001 (m^3/L)

The chemical intake or dose was estimated by multiplying the inhalation intake factor, IF_{inh}, by the chemical concentration in air (C_i). When coupled with the chemical concentration, this calculation is mathematically equivalent to the dose algorithm given in OEHHA Air Toxics Hot Spots Program guidance (OEHHA 2015).

4.3 Risk Characterization

4.3.1 Estimation of Individual Cancer Risk

Individual cancer risks were estimated as the upper-bound incremental probability that an individual will develop cancer over a lifetime as a direct result of exposure to potential carcinogens. The estimated risk was expressed as a unitless probability. The cancer risk attributed to a chemical was calculated by multiplying the chemical intake or dose at the human exchange boundaries (e.g., lungs) by the chemical-specific cancer potency factor (CPF).

The equation used to calculate the potential excess lifetime cancer risk for the inhalation pathway is as follows:

$$Risk_{inh} = C_i \text{ x } CF \text{ x } IF_{inh} \text{ x } CPF_i \text{ x } ASF$$

Where:

$Risk_{inh}$	=	Cancer Risk for the Inhalation Pathway; (unitless)
Ci	=	Annual Average Air Concentration for $Chemical_i$ (µg/m^3)
CF	=	Conversion Factor (mg/µg)

IF_{inh} = Intake Factor for Inhalation (m^3/kg-day)

CPF_i = Cancer Potency Factor for $Chemical_i$

(mg chemical/kg body weight-day)$^{-1}$

ASF = Age Sensitivity Factor (unitless)

According to OEHHA (2015), the estimated excess lifetime cancer risks for a resident were adjusted using the age sensitivity factors (ASFs) recommended in the Cal/USEPA OEHHA Technical Support Document (TSD) (Cal/USEPA 2009). This approach accounted for an “anticipated special sensitivity to carcinogens” of infants and children. Cancer risk estimates were weighted by a factor of “10” for exposures that occur from the third trimester of pregnancy to two years of age (labeled by OEHHA as “3rd trimester” and “0 < 2”), and by a factor of three for exposures that occur from two years through 15 years of age (“2 < 16”). No weighting factor (i.e., an ASF of one, which is equivalent to no adjustment) was applied to ages 16 and older.

Because the Proposed Project and the alternative 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 calculate risks and hazards 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 and daily breathing rates (“3rd Trimester”, “0 < 2”, “2 < 16”, and “≥ 16”).

For each receptor type, the most conservative (highest) exposure scenario was evaluated to estimate cancer risk results. For example, the calculation of a 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 because the childhood age sensitivity factor (ASF) used in the cancer risk calculation is the highest for age groups 3rd trimester and 0<2. 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, the average annual emissions that would occur during that sub-period were used. The cancer risk results for each sub-period were then summed over all sub-periods to obtain the total cancer risk for the entire exposure duration. For example, the 30-year residential cancer risk was determined for each of four sub-periods. The first sub-period represents a receptor age of “3rd Trimester;” assumes an exposure duration of 0.25 years; and uses Proposed Project construction emissions in 2024 (scaled down to a three-month duration from January to March 2024). The second sub-period represents a receptor age of “0 < 2;” assumes an exposure duration of 2 years; and uses Proposed Project construction and operational emissions averaged over the time period April 2024 – March 2026. The third sub-period represents a receptor age of “2 < 16;” assumes an exposure duration of 14 years; and uses Proposed Project operational emissions averaged over the time period April 2026-March 2040. The fourth sub-period represents a receptor age of “>16;” assumes an exposure duration of 14 years; and uses Proposed Project operational emissions averaged over the time period April 2040 - March 2054. The cancer risks calculated for these four sub-periods were then summed to obtain the total cancer risks for the entire exposure duration of 30 years[9].

Based on land use information and SCAQMD's recommendation, residential and non-residential sensitive receptors were evaluated for inhalation, soil ingestion, dermal contact, mother's milk ingestion, and homegrown garden ingestion pathways; occupational receptors were evaluated for inhalation, soil ingestion, and dermal contact pathways. The evaluation of the non-inhalation pathways were conducted with the help of OEHHA developed HRA software HARP2 RAST. Assumptions of the OEHHA derived method were used to evaluate the cancer risks for the non-inhalation pathways. A deposition settling velocity of 0.05 meters per second was assumed in HARP2 RAST.

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

Receptor Type [a]	Scenario [b]	Receptor Age Group	Exposure Frequency [c] (days/year)	Exposure Time [c] (hours/day)	Exposure Duration [c] (year)	Daily Breathing Rate [c] (L/kg-day)	Fraction of Time at Home (FAH) [d] (unitless)	ASF [e] (unit-less)	MAF [f] (unit-less)	Approach for Multi-Pathway Analysis [g]
Resident - Individual Cancer Risk (30 years)	Construction Scenario	3rd Trimester	350	24	0.25	361	1	10	1	Derived OEHHA Method
		0-2 years	350	24	1.25	1090	1	10		
	Operation Scenario	0-2 years	350	24	0.75	1090	1	10		
		2-16 years	350	24	14	572	1	3		
		16-30 years	350	24	14	261	0.73	1		
Resident - Population Cancer Burden (70 years)	Construction Scenario	3rd Trimester	350	24	0.25	361	1	10		
		0-2 years	350	24	1.25	1090	1	10		
	Operation Scenario	0-2 years	350	24	0.75	1090	1	10		
		2-16 years	350	24	14	572	1	3		
		16-70 years	350	24	54	233	0.73	1		
Occupational Receptors (Offsite Workers)	Construction Scenario	Adults	250	8	1.5	230	--	1	Source-specific, see note f	
	Operation Scenario	Adults	250	8	23.5	230	--	1		
Afterschool Children at Banning's Landing (5 - <18 years old)	Construction Scenario	5 - <16 years	180	12	1.5	353	--	3	Source-specific, see note f	
	Operation Scenario	5 - <16 years	180	12	9.5	353	--	3		
	Operation Scenario	16- <18 years	180	12	2	147	--	1		
Recreational User at	Construction Scenario	16 - 30 years	234	4	1.5	120	--	1	Source-	

[9] In accordance with OEHHA's Hot Spots Guidance (OEHHA 2015), the exposure during the 3rd trimester before birth is also included in the cancer risk evaluation for a resident. Therefore, the total exposure duration for evaluating individual cancer risk for a resident is actually 30.25 years.

