Appendix E3

Health Risk Assessment for the Port of Los Angeles Berth 97-109 Container Terminal Project

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1.0 Introduction

This document describes the methods and results of a health risk assessment (HRA) that evaluates potential public health effects from toxic air contaminant (TAC) emissions generated by the operation of the Port of Los Angeles (Port) Container Terminal Project (Project or proposed Project) at Berth 97-109. TACs are compounds that are known or suspected to cause adverse health effects after short-term (acute) or long-term (chronic) exposure.

The HRA evaluated health risks associated with the following scenarios:

- California Environmental Quality Act (CEQA) baseline[1]
- National Environmental Policy Act (NEPA) baseline[2]
- Proposed Project, with and without mitigation
- Alternative 1 (No Project)[3]
- Alternative 2 (No Federal Action)[4]
- Alternative 3 (Reduced Fill – No Berth 102 Wharf), with and without mitigation
- Alternative 4 (Reduced Fill – No Berth 200 South), with and without mitigation
- Alternative 5 (Reduced Construction and Operation – Phase I Construction Only), with and without mitigation
- Alternative 6 (Omni Cargo Terminal), with and without mitigation

The primary HRA analyzed Project emissions and human exposure to the emissions during the 70-year period from 2004 to 2073. This is the 70-year period with the greatest combined diesel particulate matter (DPM) emissions from proposed Project construction and operation. In addition, a second HRA spanning the years 2009 through 2078 was conducted. Because 2009 represents the first year when the Port would be able to impose

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[1] Because the Berth 97-109 Terminal was used as additional backlands storage for the Berth 121-131 Terminal during CEQA Baseline conditions, this scenario only includes terminal equipment emissions.

[2] Because the Berth 97-109 Terminal would be used as additional backlands storage for the Berth 121-131 Terminal for the NEPA Baseline, this scenario only includes terminal equipment emissions. NEPA Baseline emissions include as project elements the terminal equipment control measures in the Amended Stipulated Judgment, implementation of CAAP Measure CHE-1 starting in 2009, and 100 percent alternative fueled top picks starting in 2009.

[3] Because the Berth 97-109 Terminal would be used as additional backlands storage for the Berth 121-131 Terminal for Alternative 1, this alternative only includes terminal equipment emissions. Alternative 1 emissions include as project elements the terminal equipment control measures in the Amended Stipulated Judgment, implementation of CAAP Measure CHE-1 starting in 2009, and 100 percent alternative fueled top picks starting in 2009.

[4] Because the Berth 97-109 Terminal would be used as additional backlands storage for the Berth 121-131 Terminal for Alternative 2, this alternative only includes terminal equipment emissions. Alternative 2 emissions include as project elements the terminal equipment control measures in the Amended Stipulated Judgment, implementation of CAAP Measure CHE-1 starting in 2009, and 100 percent alternative fueled top picks starting in 2009.

mitigation measures other than those stipulated by the Settlement Agreement, the 2009-2078 HRA was conducted and intended for information purposes only. The 2009-2078 HRA assessed mitigated emissions only.

The HRA included both Project construction and operational emissions. The construction emissions included Phases II and III. As shown in this appendix, the contribution from Project construction to the health risk results would be minor relative to Project operational emissions. Phase I of construction was not included in the HRA because the 70-year period that includes Phase I (2001 to 2070) has fewer DPM emissions than the 2004 to 2073 period.

This HRA was prepared in accordance with the *Health Risk Assessment Protocol for Port of Los Angeles Terminal Improvement Projects* (Protocol) (Port, 2005a). The Protocol is a living document, developed by the Port in consultation with the South Coast Air Quality Management District (SCAQMD), California Air Resources Board (CARB), and Office of Environmental Health Hazard Assessment (OEHHA). In general, the Protocol follows the methodology for preparing Tier 1 risk assessments described in *The Air Toxics Hot Spots Program Guidance Manual for Preparation of Health Risk Assessments* (OEHHA, 2003), *Supplemental Guidelines for Preparing Risk Assessments for the Air Toxics "Hot Spots" Information and Assessment Act (AB2588)* (SCAQMD, 2005a), and *Health Risk Assessment Guidance for Analyzing Cancer Risks from Mobile Source Diesel Emissions* (SCAQMD, 2002). The methods in these guidance documents are incorporated into the Hotspots Analysis and Reporting Program (HARP) model released by the CARB in December 2003 (CARB, 2003a).

The HRA process requires four general steps to estimate health impact results: (1) quantify Project-generated emissions; (2) identify ground-level receptor locations that may be affected by the emissions (including both a regular grid of receptors and any special sensitive receptor locations such as schools, hospitals, convalescent homes, and/or daycare centers); (3) perform dispersion modeling analyses to estimate ambient TAC concentrations at each receptor location; and (4) use a risk characterization model to estimate the potential health risk at each receptor location. The following section describes in detail the methods used to develop each step of the HRA.

2.0 Development of Emission Scenarios Used in the HRA

2.1 Emission Sources

The following emission sources were included in the health risk assessment:

- **Ships transiting** to and from the berth. Ship transit in SCAQMD waters consists of the following transit segments, starting with the segment farthest from the berth:
    - Fairway transit – The portion of transit between the SCAQMD overwater boundary (about 53 nautical miles [nm] from the Berth 97-109 terminal) and Point Fermin (about 14 nm from the terminal). A sensitivity analysis showed that only the closest 15-nm portion of Fairway transit is sufficient to include in this HRA because the remaining, more distant portion of Fairway transit contributes less than 1 percent to the total risks from all Project sources at the

maximum residential and occupational receptors. Therefore, the emission source domain for ship transit was cut off at 29 nm from the Berth 97-109 terminal.

- Precautionary area transit – The portion of transit between Point Fermin and the Port breakwater. This segment length is about 10 nm.
- Harbor transit – The portion of transit between the Port breakwater and the berth. This segment length is about 4 nm.
- Turning and Docking – Final positioning of the ship near the berth.

The total one-way transit distance included in this HRA is about 29 nm. Emission sources include the ship main propulsion engine, auxiliary engines, and boiler.

Ship transit emissions were not modeled for the CEQA baseline, NEPA baseline, Alternative 1 (No Project), and Alternative 2 (No Federal Action) because the Berth 97-109 terminal would not accommodate container ships in these scenarios.

- **Ships hoteling** while at berth. Sources of hoteling emissions include the ship auxiliary engines and boiler; the main propulsion engine is turned off. When a ship uses alternative maritime power (AMP) while hoteling, the auxiliary engines also are turned off, leaving the boiler as the only emission source.

  Ship hoteling emissions were not modeled for the CEQA baseline, NEPA baseline, Alternative 1 (No Project), and Alternative 2 (No Federal Action) during operations because the Berth 97-109 terminal would not accommodate container ships in these scenarios. However, a small quantity of hoteling emissions during construction was modeled for Alternative 1 (No Project) and Alternative 2 (No Federal Action) to account for general cargo ships removing the existing shoreside gantry cranes.

- **Tugboats** used to assist the container ships between the Port breakwater and the berth (two tugboats per ship assist). Emission sources include the tugboat main propulsion and auxiliary engines.

  Tugboat emissions were not modeled for the CEQA baseline, NEPA baseline, Alternative 1 (No Project), and Alternative 2 (No Federal Action) because the Berth 97-109 terminal would not accommodate container ships in these scenarios.

- **Rail Yard Equipment at the Berth 121-131 (On-Dock) Rail Yard,** including yard tractors and top picks.

  Rail yard equipment emissions were not modeled for the CEQA baseline, NEPA baseline, Alternative 1 (No Project), and Alternative 2 (No Federal Action) because the Berth 97-109 terminal would serve only as additional backlands storage for the Berth 121-131 terminal in these scenarios. Rail yard equipment emissions also were not modeled for Alternative 6 (Omni Alternative) because this alternative would not use the Berth 121-131 (on-dock) rail yard.

- **Locomotives** switching and idling at the Berth 121-131 (on-dock) rail yard, and hauling trains between the Berth 121-131 rail yard and the Alameda Corridor, as far north as the Anaheim Street crossing. A sensitivity analysis showed that trains traveling north of Anaheim Street contribute no greater than 0.2 percent to the total risks from all Project sources at the maximum residential and occupational receptors. Therefore, the northern boundary of the emission source domain for rail transit was set at Anaheim Street.

Locomotive emissions were not modeled for the CEQA baseline, NEPA baseline, Alternative 1 (No Project), and Alternative 2 (No Federal Action) because the Berth 97-109 terminal would serve only as additional backlands storage for the Berth 121-131 terminal in these scenarios. Locomotive emissions also were not modeled for Alternative 6 (Omni Alternative) because this alternative would not use the Berth 121-131 (on-dock) rail yard.

- **Trucks** traveling along the primary container haul routes, including:
  - On-terminal driving and idling
  - Knoll entry road from Front Street to the Berth 121-131 in-gate
  - SR-47 from I-110 to the Vincent Thomas Bridge
  - I-110 from SR-47 to Anaheim Street
  - Harbor Boulevard from Swinford Avenue to Front Street
  - Front Street from Harbor Boulevard to John S. Gibson Boulevard
  - John S. Gibson Boulevard from Front Street to Harry Bridges Boulevard
  - Figueroa Street from C Street to Harry Bridges Boulevard
  - C Street from I-110 to Figueroa Street
  - Harry Bridges Boulevard from John S. Gibson Boulevard to Alameda Street
  - Alameda Street from Harry Bridges Boulevard to Anaheim Street
  - SR-47 eastbound on-ramp at Harbor Boulevard
  - SR-47 westbound on-ramp at Harbor Boulevard
  - I-110 northbound on-ramp at John S. Gibson Boulevard

  On-terminal truck emissions include trucks waiting at the Berth 121-131 in-gate, driving from the in-gate to the Berth 97-109 terminal, and driving and idling on the Berth 97-109 terminal to drop off and pick up their loads.

  A sensitivity analysis was performed to examine potential impacts from trucks traveling on roadways farther from the terminal area, including SR-47 from the Vincent Thomas Bridge to Seaside Avenue, I-110 north of Anaheim Street, Alameda Street north of Anaheim Street, Sepulveda Boulevard east of Alameda Street, and Anaheim Street east of Alameda Street. The sensitivity analysis showed that these roadway segments contribute no greater than 0.2 percent to the total risks from all Project sources at the maximum residential and occupational receptors. Therefore, these roadway segments were not included in the emission source domain for truck travel.

  Truck emissions were not modeled for the CEQA baseline, NEPA baseline, Alternative 1 (No Project), and Alternative 2 (No Federal Action) because the Berth 97-109 terminal would serve only as additional backlands storage for the Berth 121-131 terminal in these scenarios.

- **Terminal Equipment (Cargo Handling Equipment)**, including yard tractors, rubber-tired gantry cranes (RTGs), toppicks, sidepicks, forklifts, and other miscellaneous equipment. Terminal equipment was modeled for both baselines and all Project alternatives.

- **Construction Equipment**, including off-road diesel equipment, on-road delivery and haul trucks, and general cargo ships hoteling at the terminal while delivering or removing shoreside gantry cranes. The construction emissions include Phases II and III. Phase I of construction was not included in the HRA because the 70-year period that includes Phase I (2001 to 2070) has fewer DPM emissions than the 2004 to 2073 period. In accordance with SCAQMD guidance, only onsite construction emissions were included in the HRA.

  Construction equipment was not modeled for the CEQA baseline and Alternative 5 because those scenarios would have no Phase II/III construction activities.

2.2 TAC Emission Calculation Approach

The determination of health risks in this HRA required the calculation of 70-year average, maximum annual, and maximum 1-hour emission rates. The 70-year-average emission rates were used to determine individual lifetime cancer risks. For the NEPA baseline and Project alternatives, the 70-year-averaging period was assumed to be 2004 through 2073. Maximum annual emission rates during this exposure period were conservatively used to determine the chronic hazard index because the chronic exposure period for noncancer effects is assumed to be up to 8 years rather than 70 years (OEHHA, 2003). Maximum 1-hour emission rates were used to determine the acute hazard index because the acute exposure period is 1 hour for most TACs.

This extended period of analysis (up to 70 years for cancer risk) required wide-ranging predictions of the future operational characteristics of the proposed emission sources. Two of the more important factors that would affect future emissions from Project sources are:

- Reductions in emission factors due to (a) the incidental phase-in of cleaner vehicles or equipment due to normal fleet turnover; (b) the future phase-in of cleaner fuels as required by existing regulations or agreements; and (c) the future phase-in of cleaner engines as required by existing regulations or agreements
- Increased vehicle and equipment activity levels due to anticipated increases in container throughput.

Based on the future trends in these factors, this HRA developed annualized 70-year TAC emission rates for each emission source category by using the methods described in Sections 2.3, 2.4, and 2.5. The approaches for estimating maximum annual and 1-hour emissions are described in Sections 2.6 and 2.7, respectively.

The year-by-year particulate matter (PM) and volatile organic compound (VOC) emission calculations by source are attached to this Appendix.

2.3 Emission Factor Trends

The following methods were used in this HRA to develop the 70-year trends in annual emission factors for unmitigated emissions.

1. **Ships**. Unmitigated PM and VOC emission factors for main engines, auxiliary engines, and boilers on ocean-going marine vessels were held constant at existing levels for the entire 70-year period. This approach is consistent with the European study on vessel emissions because there are no future standards currently promulgated for this source category that would result in more restrictive emission factors, and fleet turnover rate is slow and uncertain (Entec, 2002).

2. **Tugboats**. Composite emission factors for main and auxiliary engines on assist tugboats were determined based on an inventory of tugboat engine sizes and model years performed in 2005 (Starcrest, 2006). A gradual replacement of older tugboat engines with new engines meeting United States Environmental Protection Agency (USEPA) Tier 2 standards (USEPA, 1999) was assumed based on default marine engine lifetimes that CARB developed (CARB, 2004d). The emission factors also assume the use of Port diesel fuel (average 1,900 parts-per-million [ppm] sulfur) before 2006, CARB diesel (maximum 500-ppm sulfur) during 2006, and ultra-low-sulfur diesel (ULSD) (15-ppm sulfur) after 2006. (ULSD actually was phased in by September 1, 2006; however, for the purposes of the risk assessment, the emission reductions are conservatively assumed to take effect starting at the beginning of calendar year 2007). Use of lower sulfur diesel fuel results in slight reductions in diesel particulate matter (DPM) emissions. The fuel sulfur content limits starting in 2006 are required for California harbor craft in accordance with California Diesel Fuel Regulations (CARB, 2004b).

3. **Terminal and Rail Yard Equipment.** Emission factors for terminal and rail yard equipment were calculated to year 2040 using methodology from the CARB OFFROAD2007 Emissions Model (CARB, 2007). This methodology accounts for the tiered implementation of future engine standards from existing CARB and USEPA rules, coupled with an assumed equipment-fleet turnover rate. To estimate future year emission factors, the OFFROAD model was run using the actual terminal equipment population at the Berth 97-109 terminal in 2005. With each future analysis year, the equipment population was allowed to age in the OFFROAD model until it would reach its useful lifetime, at which point it would be assumed replaced by new equipment meeting current emission standards. The new replacement equipment would then age in a similar manner. As a result, emission factors for terminal equipment tend to gradually increase with time as equipment ages, followed by a sharp reduction in emission factors upon replacement with new equipment. The emission factors also assume the use of CARB diesel fuel (maximum 500-ppm sulfur) before 2007, and ULSD starting in 2007 (actually September 1, 2006, but assumed January 1, 2007, for the purposes of the risk assessment), in accordance with California Diesel Fuel Regulations (CARB, 2004b). Finally, the unmitigated emission factors for toppicks at the Berth 121-131 rail yard account for the use of emulsified fuel and DOCs starting in 2005, in accordance with an agreement reached between the Port and the rail yard operator. However, starting in 2007, only DOCs were assumed because of an unanticipated shortage in emulsified fuel at the Port due to a lack of suppliers. Emission factors after the year 2040 were held constant at 2040 levels.

4. **Locomotives.** Locomotive future-year emission factors are based on the USEPA nationwide locomotive emission standard implementation schedule (USEPA, 1998). In general, locomotive emission factors decline in future years as older locomotives gradually are replaced with newer locomotives meeting the USEPA tiered emission standards. The emission factors for the yard locomotive at the Berth 121-131 terminal rail yard were adjusted starting in 2008 to account for the Pacific Harbor Line (PHL) commitment to replace the existing yard locomotive with one that meets the Tier 2 standard (Port, 2005b). The emission factors also assume the use of CARB diesel fuel (maximum 500-ppm sulfur) in yard locomotives before 2007, and ULSD starting in 2007, in accordance with California Diesel Fuel Regulations (CARB, 2004b). Line-haul locomotives are assumed to use diesel fuel with an average sulfur content of 1,927 ppm before 2008; 500 ppm starting in 2008 (actually June 1, 2007,

but assumed to be the start of calendar year 2008 for the purposes of the risk assessment); and 15 ppm starting in 2012, in accordance with the USEPA Nonroad Diesel Fuel Rule (USEPA, 2004). Emission factors after the year 2040 were held constant at 2040 levels.

5. **Trucks**. Due to the promulgation of future USEPA and CARB emission standards, coupled with normal truck fleet turnover, unmitigated emission factors for trucks will decrease with time. The emission factors also assume the use of CARB diesel fuel (maximum 500-ppm sulfur) in trucks before September 1, 2006, and ULSD starting September 1, 2006, in accordance with existing California Diesel Fuel Regulations (CARB, 2004b). Composite truck emission factors were developed using the EMFAC2007 emission factor model (CARB, 2006). Emission factors were calculated for numerous analysis years between 2001 and 2040 (the year farthest in the future that EMFAC2007 estimates emission factors). Actual inventory data for on-road trucks that serviced the San Pedro Bay ports container terminals in the year 2005 were used to develop the truck fleet age distribution used in EMFAC2007 (Starcrest, 2004). The model years of the truck fleet were stepped up for each year, such that the average truck age (i.e., study year minus model year) remained constant regardless of the year. This approach accounts for a small percentage of older trucks being retired each year and replaced with newer, cleaner trucks through normal fleet turnover. Emission factors for years between the calculated years were estimated by interpolation. Given a lack of information on how emission factors would change beyond the year 2040, emission factors after the year 2040 were held constant at 2040 levels.
6. **Construction Equipment**. Emissions from diesel-powered construction equipment were calculated using emission factors derived from OFFROAD2007. Using South Coast Air Basin fleet information, the OFFROAD model was run for each of the construction years from 2009 through 2012 for Phases II and III. Emission factors were calculated based on each type of equipment and horsepower rating of the equipment.

2.4 Activity Level Trends

The second parameter needed to develop source category emission rates is the annual source activity levels expected each year over the 70-year period. Examples of activity levels include the number of ship visits and associated energy usage, ship hoteling times, terminal equipment usage, number of departing and arriving trains, truck vehicle miles traveled (VMT), and truck travel speeds.

For the CEQA baseline scenario, terminal equipment activity levels in the baseline period April 2000 through March 2001 were held constant over the entire 70-year period. The emission factors, however, were allowed to change year-by-year as described in Section 2.3 of this Appendix E3.

For the NEPA baseline and all Project alternatives, the yearly activity levels from 2004 to 2045 were interpolated from the 2005, 2010, 2015, 2030, and 2045 analysis year projections. Actual total equivalent units (TEU) and ship visit data were used for years 2004, 2005, and 2006 for those alternatives that would use the Berth 97-109 as a container terminal (the proposed Project and Alternatives 3, 4, and 5). One additional adjustment was made for line-haul locomotives, where idling times at the Berth 121-131 rail yard were reduced from 2.5 hours to 1.5 hours per outbound train trip starting in 2006 in response to the 2005 CARB/Railroad Statewide Agreement (BNSF, 2006). Due to the lack of activity projections beyond 2045, activity levels after 2045 were held constant at 2045 levels.

2.5 70-Year-Average Emission Rates

For diesel internal combustion engines (ICEs), which represent the majority of emission sources at the Port, DPM is the only pollutant needed for the cancer risk analysis (which uses 70-year-average emission rates). The unit risk factor established by Office of Environmental Health Hazard Assessment (OEHHA) for the assessment of DPM cancer risk includes consideration of all of the individual toxic species that could be adsorbed onto the DPM particles.

For all other source types (ship boilers and alternative-fueled engines); however, speciating combustion emissions into individual TAC components was necessary. In accordance with a CARB recommendation (CARB, 2005a), speciation profiles developed for the *California Emission Inventory and Reporting System* (CEIDARS) were used in this study (CARB, 2002b, 2003b). Table E3-2-1 presents the speciation profiles that were used to convert TOG and PM combustion emissions into individual TAC emissions[5]. TACs cumulatively contributing less than 0.1 percent to the speciation profiles in terms of cancer risk were screened out of the HRA and are not shown in the table.

For each emission source category, PM and VOC emissions were calculated for each of the 70 years by multiplying the source activity level by the emission factors for that particular year. The resulting 70 annual emission rates for each pollutant were then averaged to produce the 70-year average PM and VOC emission rates needed for the HRA or speciation. Tables E3-2-2 through E3-2-6 present the 70-year average TAC emission rates used in this HRA for the CEQA baseline, NEPA baseline, proposed Project, Mitigated Project, and No Project scenarios, respectively.

For the NEPA baseline and Project alternatives, the 70-year averaging period is 2004-2073 because 2004 was the initial year of operations as a container terminal under the Settlement Agreement. For the information-only 2009 HRA, the 70-year averaging period is 2009-2078 because 2009 represents the earliest anticipated year when the Port would be able to impose mitigation measures other than those stipulated by the Settlement Agreement. Finally, because the CEQA baseline represents March 2001 operations, the 70-year averaging period for the CEQA baseline was projected forward 70 years from the baseline, 2001 to 2070.

2.6 Maximum Year Emission Rates

Similar to the cancer risk analysis, diesel ICEs need only DPM emissions to be included in the chronic hazard index analysis (which uses maximum annual emission rates). The reference exposure level (REL) established by OEHHA for the assessment of DPM for chronic noncancer effects includes consideration of all of the individual toxic species that may be adsorbed onto the DPM particles.

For all other source types (ship boilers and alternative-fueled engines), it was necessary to speciate combustion emissions into individual TAC components using the total organic gas (TOG) and PM speciation profiles shown in Table E3-2-1. TACs cumulatively

[5] In this study, TOG emissions were derived from volatile organic compound (VOC) emissions using conversion factors provided with the TOG speciation profiles.

contributing less than 0.1 percent to the speciation profiles in terms of chronic hazard index were screened out of the HRA and are not shown in the table.

For the NEPA baseline and Project alternatives, maximum year emissions were selected from the Project analysis years 2005, 2010, 2015, 2030, and 2045. To ensure the capture of maximum impacts, the highest annual emissions from each source grouping were conservatively modeled together in the HRA, even if the emissions would occur in different analysis years for different source groupings. The source groupings included (1) ships and tugboats in transit, (2) ships hoteling, (3) locomotives and rail yard equipment, (4) trucks, (5) terminal equipment, and (6) construction equipment. Maximum annual construction emissions from Phases II and III of construction correspond to the 2010 analysis year only.

For CEQA baseline conditions, emissions for the period April 2000 through March 2001 were used in the HRA.