Receptor Type [a]	Scenario [b]	Receptor Age Group	Exposure Frequency [c] (days/year)	Exposure Time [c] (hours/day)	Exposure Duration [c] (year)	Daily Breathing Rate [c] (L/kg-day)	Fraction of Time at Home (FAH) [d] (unitless)	ASF [e] (unit-less)	MAF [f] (unit-less)	Approach for Multi-Pathway Analysis [g]
USC Boathouse	Operation Scenario	16 - 30 years	234	12	3.5	120	--	1	specific, see note f	

Sources:
OEHHA. 2015. Air Toxics Hot Spots Program Risk Assessment Guidelines. Guidance Manual for Preparation of Health Risk Assessments. February.
SCAQMD. 2020. AB2588 & Rule 1402 Supplemental Guidelines: Supplemental Guideline for Preparing Risk Assessments and Risk Reduction Plan for the Air Toxics "Hot Spots" Information and Assessment Act. October.
http://www.aqmd.gov/docs/default-source/planning/risk-assessment/ab-2588-supplemental-guidelines.pdf

Notes:
[a] The HRA conservatively evaluated the non-residential sensitive receptors (i.e., schools, child care centers, hospitals, elder cares, and recreational areas) using the 30-year residential exposure assumptions from OEHHA (2015) except for the two nearest non-residential sensitive receptors to the Project site, Banning's Landing Community Center and the University of Southern California (USC) Boathouse where the health risks were evaluated based on facility-specific exposure assumptions.
[b] The Proposed Project, Reduced Project (Alternative 2), and Product Import Terminal Alternative (Alternative 3) were evaluated for combined construction and operational emissions.
[c] The exposure assumptions for residential and occupational receptors were obtained from OEHHA (2015) and SCAQMD (2020). In accordance with the recommendation from CARB's Risk Management Policy (RMP) and the SCAQMD (2020) for residential receptors, this analysis uses the 95th percentile of the breathing rates for children from the 3[rd] trimester through age 2, and 80[th] percentile breathing rates for all other age groups for the residents. For the afterschool children receptor, this analysis uses 95th percentile of the 8-hour breathing rates obtained from OEHHA (2015) assuming 8-hour light intensity and 4-hour moderate intensity activities for 12 hours per day, 180 days per year, for age 5 - <18 years old based on site-specific information. For USC boathouse, this analysis uses 95[th] percentile of the 8-hour breathing rates for moderate-intensity activities recommended by OEHHA (2015) for 4 hours per day, 6 days per week, from January to May, and August to November per year for a total of five years for the USC students training at the facility based on site-specific information.
[d] Fraction of time spent at home is conservatively assumed to be 1 (i.e., 24 hours/day) for age groups from the third trimester to less than 16 years old. Based on the OEHHA 2015 Guidance, the age group 16 to 30 years old is estimated to be at school or work for 6.5 hours of the day. Therefore, the fraction of time spent at home is assumed to be 0.73 (17.5 hours/24 hours per day) for this age group.
[e] The age sensitivity factors (ASF) are as recommended in the 2015 OEHHA Hot Spots Guidance (OEHHA 2015) for each age group.
[f] The construction emissions from all sources are from 7 AM to 5 PM on Monday through Friday in 2024 and 2025; the operation emissions from trucks are from 10 PM through 3 PM Monday through Friday starting in 2025. In accordance with OEHHA's recommendation (Cal/USEPA 2015), a modeling adjustment factor (MAF) was applied to the annual average concentrations used in the evaluation for the occupational receptors (i.e., off-site workers) and afterschool children to account for a potential alignment of proposed Project and receptor schedules due to a non-continuous construction emission schedule of 10 hours/day, 5 days a week, and an operation emission schedule of 17 hours/day, 5 days a week. The residents were assumed to be exposed to the construction and operational emissions continuously, therefore no adjustment is needed in the calculation of exposure for the residents.
[g] The "OEHHA Derived Method" is recommended by the SCAQMD (2020) for evaluating the multi-pathway exposures. For cancer risk, it uses high-end (95[th] percentile) exposure parameters for the top two dominant exposure pathways (one of which is nearly always inhalation), and average point exposure parameters for the remaining pathways.

ASF = Age Sensitivity Factor
MAF = Modeling Adjustment Factor
L/kg-day = liter per kilogram body weight per day

4.3.2 Population Cancer Burden

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 individual excess lifetime cancer risk by the population exposed to that level of risk, calculated at the census tract or block level.

The individual cancer risk is calculated assuming a 70-year exposure period assuming that the exposed person is in the 3rd trimester before birth at the beginning of the exposure period based on OEHHA's recommendation (OEHHA 2015). The exposed population is defined as the number of persons living 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 contour line (isopleth). Population cancer burdens were calculated using census block population data contained in HARP2, which are based on the 2020 U.S. Census. The centroid of each census block was modeled in AERMOD for the purpose of cancer burden analysis.

4.3.3 Non-Cancer Chronic and Acute HI

Chronic HI

The potential for exposure to result in adverse chronic noncancer effects (such as damage to the respiratory, central nervous, hematopoietic, renal, reproductive, immune, and cardiovascular systems, and decreased body weight, etc.) for the inhalation pathway is evaluated by comparing the estimated annual average air concentration (which is equivalent to the average daily air concentration) to the non-cancer chronic reference exposure level (cREL) for each chemical. When calculated for a single chemical, the comparison yields a ratio termed an HQ. To evaluate the potential for adverse chronic non-cancer health effects from simultaneous exposure to multiple chemicals, the HQs for all chemicals that affect a common target organ are summed, yielding an HI.

$$HQ_i = C_i / cREL_i$$

$$HI = \sum HQ_i$$

Where:

HQ_i	=	Chronic hazard quotient for chemical_i
HI	=	Hazard index
C_i	=	Annual average concentration of chemical_i ($\mu g/m^3$)
$cREL_i$	=	Chronic reference exposure level for chemical_i ($\mu g/m^3$)

As discussed in Section 4.4.1, based on land use information and SCAQMD's recommendation, residential and non-residential sensitive receptors were also evaluated for soil ingestion, dermal contact, mother's milk ingestion, and homegrown garden ingestion pathways; occupational receptors were also evaluated for soil ingestion and dermal contact pathways. The evaluation of the health risks for the non-inhalation pathways were conducted with the use of OEHHA-developed HRA software HARP2 RAST. Assumptions of the OEHHA derived method were used to evaluate the chronic non-cancer hazard indices for the non-inhalation pathways. A deposition settling velocity of 0.05 meters per second was conservatively assumed in HARP2 RAST (SCAQMD 2020).

Acute HI

The potential for exposure to result in adverse acute effects (such as irritation to the respiratory system, skin, and eyes, etc.) is evaluated by comparing the estimated one-hour maximum air concentration of chemical to the acute reference exposure level (aREL) for each chemical evaluated in this analysis at each receptor location. When calculated for a single chemical, the comparison yields an HQ. To evaluate the potential for adverse acute health effects from simultaneous exposure to multiple chemicals, the HQs for all chemicals that affect a common target organ are summed, yielding an HI. All receptors were evaluated for inhalation exposure pathway only for the acute HI.

$$HQ_i = C_i / aREL_i$$

$$HI = \sum HQ_i$$

Where:

HQ_i	=	Acute hazard quotient for chemical_i
HI	=	Hazard index
C_i	=	One-hour maximum concentration of chemical_i ($\mu g/m^3$)
$aREL_i$	=	Acute reference exposure level for chemical_i ($\mu g/m^3$)

5.0 Significance Criteria

The SCAQMD significance threshold for individual cancer risk (project increment) is 10 in a million (1 x 10-5). Based on this threshold, the Proposed Project or alternative would produce less than significant cancer risk impacts if the maximum cancer risk is less than 10 in a million (10 × 10-6). The air quality significance threshold for cancer burden is 0.5 excess cancer cases in areas with Project-attributable individual cancer risk above one in a million (1 × 10-6) (SCAQMD 2023).10 In addition, the SCAQMD significance threshold is 1.0 for chronic and acute non-cancer hazard indices; the Proposed Project or alternatives would produce less than significant non-cancer impacts if the chronic and acute hazard indices are less than 1.0 (SCAQMD 2023).