Table E3-2-1. Speciation Profiles for Diesel and Alternative Fuel Combustion Sources

Pollutant	CAS Number	Weight Percent							
		TOG Profile No. 504	TOG Profile No. 719	TOG Profile No. 818	PM_{10} Profile No. 112	PM_{10} Profile No. 114	PM_{10} Profile No. 119	PM_{10} Profile No. 123	PM_{10} Profile No. 425
Acetaldehyde	75070	—	0.029	7.4	—	—	—	—	—
Benzene	71432	1.9	0.11	2.0	—	—	—	—	—
Formaldehyde	50000	0.088	0.80	15	—	—	—	—	—
Xylenes	1210	0.97	0.039	1.0	—	—	—	—	—
Naphthalene	91203	0.062	—	0.085	—	—	—	—	—
n-Hexane	110543	1.4	0.020	0.16	—	—	—	—	—
Propylene	115071	4.0	1.7	2.6	—	—	—	—	—
Toluene	108883	1.9	0.039	1.5	—	—	—	—	—
Ammonia	7664417	—	—	—	—	—	—	—	0.34
Arsenic	7440382	—	—	—	0.54	0.54	—	—	0.0005
Bromine	7726956	—	—	—	—	—	—	0.05	0.0018
Cadmium	7440439	—	—	—	0.05	0.05	—	—	0.004
Copper	7440508	—	—	—	—	—	—	0.05	0.0025
Lead	7439921	—	—	—	0.55	0.55	—	—	0.0042
Manganese	7439965	—	—	—	—	—	—	0.05	0.004
Mercury	7439976	—	—	—	—	—	—	—	0.003
Nickel	7440020	—	—	—	0.05	0.05	—	0.05	0.0019
Sulfates	9960	—	—	—	25	25	15	45	1.74
Vanadium	7440622	—	—	—	—	—	0.55	—	0.0029
Antimony	7440360	—	—	—	—	—	—	—	0.0036
Chlorine	7782505	—	—	—	—	—	—	—	—
Hexavalent Chromium	18540299	—	—	—	0.027	0.027	—	0.0025	0.00006
Phosphorous	7723140	—	—	—	—	—	—	—	0.0127
Zinc	7440666	—	—	—	0.55	0.55	—	0.05	0.0438

Table E3-2-1. Speciation Profiles for Diesel and Alternative Fuel Combustion Sources

Pollutant	CAS Number	Weight Percent							
		TOG Profile No. 504	TOG Profile No. 719	TOG Profile No. 818	PM_{10} Profile No. 112	PM_{10} Profile No. 114	PM_{10} Profile No. 119	PM_{10} Profile No. 123	PM_{10} Profile No. 425
Applicable Emission Sources:		Ship boilers – residual or distillate oil	LPG /LNG terminal equipment, trucks	Ship main and aux. engines, locomotives, tugboats, cargo handling equipment, trucks – diesel fuel	Ship boilers – distillate oil	Ship aux. engines – residual or distillate fuel	Tugboats – main engine and aux. engines – diesel fuel	LPG/LNG terminal equipment, trucks	Ship main engine, locomotives, terminal equipment, trucks – diesel fuel

Notes:

[a]TACs cumulatively contributing less than 0.1 percent to the total cancer risk, chronic hazard index, or acute hazard index were screened out of each speciation profile.

[b]TOG – total organic gas.

[c]For Profile No. 504, TOG is 83.47 percent VOC.

[d]For Profile No. 719, TOG is 9.14 percent VOC.

[e]For Profile No. 818, TOG is 87.85 percent VOC.

[f]PM_{10} Profile No. 112, for ship boilers using distillate oil, yields higher health risk values than the speciation profile for ship boilers using residual fuel. Therefore, PM_{10} Profile No. 111 was conservatively used for all boilers, whether using residual or distillate fuel.

[g]Hexavalent chromium is assumed to be 5 percent of total chromium, in accordance with the CARB *AB2588 Technical Support Document* (1989), page 57.

[h]Other speciation profiles used in the HRA but not shown in this table are PM_{10} Profile No. 472 (Truck Tire Wear) and PM_{10} Profile No. 473 (Truck Brake Wear).

Source: CARB (2002b; 2003b).

Tables E3-2-2 through E3-2-6 present the maximum annual TAC emission rates used in this HRA for the CEQA baseline, NEPA baseline, proposed Project, Mitigated Project, and No Project scenarios, respectively.

2.7 Maximum 1-Hour Emission Rates

For the acute hazard index analysis, which uses maximum 1-hour emission rates, speciating combustion emissions into individual TAC components was necessary for all source types because OEHHA has not assigned an acute toxicity factor to DPM. Therefore, combustion emissions were speciated into individual TAC components using the TOG and PM speciation profiles shown in Table E3-2-1. TACs cumulatively contributing less than 0.1 percent to the speciation profiles in terms of acute hazard index were screened out of the HRA and are not shown in the table.

For the NEPA baseline and Project alternatives, maximum 1-hour emissions were calculated assuming theoretical worst-case hourly activity levels for each source category for each project analysis year (2005, 2010, 2015, 2030, and 2045). To ensure the capture of maximum impacts, the highest 1-hour emissions from each source grouping were conservatively modeled together in the HRA, even if the emissions would occur in different analysis years for different source groupings. Maximum 1-hour emissions from Phases II and III of construction correspond to the 2010 analysis year only.

CEQA baseline emissions represent theoretical worst case terminal equipment activity levels for period April 2000 through March 2001.

For marine vessels, two possible worst-case hourly activity scenarios were considered, and the scenario yielding the highest impact was reported:

- One ship is hoteling while a second ship is maneuvering, turning, and docking (with assistance from two tugboats) during the same hour
- Two ships are hoteling at adjacent berths during the same hour

For those scenarios where only one berth would be active (such as Alternatives 3 and 5), the two modeled scenarios were (1) one ship is hoteling; and (2) one ship is maneuvering, turning, and docking with assistance from two tugboats. The analysis assumed the largest ship sizes (and, therefore, with the greatest emissions) anticipated in the fleet that could be accommodated simultaneously at the terminal. As an additional conservative measure, each ship was assumed to use residual fuel with 4.5 percent sulfur content during the unmitigated worst case 1-hour scenario. (By contrast, the calculations of cancer risk and chronic hazard index, which are based on long-term exposures, assume residual fuel with 2.7 percent sulfur content, which represents the worldwide average sulfur content used by ships [Entec, 2002]).

For the Berth 121-131 rail yard, activity during the worst-case hour assumed one train being assembled and one train being disassembled at the same time. The train assembly would involve one yard locomotive, four line-haul locomotives, seven yard tractors, and two toppicks. The train disassembly would also involve one yard locomotive, four line-haul locomotives, seven yard tractors, and two toppicks. During the same hour, one four-locomotive train was also assumed to depart from the rail yard, and a second four-locomotive train was assumed to arrive at the rail yard.

For trucks and terminal equipment, maximum 1-hour emissions were derived from the peak daily emissions by applying diurnal emission scalars published by CARB in the *Diesel Particulate Matter Exposure Assessment Study for the Ports of Los Angeles and Long Beach* (April 2006). Specifically, for off-terminal trucks, these scalars assume that 80 percent of truck emissions occur from 6 a.m. to 6 p.m., and 20 percent occur from 6 p.m. to 6 a.m. For terminal equipment, the scalars assume that 80 percent of emissions occur from 8 a.m. to 5 p.m., 15 percent occur from 5 p.m. to 3 a.m., and 5 percent occur from 3 a.m. to 8 a.m. The derivation of peak daily emissions for trucks and terminal equipment is discussed in Section 3.2 of the EIS/EIR under Impact AQ-3 for each alternative.

For construction equipment, maximum 1-hour emissions were estimated by first calculating daily emissions from individual construction activities (for example, wharf construction, marine terminal crane delivery, or backlands construction). Maximum daily emissions then were determined by summing emissions from overlapping construction activities as indicated in the proposed construction schedule (Table E3-2-2) of the EIS/EIR. Maximum 1-hour emission were derived from the peak daily emissions assuming uniform distribution of emissions over a 10-hour workday, except for ship hoteling emissions, which were divided by 24 hours.

Tables E3-2-2 through E3-2-6 present the maximum 1-hour speciated emissions by source for the CEQA baseline, NEPA baseline, proposed Project, mitigated Project, and No Project scenarios, respectively.

Table E3-2-2. Toxic Air Contaminant Emissions by Source – CEQA Baseline

Emission Source	70-Year-Average Emissions (lb/yr) [b,e]				Maximum Annual Emissions (lb/yr) [c,e]				Maximum 1-Hour Emissions (lb/hr) [d]		
	DPM	Formal-dehyde	Arsenic	Sulfates	DPM	Formal-dehyde	Arsenic	Sulfates	Formal-dehyde	Arsenic	Sulfates
Terminal Equipment [f]	7.2E+02	--	--	--	1.1E+04	--	--	--	2.4E+00	3.8E-05	1.3E-01
Total - All Sources	7.2E+02	--	--	--	1.1E+04	--	--	--	2.4E+00	3.8E-05	1.3E-01

Notes:

[a] This HRA evaluated emissions of 25 toxic air contaminants (all 25 TACs are listed in Table E3-5-1). However, for brevity, only those TACs contributing at least 2 percent to the estimated health risk results are presented in this table.

[b] Seventy-year-average emissions were used to determine individual lifetime cancer risk.

[c] Maximum annual emissions were used to determine noncancer chronic hazard indexes.

[d] Maximum 1-hour emissions were used to determine noncancer acute hazard indices.

[e] For 70-year average and maximum annual emissions, only DPM emissions were modeled in the HRA for diesel terminal equipment.

[f] For the CEQA baseline, only terminal equipment emissions are associated with Berth 97-109 terminal operations.

Table E3-2-3. Toxic Air Contaminant Emissions by Source – NEPA Baseline

Emission Source	70-Year-Average Emissions (lb/yr) [b,e]				Maximum Annual Emissions (lb/yr) [c,e]				Maximum 1-Hour Emissions (lb/hr) [d]		
	DPM	Formal-dehyde	Arsenic	Sulfates	DPM	Formal-dehyde	Arsenic	Sulfates	Formal-dehyde	Arsenic	Sulfates
Terminal Equipment [f]	8.7E+02	1.5E+03	0.0E+00	6.1E+02	2.6E+03	9.9E+03	0.0E+00	2.3E+03	7.2E+00	9.5E-06	1.5E+00
Total - All Sources	8.7E+02	1.5E+03	0.0E+00	6.1E+02	2.6E+03	9.9E+03	0.0E+00	2.3E+03	7.2E+00	9.5E-06	1.5E+00

Notes:

[a] This HRA evaluated emissions of 25 toxic air contaminants (all 25 TACs are listed in Table E3-5-1). However, for brevity, only those TACs contributing at least 2 percent to the estimated health risk results are presented in this table.

[b] Seventy-year-average emissions were used to determine individual lifetime cancer risk.

[c] Maximum annual emissions were used to determine noncancer chronic hazard indexes.

[d] Maximum 1-hour emissions were used to determine noncancer acute hazard indices.

[e] For 70-year average and maximum annual emissions, only non-diesel ICE emissions (i.e., alternative fueled engines) are shown for formaldehyde, arsenic, and sulfates. Diesel ICE emissions are modeled only with DPM emissions.

[f] For the NEPA baseline, only terminal equipment emissions are associated with the Berth 97-109 terminal during operations.

[g] The NEPA baseline scenario assumes that the Settlement Agreement measures for cargo handling equipment would be implemented, CAAP measure CHE-1 (Performance Standards for Cargo Handling Equipment) would begin January 1, 2009, and 100 percent alternative fueled top picks would be implemented starting 2009.

Table E3-2-4. Toxic Air Contaminant Emissions by Source – Proposed Project without Mitigation

Emission Source	70-Year-Average Emissions (lb/yr) [b,e]				Maximum Annual Emissions (lb/yr) [c,e]				Maximum 1-Hour Emissions (lb/hr) [d]		
	DPM	Formal-dehyde	Arsenic	Sulfates	DPM	Formal-dehyde	Arsenic	Sulfates	Formal-dehyde	Arsenic	Sulfates
Ships – Transit [f,g,h]	1.0E+05	8.8E-02	3.0E+00	1.4E+02	1.1E+05	9.8E-02	3.3E+00	1.5E+02	7.1E+00	1.7E-01	8.6E+00
Ships – Hoteling [h]	3.2E+04	8.0E-01	2.7E+01	1.2E+03	3.5E+04	8.7E-01	2.9E+01	1.4E+03	2.7E-01	5.1E-02	2.4E+00
Tugboats	7.9E+02	0.0E+00	0.0E+00	0.0E+00	8.7E+02	0.0E+00	0.0E+00	0.0E+00	3.1E-01	0.0E+00	3.6E-01
Terminal Equipment	5.8E+03	0.0E+00	0.0E+00	0.0E+00	2.7E+04	0.0E+00	0.0E+00	0.0E+00	5.6E+00	7.9E-05	2.8E-01
Rail Yard Equipment	2.1E+02	0.0E+00	0.0E+00	0.0E+00	9.5E+02	0.0E+00	0.0E+00	0.0E+00	5.2E-01	7.6E-06	2.7E-02
Locomotives [i]	5.1E+02	0.0E+00	0.0E+00	0.0E+00	4.0E+02	0.0E+00	0.0E+00	0.0E+00	8.7E-01	1.6E-05	5.7E-02
Trucks - On Terminal	7.9E+02	0.0E+00	6.2E-04	2.0E-01	2.8E+03	0.0E+00	3.7E-04	1.2E-01	6.9E-01	4.7E-06	1.6E-02
Trucks - Off Terminal	2.0E+03	0.0E+00	3.6E-03	1.2E+00	5.4E+03	0.0E+00	2.6E-03	8.1E-01	4.2E-01	7.2E-06	2.3E-02
Total - All Sources	1.4E+05	8.9E-01	3.0E+01	1.4E+03	1.9E+05	9.7E-01	3.2E+01	1.5E+03	1.6E+01	2.2E-01	1.2E+01

Notes:

[a] This HRA evaluated emissions of 25 toxic air contaminants (all 25 TACs are listed in Table E3-5-1). However, for brevity, only those TACs contributing at least 2 percent to the estimated health risk results are presented in this table.

[b] Seventy-year-average emissions were used to determine individual lifetime cancer risk.

[c] Maximum annual emissions were used to determine noncancer chronic hazard indexes.

[d] Maximum 1-hour emissions were used to determine noncancer acute hazard indices.

[e] For 70-year average and maximum annual emissions, only nondiesel ICE emissions (i.e., ship boilers, tire wear, and brake wear) are shown for formaldehyde, arsenic, and sulfates. Diesel ICE emissions are modeled only with DPM emissions.

[f] Because worst-case 1-hour health risk impacts involve ships maneuvering and hoteling near the terminal, no Fairway or Precautionary Area transit emissions would occur during the worst-case hour. Therefore, maximum 1-hour emissions for ship transit include only harbor transit, turning, and docking emissions.

[g] Seventy-year-average and maximum annual ship transit emissions presented in this table include transit to the edge of the SCAQMD overwater boundary (a 53 nm distance). Of this distance, only the nearest 29 nm to the berth were included in the dispersion modeling. The remaining, more distant, portion of ship transit was not included in the modeling because it contributes less than 1 percent to the health risk values at the maximum impacted receptors.

[h] The maximum 1-hour emissions for ship transit and ship hoteling reflect a worst case scenario of one ship hoteling and another ship arriving during the same hour. This scenario produced higher acute hazard index values than 2 ships hoteling and no ships arriving.

[i] Train transit emissions include line haul locomotive emissions between the Berth 121-131 (on-dock) rail yard and the Anaheim Street crossing (about 4 km distance).

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Table E3-2-5. Toxic Air Contaminant Emissions by Source – Mitigated Project

Emission Source	70-Year-Average Emissions (lb/yr) [b,e]				Maximum Annual Emissions (lb/yr) [c,e]				Maximum 1-Hour Emissions (lb/hr) [d]		
	DPM	Formal-dehyde	Arsenic	Sulfates	DPM	Formal-dehyde	Arsenic	Sulfates	Formal-dehyde	Arsenic	Sulfates
Ships – Transit [f,g,h]	1.9E+04	8.8E-02	1.4E+00	6.3E+01	1.8E+04	9.8E-02	1.4E+00	6.7E+01	5.0E+00	1.4E-01	7.1E+00
Ships – Hoteling [h]	4.7E+02	8.0E-01	1.3E+01	5.8E+02	6.1E+03	4.1E-01	1.4E+01	6.4E+02	2.7E-01	5.1E-02	2.4E+00
Tugboats [i]	7.9E+02	0.0E+00	0.0E+00	0.0E+00	8.7E+02	0.0E+00	0.0E+00	0.0E+00	3.1E-01	0.0E+00	3.6E-01
Terminal Equipment	6.3E+02	2.3E+03	0.0E+00	1.1E+03	1.4E+03	1.2E+04	0.0E+00	2.8E+03	1.2E+01	7.3E-06	2.6E+00
Rail Yard Equipment	1.9E+02	0.0E+00	0.0E+00	0.0E+00	9.5E+02	0.0E+00	0.0E+00	0.0E+00	5.2E-01	7.6E-06	2.7E-02
Locomotives	4.2E+02	0.0E+00	0.0E+00	0.0E+00	4.0E+02	0.0E+00	0.0E+00	0.0E+00	8.7E-01	1.6E-05	5.7E-02
Trucks - On Terminal	2.5E+02	2.9E+02	6.2E-04	1.7E+02	2.3E+03	0.0E+00	1.9E-04	6.0E-02	4.6E-01	3.8E-06	1.3E-02
Trucks - Off Terminal	5.2E+02	5.6E+02	3.6E-03	6.3E+02	4.2E+03	0.0E+00	1.3E-03	4.2E-01	2.8E-01	5.5E-06	1.8E-02
Total - All Sources	2.2E+04	3.1E+03	1.4E+01	2.6E+03	3.5E+04	1.2E+04	1.5E+01	3.5E+03	1.9E+01	1.9E-01	1.3E+01

Notes:

[a] This HRA evaluated emissions of 25 toxic air contaminants (all 25 TACs are listed in Table E3-5-1). However, for brevity, only those TACs contributing at least 2 percent to the estimated health risk results are presented in this table.

[b] Seventy-year-average emissions were used to determine individual lifetime cancer risk.

[c] Maximum annual emissions were used to determine noncancer chronic hazard indexes.

[d] Maximum 1-hour emissions were used to determine noncancer acute hazard indices.

[e] For 70-year average and maximum annual emissions, only nondiesel ICE emissions (i.e., ship boilers, alternative fueled engines, tire wear, and brake wear) are shown for formaldehyde, arsenic, and sulfates. Diesel ICE emissions are modeled only with DPM emissions.

[f] Because worst-case 1-hour health risk impacts involve ships maneuvering and hoteling near the terminal, no Fairway or Precautionary Area transit emissions would occur during the worst-case hour. Therefore, maximum 1-hour emissions for ship transit include only harbor transit, turning, and docking emissions.

[g] Seventy-year-average and maximum annual ship transit emissions presented in this table include transit to the edge of the SCAQMD overwater boundary (a 53 nm distance). Of this distance, only the nearest 29 nm to the berth were included in the dispersion modeling. The remaining, more distant, portion of ship transit was not included in the modeling because it contributes less than 1 percent to the health risk values at the maximum impacted receptors.

[h] The maximum 1-hour emissions for ship transit and ship hoteling reflect a worst case scenario of one ship hoteling and another ship arriving during the same hour. This scenario produced higher acute hazard index values than 2 ships hoteling and no ships arriving.

[i] Train transit emissions include line haul locomotive emissions between the Berth 121-131 (on-dock) rail yard and the Anaheim Street crossing (about 4 km distance).

Table E3-2-6. Toxic Air Contaminant Emissions by Source – Alternative 1 (No Project)

Emission Source	70-Year-Average Emissions (lb/yr) [b,e]				Maximum Annual Emissions (lb/yr) [c,e]				Maximum 1-Hour Emissions (lb/hr) [d]		
	DPM	Formal-dehyde	Arsenic	Sulfates	DPM	Formal-dehyde	Arsenic	Sulfates	Formal-dehyde	Arsenic	Sulfates
Ships – Hoteling [f]	4.9E+00	6.8E-05	3.8E-03	1.8E-01	3.4E+02	4.7E-03	2.7E-01	1.2E+01	5.8E-02	1.1E-02	5.1E-01
Terminal Equipment [f]	7.9E+02	1.3E+03	0.0E+00	4.8E+02	2.1E+03	8.3E+03	0.0E+00	1.9E+03	5.9E+00	7.1E-06	1.3E+00
Total - All Sources	7.9E+02	1.3E+03	3.8E-03	4.8E+02	2.4E+03	8.3E+03	2.7E-01	1.9E+03	5.9E+00	1.1E-02	1.8E+00

Notes:

[a] This HRA evaluated emissions of 25 toxic air contaminants (all 25 TACs are listed in Table E3-5-1). However, for brevity, only those TACs contributing at least 2 percent to the estimated health risk results are presented in this table.

[b] Seventy-year-average emissions were used to determine individual lifetime cancer risk.

[c] Maximum annual emissions were used to determine noncancer chronic hazard indexes.

[d] Maximum 1-hour emissions were used to determine noncancer acute hazard indices.

[e] For 70-year average and maximum annual emissions, only nondiesel ICE emissions (i.e., alternative fueled engines) are shown for formaldehyde, arsenic, and sulfates. Diesel ICE emissions are modeled only with DPM emissions.

[f] For Alternative 1, only terminal equipment emissions are associated with the Berth 97-109 terminal during operations. A small amount of general cargo ship hoteling emissions was also modeled for Alternative 1 to represent removal of the four existing shoreside gantry cranes.

[g] Alternative 1 assumes that the Settlement Agreement measures for cargo handling equipment would be implemented, CAAP measure CHE-1 (Performance Standards for Cargo Handling Equipment) would begin January 1, 2009, and 100 percent alternative fueled top picks would be implemented starting 2009.

3.0 Receptor Locations Used in the HRA

This HRA analyzes the health risks associated with TAC emissions from Project-related sources at a variety of locations (receptors) throughout the project area, including at the locations of exposure to residents, offsite workers, recreational users, students, and sensitive members of the public. The analysis utilized a regular coarse grid of 1,189 receptor points spaced every 250 meters (m) apart around Berth 97-109 terminal. The regular receptor grid extended roughly 7 kilometers (km) east-west by 10 km north-south around the terminal area. Another 90 receptor points spaced at 50-m intervals were positioned along Berth 97-109 terminal property lines. Different property lines were assumed for the CEQA baseline, NEPA baseline, proposed Project, and Project alternatives in accordance with the land parcels developed for each scenario. In addition, 66 discrete receptors were placed at sensitive receptor locations of special concern, such as schools, day care centers, convalescent homes, and hospitals within a 5-km radius of the terminal.

Subsequent to the initial modeling analysis and preliminary identification of maximum impact locations, the HRA was refined by modeling with a fine grid of 924 additional receptor points. The fine grid consisted of 0.5-by-0.5-km receptor grids that surrounded the maximum impact locations with receptors spaced every 50 m apart. Figure 3-1 presents the coarse and fine receptor grids used in the AERMOD modeling analysis. Figure 3-2 shows the locations of the sensitive receptors included in the modeling analysis.

AERMAP, version 06341, was used to calculate receptor elevations and the controlling hill height for each receptor.

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

- The residential MEI was selected from all receptors in residential or zoned residential areas, including the public marinas (for possible liveaboards) located in the East Basin and Cerritos Channel.
- The occupational MEI was selected from all receptors outside Berth 97-109 terminal property and not over water. Receptors located on adjacent Port terminals, including the Berth 121-131 rail yard, were considered valid for selection. Receptors directly on the Berth 97-109 property line also were considered valid for selection. This approach is conservative, particularly for long-term occupational exposures because it is unlikely that an offsite worker would be located on or very near the Berth 97-109 property line except intermittently.
- The sensitive MEI was selected from all identified schools, day care centers, convalescent homes, and hospitals in the surrounding area.
- The student MEI was selected from all identified schools in the surrounding area.
- The recreational MEI was selected from all receptors outside Port of Los Angeles or Port of Long Beach property and not over water.