6.0 Predicted Health Impacts

6.1 Proposed Project

Table B3-6 presents the maximum predicted CEQA health impacts associated with the Proposed Project. The table includes estimates of individual cancer risk, chronic noncancer hazard index, and acute noncancer hazard index at the maximally exposed residential, occupational, and non-residential sensitive receptors. The table also presents the population cancer burden. Significance findings are made by comparing the health impacts to the significance thresholds. Figures B3-4 and B3-5 show the location of the

[10] The National Contingency Plan (NCP) (40 Code of Federal Regulations [CFR] § 300) is commonly cited as the basis for target cancer risk. According to the NCP, excess lifetime cancer risks posed by a site should not exceed one in a million (1 x 10^{-6}) to one hundred in a million (1 x 10^{-4}). One in a million is the lower end of NCP's cancer risk management range which means that no more than one person in one million people exposed to the same level of chemical contaminant(s) at a site would develop cancer over a lifetime.

maximum residential/sensitive receptor and maximum occupational receptor, respectively. These are described further in Section 6.1.1.

Table B3-6. Maximum Health Impacts Estimated for Construction and Operation of the Proposed Project

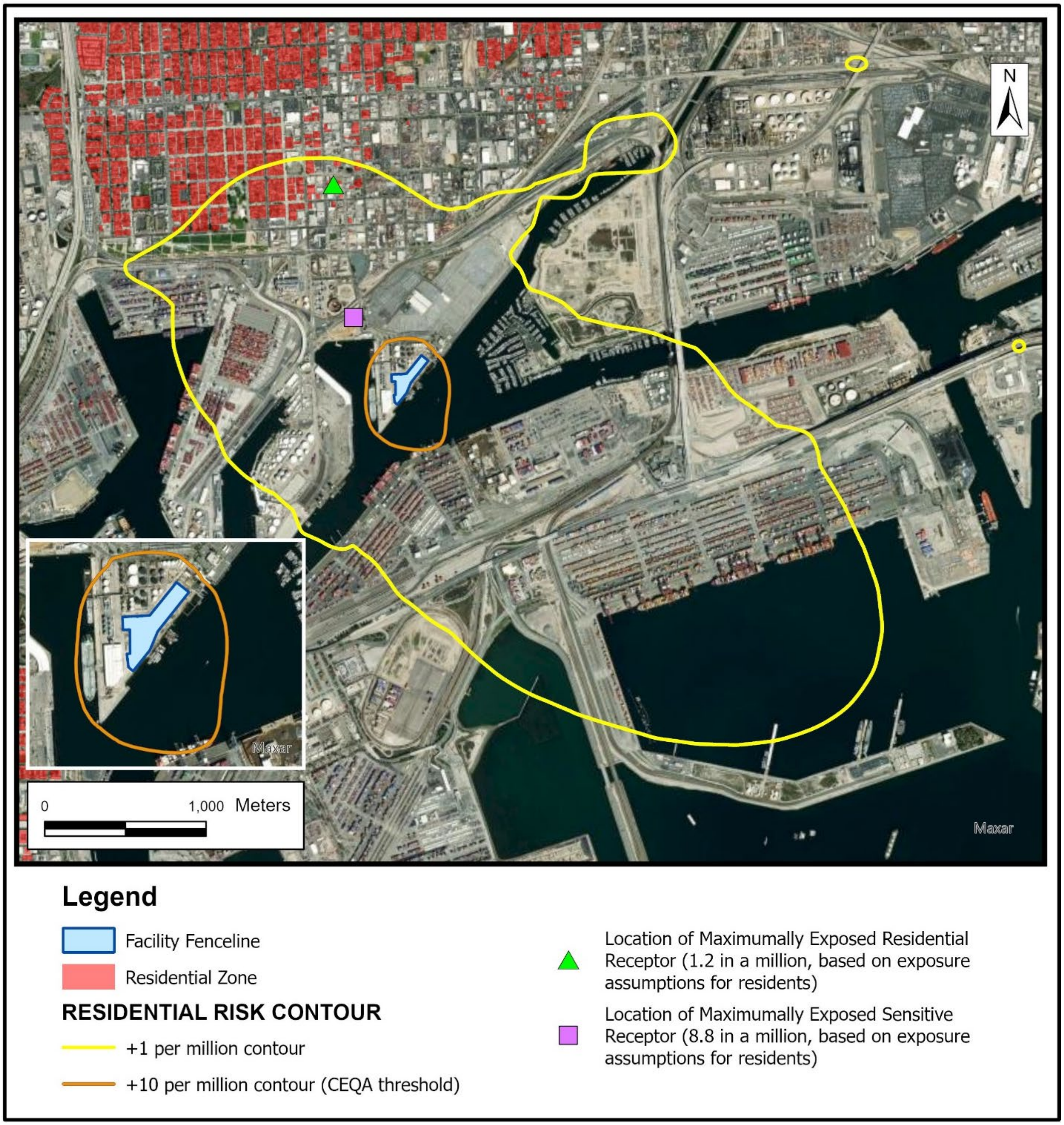
Health Impact [a]	Receptor Type	Proposed Project	Significance Threshold	Threshold Exceeded?
Individual Cancer Risk	Residential	1.2×10^{-6} 1.2 in a million	10×10^{-6} 10 in a million	No
	Non-Residential Sensitive [b]	8.8×10^{-6} 8.8 in a million		No
	Occupational	5.2×10^{-6} 5.2 in a million		No
Chronic Hazard Index	Residential	0.0068	1	No
	Non-Residential Sensitive	0.10		No
	Occupational	0.23		No
Acute Hazard Index	All Populations	0.17	1	No
				No
				No
Population Cancer Burden	0.0021		0.5	No

Notes:

[a] Each 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.