4.0 Dispersion Model Selection And Inputs

The air dispersion modeling for the HRA was performed using the USEPA AERMOD dispersion model, version 07026, based on the *Guideline on Air Quality Models* (40 CFR, Part 51, Appendix W; April 15, 2003). The AERMOD model is a steady-state, multiple-source, Gaussian dispersion model designed for use with emission sources situated in terrain where ground elevations can exceed the stack heights of the emission sources. The AERMOD model requires hourly meteorological data consisting of wind vector, wind speed, temperature, stability class, and mixing height. The AERMOD model allows input of multiple sources and source groupings, eliminating the need for multiple model runs. The selection of the AERMOD model is well suited based on (1) the general acceptance by the modeling community and regulatory agencies of its ability to provide reasonable results for large industrial complexes with multiple emission sources, (2) a consideration of the availability of annual sets of hourly meteorological data for use by AERMOD, and (3) the ability of the model to handle the various physical characteristics of project emission sources, including, “point,” “area,” and “volume” source types. AERMOD is a USEPA-approved dispersion model, and the SCAQMD approves of its use for mobile source analyses.

This HRA used the Hot Spot and Analysis Reporting Program (HARP) model to calculate cancer risk and chronic hazard index values based on the ambient air concentrations predicted by the AERMOD dispersion model. Because HARP is not directly compatible with AERMOD, it was first necessary to reformat the AERMOD output using CARB’s HARP On-Ramp software (CARB, 2007b).

For acute hazard index calculations, HARP’s refined calculation methodology requires the use of a binary concentration output file from AERMOD, which is prohibitively large for a project with hundreds of sources and thousands of receptors. Furthermore, HARP’s screening methodology for the acute hazard index, which does not require binary output from AERMOD, is grossly conservative because it sums the maximum hazard index from each source, even if the maximums do not occur simultaneously. Therefore, for this HRA, acute hazard indices were calculated directly in AERMOD by modeling toxicity-weighted 1-hour emission rates. Specifically, for each source, the 1-hour emission rate of each TAC was divided by the acute REL for that TAC, and all the quotients were subsequently added together to form a single, toxicity-weighted emission rate for use in AERMOD. Using this approach, the maximum 1-hour “concentrations” produced by AERMOD are actually the acute hazard indices. Although this approach is less conservative than HARP’s screening methodology, it is still conservative for the following reasons: (1) the hazard indices include the contributions from all TACs, regardless of their respective target organs; and (2) the hazard index exposure period for some TACs is longer than 1-hour, in which case AERMOD will over-predict the maximum concentration. In this HRA, the TACs with acute exposure periods longer than 1 hour include arsenic (4 hours) and benzene (6 hours).

4.1 Emission Source Representation

The AERMOD modeling analysis evaluated Project-related construction and operational emission sources, including construction equipment, container ships, assist tugboats, terminal and rail yard equipment, locomotives, and trucks. The HRA realistically simulated the Project-related emission sources, taking into consideration physical characteristics and operational locations of the sources. Emissions from the movement of vessels in the shipping lanes, trains on rail lines, and trucks on roadways are line-source emissions that were simulated and modeled as a series of separated volume sources. Mobile source operations confined within specific geographic locations, such as the Berth 97-109 terminal or the Berth 121-131 rail yard, were modeled as a collection of volume sources covering the area. Volume source emissions were simulated by AERMOD as being released and mixed vertically and horizontally within a volume of air prior to being dispersed downwind. Finally, stationary emissions from hoteling ships were modeled as point (stack) sources with upward plume velocity and buoyancy.

The operational characteristics of each source type in terms of area of operation and vertical stack height or source height determined the release parameters of each volume or point source. A total of 918 emission sources were simulated in AERMOD. The specific methodology for defining the sources is discussed below.

1. **Ship transit lanes (Fairway, Precautionary Area, and Harbor Transit)**. Emissions from marine vessels that transit between the offshore shipping lanes and the berth were simulated as a series of separated volume sources beginning approximately 15 nm beyond Point Fermin and extending to the wharf at Berth 97-109. Total transit emissions were calculated and divided equally among the volume sources for each of the Fairway, Precautionary Area, and Harbor Transit segments. Tug assist emissions also were included in the Harbor Transit volume sources.

   Vessel transit sources were modeled as occurring from elevated-release volume sources separated by a distance equal to the width of each volume source (i.e., the center-to-center distance is twice the source width), as recommended for the simulation of line sources in the *ISCST User's Guide* (USEPA, 1995). For the Fairway and Precautionary Area segments, the volume source width was set to 300 meters, roughly the width of the shipping lane. Hence, the center-to-center spacing of the Fairway and Precautionary Area transit sources was 600 meters. For Harbor Transit sources, the volume source width was set to 100 meters because the narrower shipping lane and proximity to receptors require a smaller source width and closer source spacing. The center-to-center spacing of the Harbor Transit sources was 200 m.

   Based on a series of visual observations of containership exhaust plumes at the Port, the plume height for ship transit sources was conservatively assumed to be 25 percent above stack height for fairway and precautionary area transit, and 50 percent above stack height for harbor transit (SAIC, 2006). The lower apparent wind speeds at slower ship speeds result in a higher plume rise.

   The transit sources were positioned along the centerline of the vessel inbound/outbound traffic lanes through the Fairway and Precautionary Area, along a line from the edge of the Precautionary Area to Angels Gate, and then up the center of the Main Channel to the Berth 97-109 terminal.

2. **Vessel berth maneuvering area (Turning Basin and Docking)**. Ship Turning and Docking represent activities with concentrated emissions that occur in designated locations near the berth. As a result, dedicated volume sources were created to simulate these activities. A turning-basin volume source was located in the center of the turning basin nearest the wharf at Berth 97-109. The volume-source width was set to 300 m, which is the approximate size of the turning basin. The docking volume source was positioned adjacent to the wharf at Berth 97-109. Its volume-source width also was set to 300 m. Based on a series of visual observations of containership exhaust plumes at the Port, the plume height was assumed to be 100 percent above stack height (i.e., twice the stack height) for ship turning and docking (SAIC, 2006).

3. **Vessel hoteling locations**. Because they are stationary, hoteling-vessel emission sources were modeled as stack-type point sources located adjacent to Berths 97-109. Three sets of stack parameters for hoteling auxiliary engines were developed for three categories of ship sizes, based on data collected during the vessel-boarding program (Port, 2004). Due to a limited amount of data collected for ship boilers, one set of stack parameters for hoteling boilers representing all ship sizes was developed. The stack exit velocities for these representative stacks were adjusted downward to account for nonvertical plume releases.

4. **Terminal and rail yard areas.** The areas of the Berth 97-109 Terminal, truck in-gate (at the Berth 121-131 terminal), and Berth 121-131 rail yard were overlain with square boxes of various sizes to achieve complete coverage of the surface areas where the sources operate. Each of the boxes represents the base of a volume source. The emissions were assumed to be spread uniformly over the entire area represented by the volume sources. Emissions, therefore, were assigned to each volume source in proportion to the base area of the source divided by the total area of all sources. Emissions from construction equipment, terminal equipment, on-terminal trucks, and rail yard cargo-handling equipment were assigned a release height of 15 feet, which is the approximate average height of the exhaust port plus a nominal amount of plume rise.

   Emissions from yard locomotives and idling line-haul locomotives at the Berth 121-131 rail yard were assigned a release height equal to the average stack height of 15 feet plus a designated amount of vertical plume rise. Based on a screening-level modeling analysis conducted for the Roseville Rail Yard Study, the volume source height for locomotives at the on-dock rail yard was set to 21.8 feet and 44.5 feet above ground for daytime and nighttime conditions, respectively (CARB, 2004b).

5. **Roadways and railways.** Truck movements on roadways and train movements on rail lines were modeled as a series of separated volume sources, as recommended for the simulation of line sources in the ISCST User's Guide (USEPA, 1995). Roadways were divided into links that have uniform average speeds and widths. Average roadway speeds were estimated using California Department of Transportation (Caltrans) guidelines for peak-hour conditions (Caltrans, 1997). The rail line was assumed to have uniform width and average speed (9 miles per hour [mph]) over the entire segment from the Berth 121-131 rail yard to the Anaheim Street crossing. Therefore, the source characteristics for each volume source along a given link are identical except for the centerpoint locations. Total link emissions were divided equally among the number of sources in a given link.

Emissions from trucks were assigned a release height of 15 feet, which is the approximate average height of the exhaust port plus a nominal amount of plume rise. Emissions from trains were assigned a release height equal to the average stack height of 15 feet plus a designated amount of vertical plume rise. Based on a screening-level modeling analysis conducted for the Roseville Rail Yard Study, the volume source heights for locomotives in transit were set to 18.3 feet and 47.7 feet above ground for daytime and nighttime conditions, respectively (CARB, 2004b). The width of the volume sources for roadways and rail lines were set equal to the width of the roadway or rail corridor plus 3 m on each side.

The HRA positioned the emission sources by using the Universal Transverse Mercator (UTM) coordinate system (NAD-27) referenced to topographic data obtained from the United States Geological Survey (USGS).

Table E3-4-1 lists the source release parameters used in the AERMOD model. Figures 4-1 and 4-2 show the sizes and locations of the emission sources over a base map of the Project vicinity.

4.2 Meteorological Data

Due to the blocking effect of the Palos Verdes Hills, wide variations in wind conditions often occur within the Port of Los Angeles. For example, during typical sea-breeze conditions, the hills can create a relatively light wind zone in the Inner Harbor while the Outer Harbor experiences stronger winds in a different direction. The monthly and hourly streamlines developed for the South Coast Air Basin in *California South Coast Air Basin Hourly Wind Flow Patterns* show a clear difference in wind speed and direction between the inner and outer harbor regions (SCAQMD, 1977).

The Port currently is operating a monitoring program that includes the collection of meteorological data from several locations within Port boundaries (Port, 2004). Recently, meteorological data sets containing a full year of consecutive hourly observations, from July 1, 2005, through June 30, 2006, became available. The data sets contain 8,760 hourly observations of wind speed, wind direction, temperature, atmospheric stability, and mixing height recorded at each of the monitoring stations in the network.

The two most representative meteorological data sets selected for this analysis were collected at Saints Peter and Paul Elementary School (SPPS) in Wilmington, about 2 miles north of the project site, and at Berth 47, about 2.5 miles south of the project site. The SPPS station is representative of inner harbor wind patterns, while the Berth 47 station is representative of outer harbor wind patterns.

Table E3-4-1. AERMOD Source Release Parameters for the HRA

Source Type	Source Description	AERMOD Source Type	No. of Sources	Release Height (feet)	Source Width [h] (m)	Initial Vertical Thickness[g] (feet)	Line Source Spacing (m)	Exit Velocity (fpm)	Exit Temp. (°F)	Stack Diam. (feet)
Ships	Fairway Transit	Volume	48	161 [f]	300	64	600	—	—	—
	Precautionary Area Transit	Volume	32	161 [f]	300	64	600	—	—	—
	Harbor Transit	Volume	33	194 [f]	100	130	200	—	—	—
	Turning	Volume	1	258 [f]	300	258	600	—	—	—
	Docking	Volume	1	258 [f]	300	258	600	—	—	—
	Hoteling Auxiliary Engines <3,000 TEU ship size	Point	2 [a]	122	—	—	—	1,815	572	1.28
	Hoteling Auxiliary Engines 3,000-5,000 TEU ship size	Point	2 [a]	118	—	—	—	1,516	581	1.54
	Hoteling Auxiliary Engines >5,000 TEU ship size	Point	2 [a]	146	—	—	—	1,476	590	1.77
	Hoteling Boilers – all ship sizes	Point	2 [a]	131	—	—	—	3,590	547	1.62
Tugboats	Harbor Transit	Volume	33	50	100	50	200	—	—	—
	Turning	Volume	1	50	300	50	600	—	—	—
	Docking	Volume	1	50	300	50	600	—	—	—
Terminal & Construction Equipment	Terminal Equipment and Construction Equipment at Berth 97-109	Volume	86 [e]	15	Various [d]	15	—	—	—	—
	Berth 121-131 Rail Yard Equipment	Volume	16	15	50	15	—	—	—	—
Locomotives	Berth 121-131 Rail Yard Locomotives	Volume	16	Various [b]	50	Various [b]	—	—	—	—
	Trains Departing/Arriving Berth 121-131 Rail Yard	Volume	142	Various [c]	15	Various [c]	30	—	—	—
Trucks	Trucks Queuing at Berth 121-131 In-Gate	Volume	1	15	100	15	—	—	—	—
	Trucks driving from In-Gate to B97-109 Terminal	Volume	3	15	75	15	—	—	—	—
	Trucks on B97-109 Terminal	Volume	86 [e]	15	Various [d]	15	—	—	—	—
	Knoll entry road from Front Street to Berth 121-131 in-gate	Volume	39	15	22	15	44	—	—	—
	SR-47 from I-110 to the Vincent Thomas Bridge	Volume	17	15	22	15	44	—	—	—
	I-110 from SR-47 to Anaheim Street	Volume	62	15	39	15	78	—	—	—
	Harbor Boulevard from Swinford Avenue to Front Street	Volume	9	15	24	15	48	—	—	—
	Front Street from Harbor Boulevard to John S. Gibson Boulevard	Volume	27	15	24	15	48	—	—	—

Table E3-4-1. AERMOD Source Release Parameters for the HRA

Source Type	Source Description	AERMOD Source Type	No. of Sources	Release Height (feet)	Source Width[h] (m)	Initial Vertical Thickness[g] (feet)	Line Source Spacing (m)	Exit Velocity (fpm)	Exit Temp. (°F)	Stack Diam. (feet)
Trucks (continued)	J.S. Gibson Boulevard from Front Street to Harry Bridges Boulevard	Volume	41	15	24	15	48	—	—	—
	Figueroa Street from C Street to Harry Bridges Boulevard	Volume	5	15	24	15	48	—	—	—
	C Street from I-110 to Figueroa Street	Volume	4	15	24	15	48	—	—	—
	Harry Bridges Boulevard from J.S. Gibson to Alameda Street	Volume	43	15	21	15	42	—	—	—
	Alameda Street from Harry Bridges Boulevard to Anaheim Street	Volume	43	15	21	15	42	—	—	—
	SR-47 eastbound on-ramp at Harbor Boulevard	Volume	17	15	13	15	26	—	—	—
	SR-47 westbound on-ramp at Harbor Boulevard	Volume	17	15	13	15	26	—	—	—
	I-110 northbound on-ramp at J.S. Gibson Boulevard	Volume	14	15	13	15	26	—	—	—

[a] One source represents Berth 100 and the other represents Berth 102.

[b] The volume source height for locomotives at the on-dock rail yard was 21.8 feet and 44.5 feet for daytime and nighttime conditions, respectively. These heights were derived from the *Roseville Railyard Study* (CARB, 2004). The initial vertical thickness was set equal to the source height.

[c] The volume source height for locomotives in transit was 18.3 feet and 47.7 feet for daytime and nighttime conditions, respectively. These heights were derived from the *Roseville Railyard Study* (CARB, 2004). The initial vertical thickness was set equal to the source height.

[d] Volume sources covering the Berth 97-109 terminal area range in width from 50 to 250 meters.

[e] The full Berth 97-109 terminal area for the proposed Project is represented by 86 volume sources. Fewer than 86 sources are used to represent the terminal area for the CEQA baseline, NEPA baseline, and various Project alternatives.

[f] Based on a series of visual observations of containership exhaust plumes at the Port of Los Angeles, the plume height was conservatively assumed to be 25% above stack height for fairway and precautionary area transit, 50% above stack height for harbor transit, and 100% above stack height for turning and docking. The lower apparent wind speeds at slower ship speeds result in a higher plume rise.

[g] Vertical thickness is converted to a sigma-z value for AERMOD by dividing by 4.3 for elevated releases (ships and tugboats) and by 2.15 for ground-based releases (terminal equipment, locomotives, and trucks).

[h] Source width is converted to a sigma-y value for AERMOD by dividing by 4.3 for stand-alone sources (turning, docking, and Berth 121-131 in-gate) and by 2.15 for line or contiguous area sources (all other volume sources).

fpm feet per minute
m meter
°F degrees Fahrenheit

To account for the unique wind patterns in the Project area, the modeling domain for this analysis was split into inner and outer harbor regions. The division between the inner harbor (to the north) and the outer harbor (to the south) is roughly a line extending east and west of the 22nd Street landing at the port. Emission sources located in the inner harbor region, which includes construction sources and most operational sources, were modeled with the SPPS meteorological data. Emission sources located in the outer harbor region, which includes ships and tugboats, were modeled with the Berth 47 meteorological data. The modeling results were then summed at each common receptor point.

The meteorological data were processed using USEPA-approved AERMET (version 04300) meteorological data preprocessor for the AERMOD dispersion model. AERMET uses three steps to preprocess and combine the surface and upper-air soundings to output the data in a format, which is compatible with the AERMOD model. The first step extracts the data and performs a brief quality assurance check of the data. The second step merges the meteorological data sets. The third step outputs the data in the AERMOD compatible format while also incorporating surface characteristics surrounding the collection or application site.

The output from the AERMET model consists of two separate files: the surface conditions file and a vertical profile dataset. AERMOD utilizes these two files in the dispersion modeling algorithm to predict pollutant concentrations resulting from a source's emissions.

4.3 Model Options

Technical options selected for the AERMOD model were regulatory default. Use of these options follows the USEPA modeling guidance (40 CFR, Appendix W; April 15, 2003).

The following temporal distribution of emissions was modeled for annual average concentrations (for cancer risk and chronic hazard index):

Ships in transit, Tugboats	80% of emissions 4 am – 8 pm 20% of emissions 8 pm – 4 am
Terminal Equipment, Rail Yard Equipment, Onsite Trucks	80% of emissions 8 am – 5 pm 15% of emissions 5 pm – 3 am 5% of emissions 3 am – 8 am
Offsite Trucks	80% of emissions 6 am – 6 pm 20% of emissions 6 pm – 6 am
Locomotives, Hoteling Ships	Uniform distribution of emissions 24 hr/day

These emission distributions are based on data published by CARB in the *Diesel Particulate Matter Exposure Assessment Study for the Ports of Los Angeles and Long Beach* (April 2006).

The following temporal distribution of emissions was modeled for peak 1-hour concentrations (acute hazard index):

Ships in transit, Tugboats, Hoteling Ships, Rail Yard Equipment, Locomotives	Peak hour emissions 24 hr/day
Terminal Equipment, Onsite Trucks	80% of emissions 8 am – 5 pm (peak hour emissions) 15% of emissions 5 pm – 3 am 5% of emissions 3 am – 8 am
Offsite Trucks	80% of emissions 6 am – 6 pm (peak hour emissions) 20% of emissions 6 pm – 6 am

5.0 Calculation of Health Risks

For long-term health risk values, the results of the AERMOD dispersion modeling analysis represent an intermediate product in the HRA process. The HARP model subsequently was used to determine cancer risk and chronic hazard indices from exposure to Project emissions by factoring pollutant concentrations by pollutant-specific cancer potency values and chronic RELs obtained from OEHHA (CARB, 2005b).

5.1 Toxicity Factors

The inhalation cancer potency factor is the probability that a person will contract cancer from the continuous inhalation of 1 milligram (mg) of a chemical per kilogram (kg) of body weight per day over a period of 70 years. The inhalation potency factor is used to calculate a potential inhalation cancer risk using the new risk assessment algorithms defined in the OEHHA (2003).

To assess the potential for noncancer health effects resulting from chronic and acute inhalation exposure, OEHHA has established RELs to which ambient TAC concentrations are compared. An REL is an estimate of the continuous inhalation exposure concentration to which the human population (including sensitive subgroups) is likely to be without appreciable risk of experiencing deleterious noncancer effects.

In addition to the inhalation exposure pathway, several noninhalation exposure pathways also were incorporated in the HRA, including dermal adsorption, soil ingestion, home-grown produce ingestion (residential and sensitive receptors only), and mother's milk ingestion (residential and sensitive receptors only). The various exposure parameters and settings used in HARP for these exposure pathways are consistent with SCAQMD guidelines (SCAQMD, 2005a). The results of this study show that the contributions of the noninhalation exposure pathways to the HRA results are negligible compared to the inhalation pathway.

Table E3-5-1 presents the cancer, chronic noncancer, and acute noncancer toxicity factors used to assess health risks in this study.

Table E3-5-1. Toxicity Factors Used in the HRA

Pollutant	CAS Number	Inhalation Cancer Potency Factor $(mg/kg\text{-}d)^{-1}$	Chronic Inhalation REL $(\mu g/m^3)$	Target Organ for Chronic Exposure	Acute Inhalation REL $(\mu g/m^3)$	Target Organ for Acute Exposure
DPM [a]	9901	1.1	5	I	—	—
Acetaldehyde	75070	0.01	9	I	—	—
Benzene [b]	71432	0.1	60	C,E,G	1,300	C,E,F,H
Formaldehyde	50000	0.021	3	D,I	94	D,F,I
Xylenes	1210	—	700	G,I	22,000	D,I
Naphthalene	91203	0.12	9	I	—	—
n-Hexane	110543	—	7,000	G	—	—
Propylene	115071	—	3,000	I	—	—
Toluene	108883	—	300	C,G,I	37,000	C,D,G,H,I
Ammonia	7664417	—	200	I	3,200	D,I
Arsenic [b, c]	7440382	12	0.03	B,C,G,J	0.19	C,H
Bromine	7726956	—	1.7	I	—	—
Cadmium [c]	7440439	15	0.02	I,M	—	—
Copper	7440508	—	2.4	I	100	I
Lead [c]	7439921	0.042	—	—	—	—
Manganese	7439965	—	0.2	G	—	—
Mercury [c]	7439976	—	0.09	F,G,M	1.8	C,H
Nickel [c]	7440020	0.91	0.05	A,E,I	6.0	F,I
Sulfates	9960	—	25	I	120	I
Vanadium	7440622	—	—	—	30	D,I
Antimony	7440360	—	0.2	I	—	—
Chlorine	7782505	—	0.2	I	210	D,I
Hexavalent Chromium	18540299	510	0.2	E,I	—	—
Phosphorous	7723140	—	0.07	C,H	—	—
Zinc	7440666	—	35	B,E,I	—	—

Notes:

[a]For diesel ICEs, only DPM emissions were evaluated for cancer risk and chronic hazard indices, because DPM is a surrogate for the combined health effects associated with exposure to diesel exhaust emissions. For all other emission sources (external combustion boilers, alternative fuel engines, tire and brake wear), emissions of the 24 other toxic air contaminants were evaluated for cancer risk and chronic hazard indices. For the acute hazard indices, DPM was not evaluated; rather, emissions of the 24 other toxic air contaminants were evaluated for all emission sources (including diesel ICEs).

[b]The acute exposure period is 1 hour for all compounds except benzene (6 hours) and arsenic (4 hours).

[c]Arsenic, cadmium, lead, mercury, nickel, and hexavalent chromium were also evaluated for noninhalation exposure pathways. For arsenic, the cancer risk oral slope factor is 1.5 $(mg/kg/day)^{-1}$, and the noncancer chronic oral REL is 0.0003 mg/kg/day. For cadmium, the noncancer chronic oral REL is 0.0005 mg/kg/day. For lead, the cancer risk oral slope factor is 0.0085 $(mg/kg/day)^{-1}$. For mercury, the noncancer chronic oral REL is 0.0003 mg/kg/day. For nickel, the noncancer chronic oral REL is 0.05 mg/kg/day. For hexavalent chromium, the noncancer chronic oral REL is 0.02 mg/kg/day.

Key to noncancer acute and chronic exposure target organs:

A. Alimentary Tract
B. Cardiovascular System
C. Developmental System
D. Eye
E. Hematologic System
F. Immune System
G. Nervous System
H. Reproductive System
I. Respiratory System
J. Skin
K. Bone
L. Endocrine System
M. Kidney

Source: CARB, 2005b

5.2 Exposure Scenarios for Individual Lifetime Cancer Risk

For the cancer risk evaluation, the frequency and duration of exposure to TACs are assumed to be directly proportional to the risk. Therefore, this HRA used specific exposure assumptions for each receptor type, as described below.