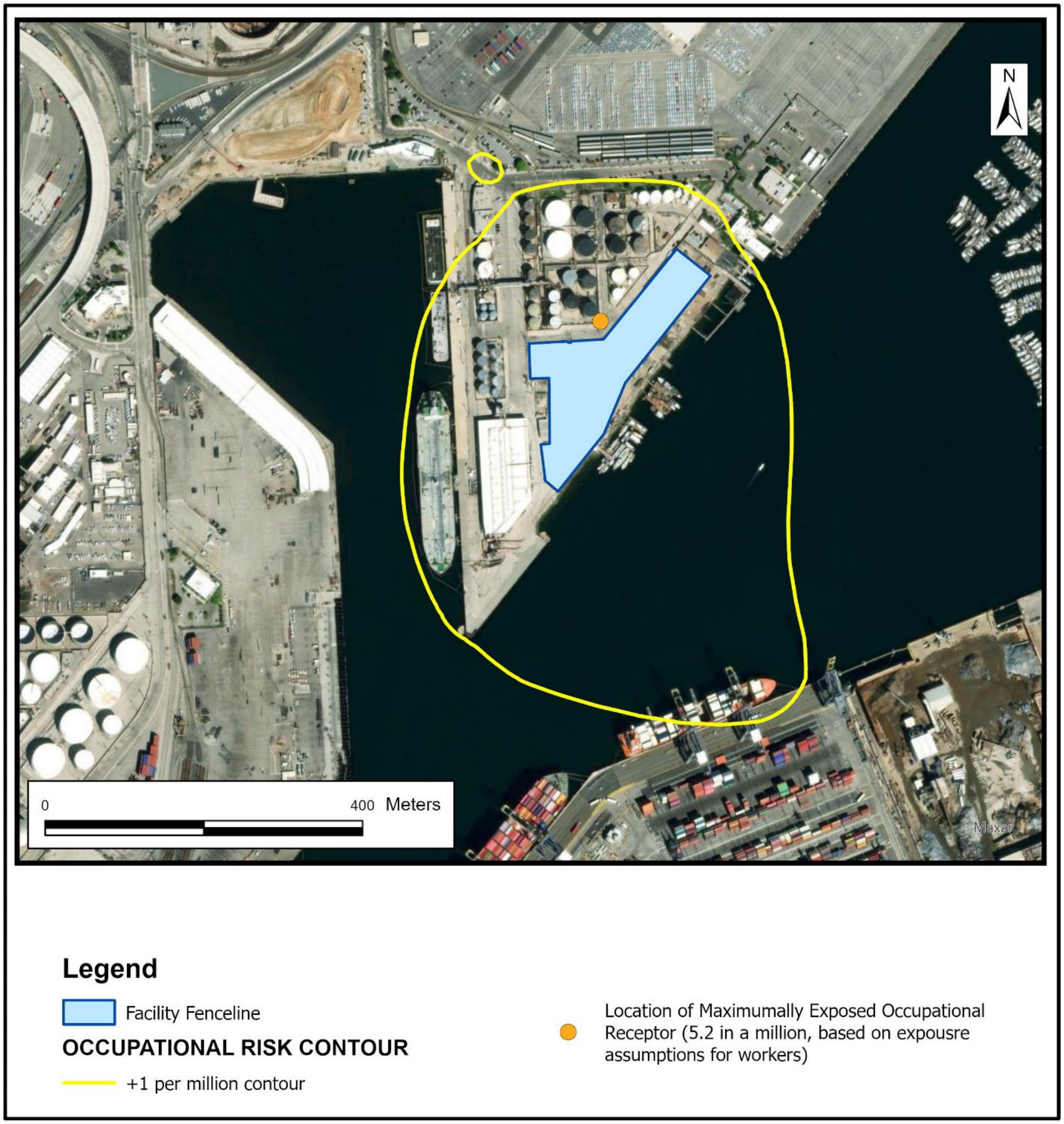
[b] The non-residential sensitive receptor location with the maximum cancer risk is located at the Wilmington Waterfront Promenade which is currently under development and located approximately 400 meters northwest of the Project site.

Figure B3-4. Isopleths of 30-Year Residential Cancer Risk – Proposed Project



Note: The cancer risk contours (isopleths) reflect 30-year residential exposure assumptions in all areas, including areas where there are no residents. The CEQA threshold for cancer risk is 10 in a million. The cancer risk estimates for the maximumly exposed residential and non-residential sensitive receptors are below the threshold.

Figure B3-5. One-in-a-Million Isopleth of 25-year Occupational Cancer Risk – Proposed Project



Note: The maximum individual cancer risk at a hypothetical occupational receptor location for the Proposed Project is 9.8 (right outside the facility fenceline). Therefore, no +10 per million cancer risk contour is generated.

The health impacts for the Proposed Project are summarized and discussed in Sections 6.1.1 through 6.1.3 for each evaluated health endpoint.

6.1.1 Individual Cancer Risk

As shown in Table B3-6, the maximum cancer risk for the Proposed Project is predicted to be less than the 10 in a million significance threshold for all evaluated receptor types (i.e., occupational, residential, and non-residential sensitive receptors). Therefore, the impact of individual cancer risk for the Proposed Project would be less than significant.

Figure B3-4 shows the individual residential cancer risk contour of one in a million and the locations of the MEI residential receptor and the MEI non-residential sensitive receptor for the Proposed Project. The one in a million residential risk contour was generated using cancer risk estimates calculated based on the default 30-year residential assumptions at each modeled receptor regardless of whether it is an actual residential receptor. As shown in this figure, only a small area within the one in a million contour overlaps with the residential zone in Wilmington. The residential MEI receptor for cancer risk (with an estimated cancer risk of 1.2 in a million, well below the 10 in a million threshold), is located in the vicinity of Fries Avenue and West E Street in Wilmington. The MEI non-residential sensitive receptor with an estimated cancer risk of 8.8 in a million (also below the 10 in a million threshold) is located at the Wilmington Waterfront Promenade which is currently under development and located approximately 400 meters northwest of the Project site. Because the cancer risk for this receptor location was conservatively evaluated as residents assuming continuous exposure for 30 years, the actual risks for the recreational users or occupational receptors at this location are expected to be much lower.

Figure B3-5 shows the individual occupational cancer risk contour of one in a million and the location of the MEI occupational receptor for the Proposed Project. The one in a million occupational risk contour was generated using cancer risk estimates calculated based on the default occupational exposure assumptions at each modeled receptor (regardless of whether it is an actual occupational receptor). The occupational MEI receptor for cancer risk, which is estimated to be 5.2 in a million (below the 10 in a million threshold), is located to the north of the Project facility near the southern edge of Vopak's tank farm.

Because the maximum cancer risk estimates for the MEI locations for the Proposed Project are all below the significance threshold of 10 in a million for cancer risk, no 10 in a million risk contour is shown in these risk figures.

6.1.2 Population Cancer Burden

The cancer burden increments for the Project are predicted to be less than the significance threshold (see Table B3-6).

6.1.3 Chronic and Acute Hazard Indices

The maximum chronic and acute HI increments are predicted to be less than the significance threshold for all receptor types (see Table B3-6).

6.2 No Project Alternative

As discussed in Section 1, the No Project Alternative (Alternative 1) represents continued activity from the baseline projected in the future, assuming that no project elements are constructed. Under this alternative, the Project site would remain largely unused at the backlands of Berth 192-194. Consistent with the CEQA Baseline, the activities under the

No Project Alternative (Alternative 1) are considered negligible in the foreseeable future as no future development has been permitted or approved. Therefore, the No Project Alternative (Alternative 1) was not quantitatively evaluated in the HRA, and it would have no impact relative to baseline conditions.