1. **Residential and Sensitive Receptors.** Cancer risks for residential and sensitive receptors were estimated using the breathing rates described in the *CARB Recommended Interim Risk Management Policy for Inhalation-Based Residential Cancer Risk (October 2003)* (CARB, 2004a). For risk assessments based on multiple exposure pathways, where a single cancer risk value is required for a risk management decision, the CARB policy recommends that the potential cancer risk be based on the derived cancer risk method outlined in the OEHHA HRA Guidance Manual (OEHHA, 2003) together with the 80th percentile breathing rate of 302 liters per kilogram of body weight per day (L/kg-day). The HRA, therefore, determined maximum residential and sensitive receptor cancer risk impacts by using the HARP built-in 80th percentile point estimate analysis method and an exposure duration of 24 hours per day, 350 days per year over 70 years (i.e., the “Derived [Adjusted]” risk calculation method). For supplemental information, residential cancer risks also were calculated using a 65th percentile (“average”) breathing rate of 271 L/kg-day and a 95th percentile (“high-end”) breathing rate of 393 L/kg-day.

2. **Occupational impacts**. Workers generally do not spend as much time within a project region as residents of the region. The SCAQMD, therefore, allows an exposure adjustment for workers (SCAQMD, 2005a). Lifetime occupational exposure is based on a worker presence of 8 hours per day, 245 days per year for 40 years (as recommended by OEHHA [2003]). The breathing rate for workers is equal to 447 L/kg-day, which equates to 149 L/kg-day over an 8-hour workday (OEHHA, 2003). Occupational cancer risk estimates were calculated directly in HARP assuming an 18-hour-per-day project operating schedule for inner harbor sources and a 24-hour-per-day operating schedule for outer harbor sources (which are exclusively marine vessels). The use of an 18-hour-per-day project operating schedule for inner harbor sources could yield conservative (overpredictive) results for workers because some sources would operate 24 hours per day, resulting in proportionately less exposure during the time the worker is at the job site.

3. **Student impacts**. Because HARP does not directly compute risks for student exposure assumptions, risks for student receptors were scaled from the results for workers (students and workers have the same noninhalation exposure pathways of dermal adsorption and soil ingestion). The SCAQMD policy is to evaluate student cancer risk based upon a full 70 years of exposure. However, students actually spend a limited time at a given school. Based upon an assumed maximum presence of 6 hours per day, 180 days per year for 6 years, this exposure time produces an adjustment factor of $(6 \times 180 \times 6)/(8 \times 245 \times 40) = 0.083$ relative to worker exposures. This factor is further modified to account for differences in the breathing rate of children compared to the worker-breathing rate. The high-end breathing rate for children is equal to 581 L/kg-day (OEHHA, 2003). The risk values predicted at school sites, therefore, were multiplied by $(0.083 \times 581 / 447) = 0.11$ to produce the maximum student risks actually expected from the Project. For supplemental information, the risk values assuming an SCAQMD-recommended full 70 years of exposure also are reported in this HRA.

4. **Recreational user impacts**. Because HARP does not directly compute risks for recreational exposure assumptions, risks for recreational receptors were scaled from the results for workers (recreational users and workers have the same noninhalation exposure pathways of dermal adsorption and soil ingestion). Based upon an assumed maximum recreational presence of 2 hours per day, 350 days per year for 70 years, this exposure time produces an adjustment factor of (2 × 350 × 70)/(8 × 245 × 40). This factor is further modified to account for differences in the breathing rate of a person engaged in recreation compared to the worker breathing rate. The breathing rate during recreation is assumed to be a "heavy-activity" rate equal to 1,097 L/kg-day, which was obtained from the USEPA *Exposure Factors Handbook* (USEPA, 1997). The risk values predicted in recreation areas, therefore, were multiplied by (0.63 × 1,097/447) = 1.5 to produce the maximum recreational user risks expected from the Project.

Table E3-5-2 summarizes the primary exposure assumptions used to calculate individual lifetime cancer risk by receptor type. In accordance with OEHHA and SCAQMD guidelines, no exposure adjustments were made to the chronic and acute hazard index calculations other than the normal adjustment for worker exposure for the chronic hazard index, which is applied only to the noninhalation exposure pathways.

Table E3-5-2. Exposure Assumptions for Individual Lifetime Cancer Risk

Receptor Type	Exposure Frequency		Exposure Duration (Years)	Breathing Rate (L/kg-day)
	Hours/Day	Days/Year		
Residential	24	350	70	302
Occupational	8	245	40	447
Sensitive	24	350	70	302
Student	6	180	6	581
Recreational	2	350	70	1,097

Notes:

[a]The residential breathing rate of 302 L/kg BW-day represents the 80th percentile breathing rate. For informational purposes, residential cancer risks were also calculated for a 65th percentile ("average") breathing rate of 271 L/kg BW-day and a 95th percentile ("high end") breathing rate of 393 L/kg BW-day (OEHHA, 2003).

[b]The occupational exposure frequency of 245 days/year represents 5 days/week, 49 weeks/year. The occupational breathing rate of 447 L/kg BW-day equates to 149 L/kg BW-day over an 8-hour work day (OEHHA, 2003).

[c]The student breathing rate of 581 L/kg BW-day represents the high end child breathing rate (OEHHA, 2003).

[d]The recreational breathing rate of 1,097 L/kg BW-day represents a "heavy activity" breathing rate, which is derived from a breathing rate of 3.2 m^3/hr (and assuming a 70-kg adult) as reported in the USEPA Exposure Factors Handbook (USEPA, 1997). This recreational breathing rate is conservative because it assumes that an individual could sustain the maximum hourly breathing rate for 2 consecutive hours.

6.0 Significance Criteria for Project Health Risks

The Port has adopted the threshold of less than 10 in a million as being an acceptable risk level for receptors. Based on this threshold, a project would produce less than significant cancer risk impacts if the maximum incremental cancer risk due to the project is less than 10 chances in 1 million (10×10^{-6}).

For chronic and acute noncancer exposures, maximum predicted annual and 1-hour TAC concentrations are compared with the RELs developed by OEHHA. A hazard index (defined as the summation of predicted TAC concentrations divided by their respective RELs) less than 1.0 indicates that the exposure would present an acceptable or insignificant health risk (i.e., no adverse noncancer health impact). Hazard indexes above 1.0 represent the potential for an unacceptable or significant health risk.

For the determination of significance from a CEQA standpoint, this HRA determined the incremental increase in health effects values due to the proposed Project by estimating the net change in impacts between the proposed Project and CEQA baseline conditions. For the determination of significance from a NEPA standpoint, this HRA determined the incremental increase in health effects values due to the proposed Project by estimating the net change in impacts between the proposed Project and NEPA baseline. Both of these incremental health effects values (proposed Project minus CEQA baseline, and proposed Project minus NEPA baseline) were compared to the significance thresholds described above.

7.0 Predicted Health Impacts

7.1 Unmitigated Project Health Impacts

Table E3-7-1 presents a summary of the maximum health impacts that would occur for each receptor type with construction and operation of the proposed Project without mitigation. The table also shows the maximum health impacts from the CEQA baseline and NEPA Baseline scenarios, as well as the CEQA increment (Project minus CEQA baseline) and NEPA increment (Project minus NEPA baseline). Because the results in Table E3-7-1 represent the maximum impacts predicted for each receptor type, the impacts at all other receptors would be less than these values.

The data in Table E3-7-1 show that the maximum CEQA cancer risk increment is predicted to be 85 in a million (85×10^{-6}), at a residential receptor. This risk value exceeds the significance threshold of 10 in a million. The maximum NEPA cancer risk increment is also predicted to be 85 in a million (85×10^{-6}), at a residential receptor, which also exceeds the significance threshold. The receptor location for the maximum CEQA and NEPA increments is on Knoll Hill, approximately 200 m west of the proposed Berth 97-109 terminal boundary. The CEQA and NEPA increments would also exceed the significance threshold at the maximum occupational, sensitive, and recreational receptors.

Table E3-7-1. Maximum Health Impacts Associated with the Proposed Project without Mitigation

Health Impact	Receptor Type	Maximum Predicted Impact					Significance Threshold
		Proposed Project	CEQA Baseline	CEQA Increment	NEPA Baseline	NEPA Increment	
Cancer Risk	Residential	99×10^{-6} (99 in a million)	14×10^{-6} (14 in a million)	85×10^{-6} **(85 in a million)**	9.1×10^{-6} (9.1 in a million)	90×10^{-6} **(90 in a million)**	10×10^{-6} (10 in a million)
	Occupational	71×10^{-6} (71 in a million)	11×10^{-6} (11 in a million)	61×10^{-6} **(61 in a million)**	7.5×10^{-6} (7.5 in a million)	63×10^{-6} **(63 in a million)**	
	Sensitive	53×10^{-6} (53 in a million)	2.3×10^{-6} (2.3 in a million)	50×10^{-6} **(50 in a million)**	2.1×10^{-6} (2.1 in a million)	51×10^{-6} **(51 in a million)**	
	Student	1.5×10^{-6} (1.5 in a million)	0.1×10^{-6} (0.1 in a million)	1.4×10^{-6} (1.4 in a million)	0.1×10^{-6} (0.1 in a million)	1.4×10^{-6} (1.4 in a million)	
	Recreational	93×10^{-6} (93 in a million)	18×10^{-6} (18 in a million)	83×10^{-6} **(83 in a million)**	9.9×10^{-6} (9.9 in a million)	83×10^{-6} **(83 in a million)**	
Chronic Hazard Index	Residential	0.23	0.14	0.10	0.12	0.10	1.0
	Occupational	0.71	0.43	0.42	0.39	0.37	
	Sensitive	0.08	0.02	0.05	0.03	0.05	
	Student	0.08	0.02	0.05	0.03	0.05	
	Recreational	0.61	0.43	0.39	0.33	0.33	
Acute Hazard Index	Residential	1.31	0.13	1.29	0.24	1.25	1.0
	Occupational	2.05	0.22	2.03	0.38	1.96	
	Sensitive	1.10	0.04	1.06	0.14	1.04	
	Student	1.10	0.04	1.06	0.14	1.04	
	Recreational	1.58	0.22	1.54	0.34	1.46	

[a] Exceedances of the significance thresholds are in **bold**. The significance thresholds apply to the CEQA and NEPA increments only.

[b] The maximum increments might not occur at the same receptor locations as the maximum impacts. This means that the increments cannot necessarily be determined by subtracting the CEQA baseline or NEPA baseline impacts from the Project impact. Rather, the subtraction must be done at each receptor, for all modeled receptors, and the maximum result selected.

[c] The CEQA Increment represents Project minus CEQA baseline. The NEPA Increment represents Project minus NEPA baseline.

[d] Data represent the receptor locations with the maximum impacts or increments. The impacts or increments at all other modeled receptors would be less than these values for each receptor type.

[e] The NEPA baseline scenario assumes that the Settlement Agreement measures for cargo handling equipment would be implemented, CAAP measure CHE-1 (Performance Standards for Cargo Handling Equipment) would begin January 1, 2009, and 100 percent alternative fueled top picks would be implemented starting 2009.

[f] The cancer risk values reported in this table for the residential receptor are based on the 80th percentile breathing rate. The risks associated with the 65th percentile (average) breathing rate are 89×10^{-6} for the Project impact, 13×10^{-6} for the CEQA baseline impact, 76×10^{-6} for the CEQA increment, 8.2×10^{-6} for the NEPA baseline impact, and 81×10^{-6} for the NEPA increment. The risks associated with the 95th percentile (high end) breathing rate are 129×10^{-6} for the Project impact, 19×10^{-6} for the CEQA baseline impact, 111×10^{-6} for the CEQA increment, 12×10^{-6} for the NEPA baseline impact, and 117×10^{-6} for the NEPA increment.

[g] The cancer risk values reported in this table for the maximum student receptor are based on exposure assumptions of 6 hr/day, 180 days/year, for 6 years. The cancer risk values for this same receptor using SCAQMD-recommended exposure assumptions of 6 hr/day, 180 days/year, for 70 years are 17×10^{-6} for the Project impact, 0.7×10^{-6} for the CEQA baseline impact, 16×10^{-6} for the CEQA increment, 0.7×10^{-6} for the NEPA baseline impact, and 17×10^{-6} for the NEPA increment.

The maximum chronic hazard index increments are predicted to be less than the significance threshold of 1.0 at all receptors for both CEQA and NEPA.