6.3 Reduced Project Alternative (Alternative 2)

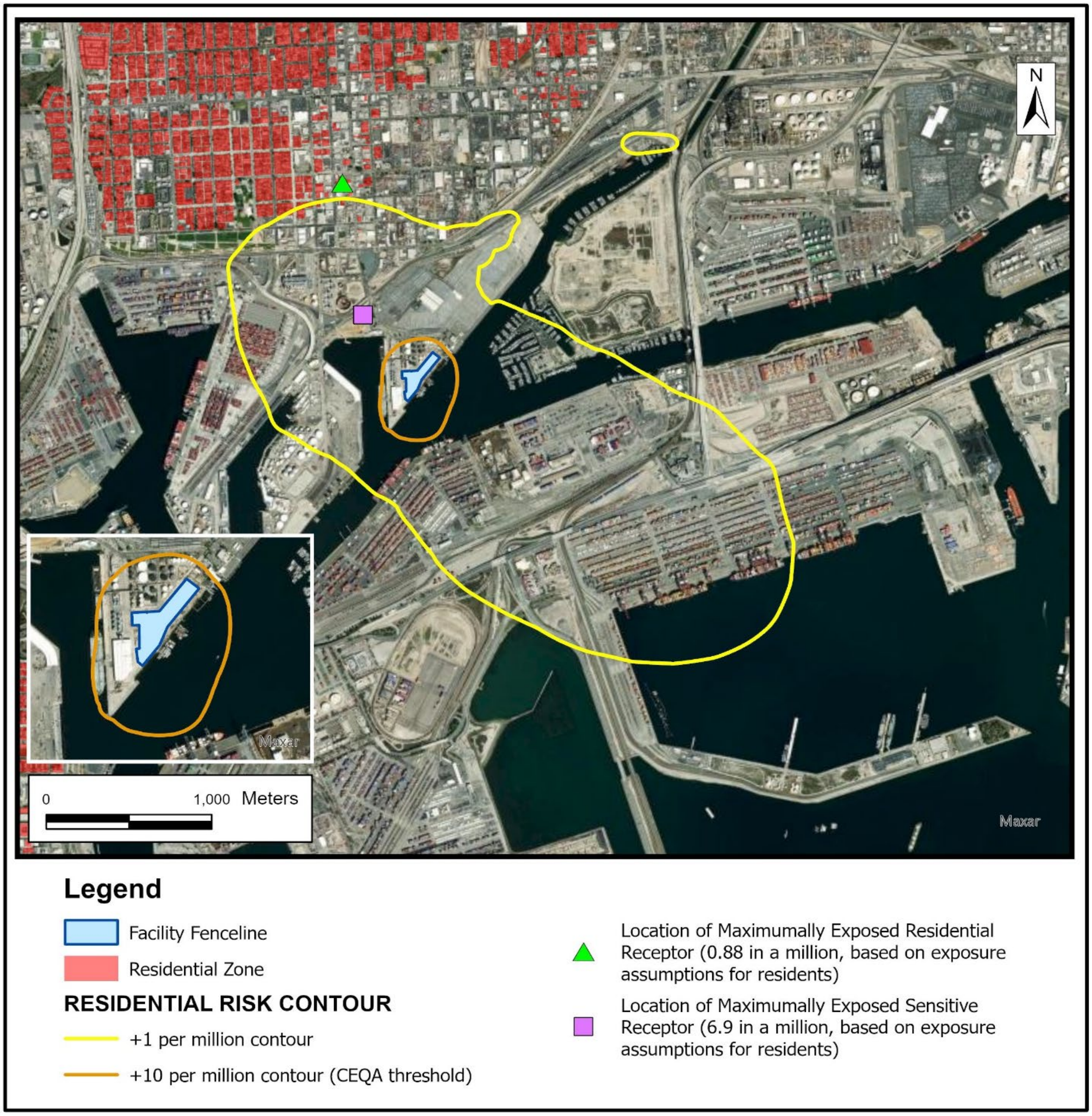
Table B3-7 presents the maximum predicted CEQA health impacts of the Reduced Project Alternative (Alternative 2). The table includes estimates of individual cancer risk, chronic non-cancer HI, and acute non-cancer HI at the maximally exposed residential, non-residential sensitive, and occupational receptors. The table also presents the population cancer burden increments. Significance findings are made by comparing the health impacts to the significance thresholds. Figures B3-6 and B3-7 show the location of the maximum residential/sensitive receptor and maximum occupational receptor, respectively. These are described further in Section 6.3.1.

Table B3-7. Maximum Health Impacts Estimated for Construction and Operation of the Reduced Project (Alternative 2)

Health Impact [a]	Receptor Type	Reduced Project	Significance Threshold	Threshold Exceeded?
Individual Cancer Risk	Residential	0.88×10^{-6} 0.88 in a million	10×10^{-6} 10 in a million	No
	Non-Residential Sensitive [b]	6.9×10^{-6} 6.9 in a million		No
	Occupational	4.5×10^{-6} 4.5 in a million		No
Chronic Hazard Index	Residential	0.0046	1	No
	Non-Residential Sensitive	0.069		No
	Occupational	0.23		No
Acute Hazard Index	All Populations	0.17	1	No
				No
				No
Population Cancer Burden	0.00033		0.5	No

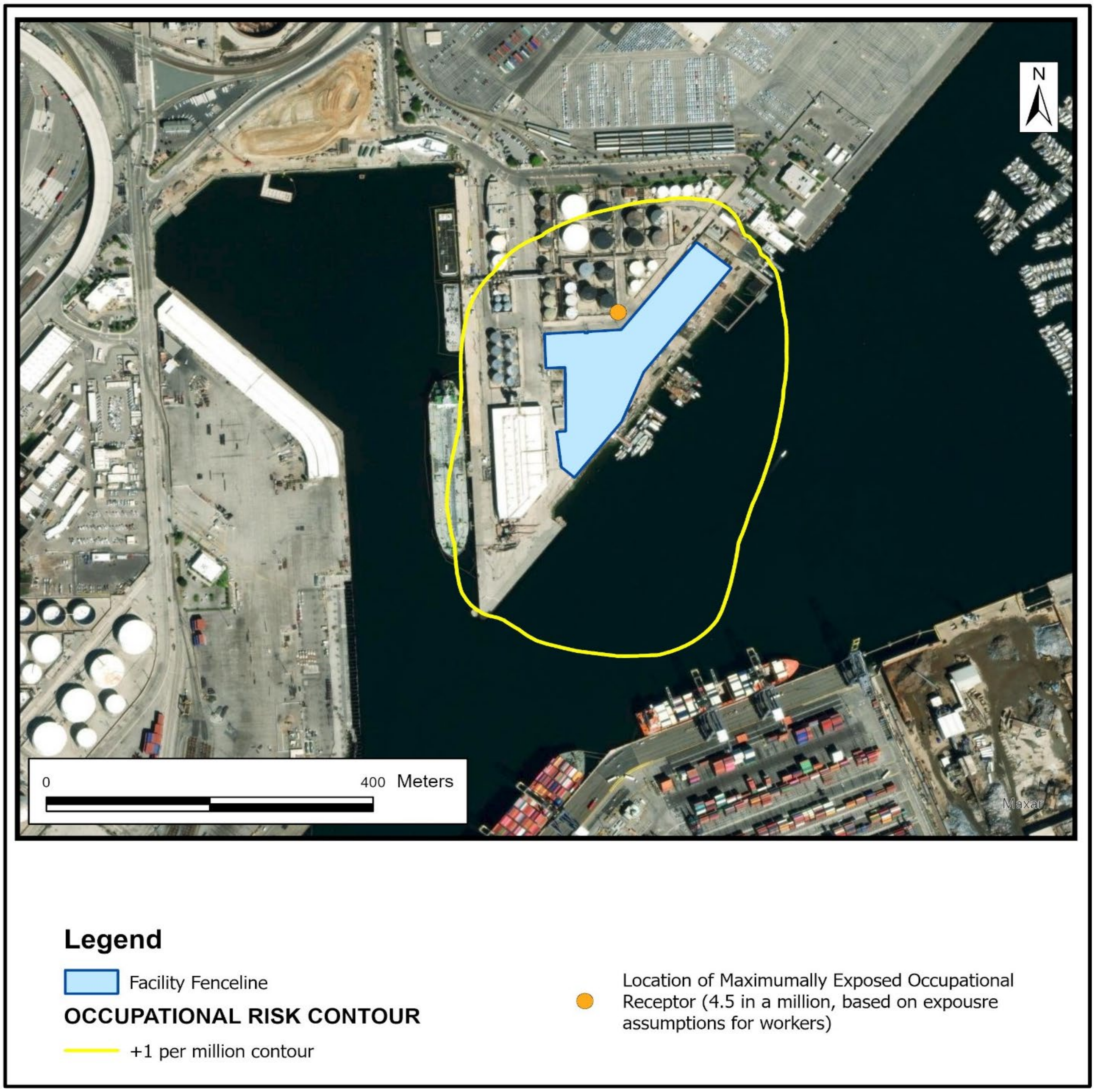
Notes:
[a] Each result shown in the table for cancer risk, chronic hazard index, and acute hazard index represents the receptor location with the maximum modeled health value. The health values at all other modeled receptors would be less than the values in the table.
[b] The non-residential sensitive receptor location with the maximum cancer risk is located at the Wilmington Waterfront Promenade which is currently under development and located approximately 400 meters northwest of the Project site.

Figure B3-6. Isopleths of 30-year Residential Cancer Risk – Reduced Project (Alternative 2)



Note: The cancer risk contours (isopleths) reflect 30-year residential exposure assumptions in all areas, including areas where there are no residents. The CEQA threshold for cancer risk is 10 in a million. The cancer risk estimates for the maximumly exposed residential and non-residential sensitive receptors are below the threshold.

Figure B3-7. One-in-a-Million Isopleth of 25-year Occupational Cancer Risk – Reduced Project (Alternative 2)



Note: The maximum individual cancer risk at a hypothetical occupational receptor location for the Reduced Project (Alternative 2) is 8.3 (right outside the facility fenceline). Therefore, no +10 per million cancer risk contour is generated.

The health impacts for the Reduced Project Alternative (Alternative 2) are summarized and discussed in Sections 6.3.1 through 6.3.3 for each evaluated health endpoint.

6.3.1 Individual Cancer Risk

As shown in Table B3-7, the maximum cancer risk for the Reduced Project Alternative (Alternative 2) is predicted to be less than the 10 in a million significance threshold for all evaluated populations (i.e., occupational, residential, and non-residential sensitive receptors). Therefore, the impact of individual cancer risk for the Reduced Project Alternative (Alternative 2) would be less than significant.

Figure B3-6 shows the individual residential cancer risk contour of one in a million and the locations of the MEI residential receptor and the MEI non-residential sensitive receptor for the Reduced Project Alternative (Alternative 2). The one in a million residential risk contour was generated using cancer risk estimates calculated based on the default 30-year residential assumptions at each modeled receptor regardless of whether it is an actual residential receptor. As shown in this figure, the residential areas near the Project site are not within the one in a million cancer risk contour. The residential MEI receptor for cancer risk (with an estimated cancer risk of 0.88 in a million, well below the 10 in a million threshold), is located in the vicinity of Fries Avenue and West E Street in Wilmington, right outside the northern boundary of the one in a million risk contour. The MEI non-residential sensitive receptor with an estimated cancer risk of 6.9 in a million (also below the 10 in a million threshold) is located at the Wilmington Waterfront Promenade which is currently under development and located approximately 400 meters northwest of the Project site. Because the cancer risk for this receptor location was conservatively evaluated as residents assuming continuous exposure for 30 years, the actual risks for the recreational users or occupational receptors at this facility location are expected to be much lower.

Figure B3-7 shows the individual occupational cancer risk contour of one in a million and the location of the MEI occupational receptor for the Reduced Project Alternative (Alternative 2). The one in a million occupational risk contour was generated using cancer risk estimates calculated based on the default occupational exposure assumptions at each modeled receptor (regardless of whether it is an actual occupational receptor). The occupational MEI receptor for cancer risk, which is estimated to be 4.5 in a million (below the 10 in a million threshold), is located to the north of the Project facility near the southern edge of Vopak's tank farm.

Because the maximum cancer risk estimates for the MEI locations for this alternative are all below the significance threshold of 10 in a million for cancer risk, no 10 in a million risk contour is shown in these risk figures.

6.3.2 Population Cancer Burden

The cancer burden increments for the Reduced Project Alternative (Alternative 2) are predicted to be less than the significance threshold (see Table B3-7).

6.3.3 Chronic and Acute Hazard Indices

The maximum chronic and acute HI increments are predicted to be less than the significance threshold for all receptor types (Table B3-7).

6.4 Product Import Terminal Alternative (Alternative 3)

Table B3-12 presents the maximum predicted health impacts of the Product Import Terminal Alternative (Alternative 3). The table includes estimates of individual cancer risk, chronic non-cancer HI, and acute non-cancer HI at the maximally exposed residential and occupational receptors. The table also presents the population cancer burden increments for the Product Import Terminal Alternative (Alternative 3). Figures B3-8 and B3-9 show the location of the maximum residential/sensitive receptor and maximum occupational receptor, respectively. These are described further in Section 6.4.1.

Table B3-8. Maximum Health Impacts Estimated for Construction and Operation of the Product Import Terminal Alternative (Alternative 3)

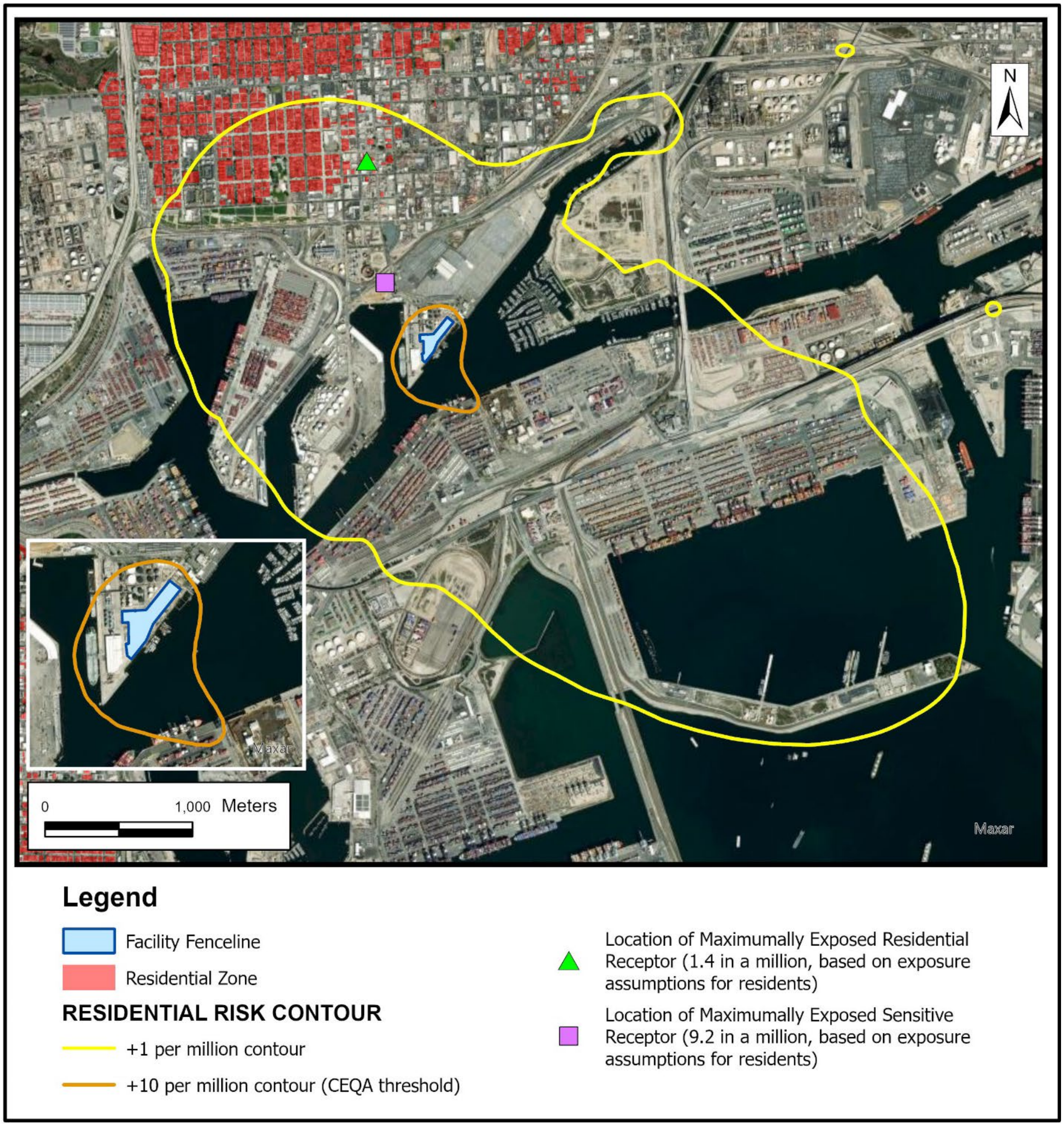
Health Impact [a]	Receptor Type	Product Import Terminal	Significance Threshold	Threshold Exceeded?
Individual Cancer Risk	Residential	1.4×10^{-6} 1.4 in a million	10×10^{-6} 10 in a million	No
	Non-Residential Sensitive [b]	9.2×10^{-6} 9.2 in a million		No
	Occupational	4.2×10^{-6} 4.2 in a million		No
Chronic Hazard Index	Residential	0.0022	1	No
	Non-Residential Sensitive	0.044		No
	Occupational	0.22		No
Acute Hazard Index	All Populations	0.16	1	No No No
Population Cancer Burden	0.0081		0.5	No

Notes:

[a] Each 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.

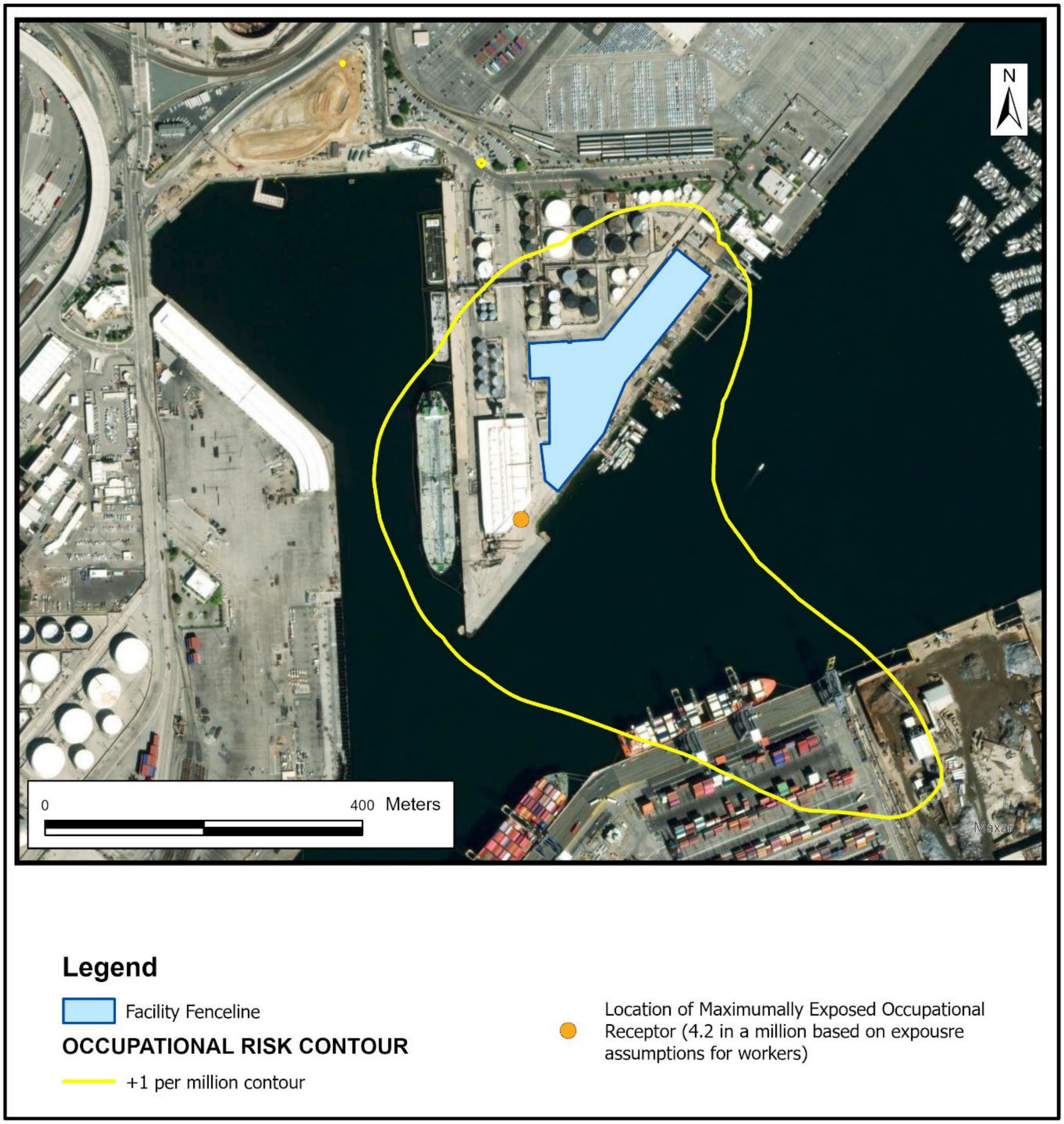
[b] The non-residential sensitive receptor location with the maximum cancer risk is located at the Wilmington Waterfront Promenade which is currently under development and located approximately 400 meters northwest of the Project site.

Figure B3-8. Isopleths of 30-year Residential Cancer Risk – Product Import Terminal Alternative (Alternative 3)



Note: The cancer risk contours (isopleths) reflect 30-year residential exposure assumptions in all areas, including areas where there are no residents. The CEQA threshold for cancer risk is 10 in a million. The cancer risk estimates for the maximumly exposed residential and non-residential sensitive receptors are below the threshold.

Figure B3-9. One-in-a-Million Isopleth of 25-year Occupational Cancer Risk – Product Import Terminal Alternative (Alternative 3)



Note: The maximum individual cancer risk at a hypothetical occupational receptor location for the Product Import Terminal Alternative (Alternative 3) is 4.6 (right outside the facility fenceline). Therefore, no +10 per million cancer risk contour is generated.

The health impacts for the Product Import Terminal Alternative (Alternative 3) are summarized and discussed in Sections 6.4.1 through 6.4.3 for each evaluated health endpoint.

6.4.1 Individual Cancer Risk

As shown in Table B3-8, the maximum cancer risk is predicted to be less than the significance threshold for the residential, non-residential sensitive, and occupational receptors. Therefore, the Product Import Terminal Alternative (Alternative 3) would result in a less than significant cancer risk impact.

Figure B3-8 shows the individual residential cancer risk contour of one in a million and the locations of the MEI residential receptor and the MEI non-residential sensitive receptor for the Product Import Terminal Alternative (Alternative 3). The one in a million residential risk contour was generated using cancer risk estimates calculated based on the default 30-year residential assumptions at each modeled receptor regardless of whether it is an actual residential receptor. As shown in this figure, only a small area within the one in a million contour overlaps with the residential zone in Wilmington. The residential MEI receptor for cancer risk (with an estimated cancer risk of 1.4 in a million, well below the 10 in a million threshold), is located in the vicinity of Fries Avenue and West E Street in Wilmington. The MEI non-residential sensitive receptor with an estimated cancer risk of 9.2 in a million (also below the 10 in a million threshold) is located at the Wilmington Waterfront Promenade which is currently under development and located approximately 400 meters northwest of the Project site. Because the cancer risk for this receptor location was conservatively evaluated as residents assuming continuous exposure for 30 years, the actual risk for the future recreational users at this facility location is expected to be much lower.

Figure B3-9 shows the individual occupational cancer risk contour of one in a million and the location of the MEI occupational receptor for the Product Import Terminal Alternative (Alternative 3). The one in a million occupational risk contour was generated using cancer risk estimates calculated based on the default occupational exposure assumptions at each modeled receptor (regardless of whether it is an actual occupational receptor). The occupational MEI receptor for cancer risk, which is estimated to be 4.2 in a million (below the 10 in a million threshold), is located to the southwest of the Project facility near the southern edge of Vopak's cement warehouse.

Because the maximum cancer risk estimates for the MEI locations for this alternative are all below the significance threshold of 10 in a million for cancer risk, no 10 in a million risk contour is shown in these risk figures.

6.4.2 Population Cancer Burden

The cancer burden increments for the Product Import Terminal Alternative (Alternative 3) are predicted to be less than the significance threshold (see Table B3-8).

6.4.3 Chronic and Acute Hazard Indices

The maximum chronic and acute HI increments are predicted to be less than the significance threshold for all receptor types (see Table B3-8).

Source Contributions

Table B3-9 shows the emission source contributions to cancer risk from the Proposed Project at the residential, non-residential sensitive, and occupational receptor location with the highest predicted cancer risk (i.e. the MEIs). Emissions are modeled in 'source groups' according to their common modeling characteristics: equipment type, fuel type (speciation), operation schedule (temporal), and relative location in the modeling domain (spatial). Cancer risks for the MEI residential and non-residential sensitive receptors for the Proposed Project are primarily driven by the vessel hoteling exhaust during operations, with the second and third largest contributions from the construction off-road equipment and the GGBFS and gypsum trucks during operations. Cancer risk for the MEI occupational receptor is primarily driven by the construction off-road equipment, with the second and third largest contributions from the operational use of the FEL and excavator. DPM from these sources is the dominant risk driver among all toxic air pollutants.

Table B3-9. Source Contributions to Cancer Risk at the Maximumly Exposed Non-Residential Sensitive, Residential, and Occupational Receptor for the Proposed Project

Source Category	Non-Residential Sensitive Receptor		Residential Receptor		Occupational Receptor	
	Risk	% Total Risk	Risk	% Total Risk	Risk	% Total Risk
Operations - Vessel Hoteling at Berth (auxiliary engine)	3.5	40.1%	0.70	59.3%	0.21	4.1%
Construction - Offroad Equipment	2.8	31.4%	0.25	21.5%	3.3	63.1%
Operations - GGBFS and Gypsum Trucks	1.2	13.4%	0.087	7.4%	0.075	1.5%
Operations - Front End Loader (off-road equipment)	0.71	8.2%	0.064	5.4%	1.3	25.1%
Operations - Excavator (off-road equipment)	0.15	1.7%	0.014	1.2%	0.27	5.2%
Remaining Source Categories (Vessel transit, Harbor Craft, Stationary Sources, Construction Trucks, etc.)	0.46	5.2%	0.062	5.3%	0.051	1.0%
Total	**8.8**	**100%**	**1.2**	**100%**	**5.2**	**100%**

Note:
Numbers may not add up due to rounding.

Table B3-10 shows the emission source contributions to cancer risk for the Product Import Terminal Alternative (Alternative 3) at the residential, non-residential sensitive, and occupational receptor location with the highest predicted cancer risk increment. Cancer risks for the MEI residential and non-residential sensitive receptors for the Product Import Terminal Alternative (Alternative 3) are primarily driven by the vessel hoteling exhaust during operations, with the second and third largest contributions from the construction off-road equipment and the GGBFS hauling trucks during operations. Cancer risk for the MEI occupational receptor is primarily driven by the construction off-road equipment, with the second and third largest contributions from vessel hoteling exhaust during operations and use of the tugboats during construction. DPM from these sources is the dominant risk driver among all toxic air pollutants.

Table B3-10. Source Contributions to Cancer Risk at the Maximumly Exposed Non-Residential Sensitive, Residential, and Occupational Receptor for the Product Import Terminal Alternative (Alternative 3)

Source Category	Non-Residential Sensitive Receptor		Residential Receptor		Occupational Receptor	
	Risk	% Total Risk	Risk	% Total Risk	Risk	% Total Risk
Operations - Vessel Hoteling at Berth (auxiliary engine)	5.4	58.5%	1.1	75.3%	1.2	28.6%
Construction - Offroad Equipment	2.3	24.7%	0.21	14.7%	2.5	58.9%
Operations – GGBFS Trucks	1.1	11.9%	0.081	5.7%	0.013	0.31%
Construction - Tugboats	0.26	2.8%	0.027	1.9%	0.0052	9.2%
Operational - Yokahama Tugboats (auxiliary and propulsion engines)	0.14	1.5%	0.016	1.1%	0.0033	2.8%
Remaining Source Categories (Vessel transit, Stationary Sources, Construction Trucks, etc.)	0.052	0.6%	0.017	1.2%	0.22	0.19%
Total	**9.2**	**100%**	**1.4**	**100%**	**4.2**	**100%**

Note:
Numbers may not add up due to rounding.

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.*

An REL (or RfD) is the concentration level (or dose 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 and RfDs 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 and RfDs are meant to err on the side of public health protection in order to avoid underestimation of non-cancer hazards. An estimated HI higher than the threshold of 1 using the REL or RfD does not automatically indicate an adverse health impact. However, increasing HI above the threshold of 1 increases the likelihood that the adverse non-cancer 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.

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