The maximum acute hazard index increments are predicted to be greater than the significance threshold of 1.0 at each receptor type for both CEQA and NEPA.

Figures 7-1, 7-2, and 7-3 show the maximum receptor locations for the CEQA baseline, NEPA baseline, and proposed Project scenarios, respectively. The residential, occupational, and recreational MEIs are not necessarily located directly on existing homes, workplaces, or recreational facilities; rather, they are located in areas that contain these land use types.

Table E3-7-2 presents the contributions from each emission source to the maximum health effects values for the proposed Project without mitigation. At the maximum residential receptor, the greatest contributor to the cancer risk and chronic hazard index is terminal equipment. The proximity of the receptor to the Berth 97-109 terminal area and the relatively low height for emission release of terminal equipment are two important factors for why terminal equipment is the dominant contributor to these health risk values. By contrast, the greatest contributor to the acute hazard index at the maximum residential receptor is ships in transit (harbor transit, turning, and docking emissions). The worst-case combination of one maneuvering ship and one hoteling ship during a 1-hour period would produce relatively high emissions during that hour, enough to cause ships to contribute more than terminal equipment for a short-term period.

Table E3-7-2. Source Contributions at the Residential and Occupational MEIs for the Proposed Project without Mitigation

Emission Source	Maximum Residential Receptor			Maximum Occupational Receptor		
	Cancer Risk	Chronic Hazard Index	Acute Hazard Index	Cancer Risk	Chronic Hazard Index	Acute Hazard Index
Ships - Transit	8.2%	2.6%	85.5%	3.1%	0.9%	96.0%
Ships - Hoteling	17.1%	5.1%	13.2%	7.6%	1.9%	2.6%
Tugboats	1.0%	0.3%	0.7%	0.5%	0.1%	0.8%
Terminal Equipment	54.5%	69.2%	0.3%	71.0%	77.5%	0.2%
Rail Yard Equipment	0.3%	0.4%	<0.1%	0.2%	0.2%	0.1%
Locomotives	1.0%	0.2%	0.2%	0.5%	0.1%	0.3%
Trucks - On Terminal	8.8%	8.8%	<0.1%	9.1%	7.8%	<0.1%
Trucks - Off Terminal	8.9%	13.5%	0.2%	7.8%	11.5%	<0.1%
Construction Equipment	0.2%	<0.1%	<0.1%	0.3%	<0.1%	<0.1%

At the maximum occupational receptor, the greatest contributor to the cancer risk and chronic hazard index is terminal equipment. The greatest contributor to the acute hazard index is ships in transit.

Table E3-7-3 presents the contributions from each TAC to the maximum health effects values for the proposed Project without mitigation. Because DPM is a surrogate for all diesel ICE emissions for cancer risk and chronic hazard index calculations, DPM is the maximum contributor (nearly 100 percent) to these health risk values. The acute hazard index, however, was calculated by using speciated TAC emissions from all sources. The table shows that the greatest acute hazard index contributor is arsenic at both the maximum residential and occupational receptors. Because the acute hazard index was calculated using maximum 1-hour concentrations, yet the acute REL for arsenic is based on a maximum 4-hour concentration, this suggests that the acute hazard indices reported in Table E3-7-1 are very conservative.

Table E3-7-3. TAC Contributions at the Residential and Occupational MEIs for the Proposed Project without Mitigation

Pollutant	Maximum Residential Receptor			Maximum Occupational Receptor		
	Cancer Risk	Chronic Hazard Index [a]	Acute Hazard Index [a]	Cancer Risk	Chronic Hazard Index [a]	Acute Hazard Index [a]
DPM	99.1%	99.6%	0.0%	99.5%	99.7%	0.0%
Acetaldehyde	<0.1%	<0.1%	<0.1%	<0.1%	<0.1%	<0.1%
Benzene	<0.1%	<0.1%	0.1%	<0.1%	<0.1%	0.1%
Formaldehyde	<0.1%	<0.1%	7.2%	<0.1%	<0.1%	7.9%
Xylenes	<0.1%	<0.1%	<0.1%	<0.1%	<0.1%	<0.1%
Naphthalene	<0.1%	<0.1%	<0.1%	<0.1%	<0.1%	<0.1%
n-Hexane	<0.1%	<0.1%	<0.1%	<0.1%	<0.1%	<0.1%
Propylene	<0.1%	<0.1%	<0.1%	<0.1%	<0.1%	<0.1%
Toluene	<0.1%	<0.1%	<0.1%	<0.1%	<0.1%	<0.1%
Ammonia	<0.1%	<0.1%	<0.1%	<0.1%	<0.1%	<0.1%
Arsenic	0.6%	1.1%	85.2%	0.3%	0.4%	84.5%
Bromine	<0.1%	<0.1%	<0.1%	<0.1%	<0.1%	<0.1%
Cadmium	<0.1%	0.1%	<0.1%	<0.1%	<0.1%	<0.1%
Copper	<0.1%	<0.1%	<0.1%	<0.1%	<0.1%	<0.1%
Lead	<0.1%	<0.1%	<0.1%	<0.1%	<0.1%	<0.1%
Manganese	<0.1%	<0.1%	<0.1%	<0.1%	<0.1%	<0.1%
Mercury	<0.1%	<0.1%	0.1%	<0.1%	<0.1%	0.1%
Nickel	<0.1%	0.1%	0.3%	<0.1%	0.1%	0.3%
Sulfates	<0.1%	<0.1%	7.1%	<0.1%	<0.1%	7.1%
Vanadium	<0.1%	<0.1%	<0.1%	<0.1%	<0.1%	0.1%
Antimony	<0.1%	<0.1%	<0.1%	<0.1%	<0.1%	<0.1%
Chlorine	<0.1%	0.2%	<0.1%	<0.1%	0.2%	<0.1%
Hexavalent Chromium	0.3%	<0.1%	<0.1%	0.2%	<0.1%	<0.1%
Phosphorus	<0.1%	0.1%	<0.1%	<0.1%	0.1%	<0.1%
Zinc	<0.1%	<0.1%	<0.1%	<0.1%	<0.1%	<0.1%

[a] The chemical contributions for the chronic and acute hazard indices include all chemicals regardless of the target organs they affect. As a result, the contributions may add to greater than 100 percent because not all chemicals affect the same target organ.

[b] For diesel internal combustion engines, only DPM emissions were evaluated for cancer risk and chronic hazard indices, because DPM is a surrogate for the combined health effects associated with exposure to diesel exhaust emissions. For all other emission sources (external combustion boilers, alternative fuel engines, tire and brake wear), emissions of the 24 other toxic air contaminants were evaluated for cancer risk and chronic hazard indices. For the acute hazard indices, DPM was not evaluated; rather, emissions of the 24 other toxic air contaminants were evaluated for all emission sources (including diesel ICEs).

To illustrate the geographical extent of health risk impacts associated with the proposed Project, a series of health risk isopleths (contours) has been prepared. The isopleths show individual lifetime cancer risks over a map of the surrounding community, assuming residential exposure conditions (24 hours per day, 350 days per year, for 70 years) and an 80th percentile breathing rate. The risk isopleths are as follows:

Cancer Risk Isopleths Associated with All Emission Sources	
Figure 7-4	CEQA Baseline
Figure 7-5	NEPA Baseline
Figure 7-6	Proposed Project Minus CEQA Baseline
Figure 7-7	Proposed Project Minus NEPA Baseline

7.2 Mitigated Project Health Impacts

This HRA evaluated the effect on health risks resulting from the implementation of the air quality mitigation measures identified in Section 3.2 of the EIS/EIR. A summary of the mitigation measures quantified in this HRA for project construction is as follows:

MM AQ-3: **Fleet Modernization for On-Road Trucks.** All on-road heavy-duty diesel trucks with a gross vehicle weight rating (GVWR) of 19,500 pounds or greater used on-site or to transport materials to and from the site shall comply with EPA 2004 on-road PM emission standards and be the cleanest available NO_X (0.10g/bhp-hr PM_{10} and 2.0 g/bhp-hr NO_X). In addition, all on-road trucks shall be outfitted with the Best Available Control Technology (BACT) devices certified by the California Air Resources Board (CARB). Any emissions control device used by the Contractor shall achieve emissions reductions no less than what could be achieved by a Level 3 diesel emissions control strategy for a similar sized engine as defined by CARB regulations.

MM AQ-4: **Fleet Modernization for Construction Equipment.**

(a) January 1, 2009 to December 31, 2011: All off-road diesel-powered construction equipment greater than 50 hp, except derrick barges and marine vessels, shall meet Tier 2 off road emissions standards. In addition, all construction equipment shall be outfitted with the Best Available Control Technology (BACT) devices certified by the California Air Resources Board (CARB). Any emissions control device used by the Contractor shall achieve emissions reductions no less than what could be achieved by a Level 2 or Level 3 diesel emissions control strategy for a similar sized engine as defined by CARB regulations.

(b) Post January 1, 2012: All off-road diesel-powered construction equipment greater than 50 hp, except derrick barges and marine vessels, shall meet Tier 3 off road emissions standards. In addition, all construction equipment shall be outfitted with the Best Available Control Technology (BACT) devices certified by the California Air Resources Board (CARB). Any emissions control device used by the Contractor shall achieve emissions reductions no less than what could be achieved by a Level 2 or Level 3 diesel emissions control strategy for a similar sized engine as defined by CARB regulations.

A summary of the mitigation measures quantified in this HRA for Project operations for the proposed Project and Alternatives 3, 4, and 5 is as follows[6]:

MM AQ-9: Alternative Maritime Power (AMP)

China Shipping ships calling at Berth 97-109 must use AMP at the following percentages while hoteling in the Port:

- 60 percent of total ship calls at the terminal shall use AMP from January 1 to June 30, 2005
- 70 percent of total ship calls at the terminal shall use AMP starting July 1, 2005
- 90 percent of ship calls starting January 1, 2010
- 100 percent of ship calls starting January 1, 2011

MM AQ-10: Vessel Speed Reduction Program

All ships calling at Berth 97-109 shall comply with the expanded VSRP of 12 knots between 40 nm from Point Fermin and the Precautionary Area in the following implementation schedule:

- 100 percent starting January 1, 2009

MM AQ-11: Low Sulfur Fuel

Ships calling at Berth 97-109 shall use low-sulfur fuel (maximum sulfur content of 0.2 percent) in auxiliary engines, main engines, and boilers within 40 nm of Point Fermin (including hoteling for non-AMP ships) at the following annual participation rates:

- Calendar Year (CY) 2009: 30 percent of auxiliary engines, main engines, and boilers
- CY 2010: 50 percent of auxiliary engines, main engines, and boilers
- CY 2013 and thereafter: 100 percent of auxiliary engines, main engines, and boilers

[6] Alternative 1, Alternative 2, and the NEPA Baseline were assumed to include as project elements the following emission reduction measures: (a) the terminal equipment control measures in the Amended Stipulated Judgment; (b) implementation of CAAP Measure CHE-1 starting in 2009; and (c) 100 percent alternative fueled top picks starting in 2009. These project elements were assumed to be equivalent to MM AQ-15 in its entirety and MM AQ-17 without the requirement for electric RTGs.

MM AQ-12: Slide Valves

Ships calling at Berth 97-109 shall be equipped with slide valves or equivalent on main engines in the following percentages:

- 25 percent in CY 2009
- 50 percent in CY 2010
- 75 percent in CY 2012
- 100 percent in CY 2014 and thereafter

MM AQ-15: Yard Tractors at Berth 97-109 Terminal

All yard tractors operated at the Berth 97-109 terminal shall run on alternative fuel (LPG) beginning September 30, 2004 until December 31, 2014.

Beginning in January 1, 2015, all yard tractors operated at the Berth 97-109 terminal shall be the cleanest available Nitrogen Oxide (NO_X) alternative-fueled engine meeting 0.015 gm/hp-hr for PM.

MM AQ-16: Yard Equipment at Berth 121-131 Rail Yard

All diesel-powered equipment operated at the Berth 121-131 terminal rail yard that handles containers moving through the Berth 97-109 terminal shall implement the following measures:

- Beginning January 1, 2009, all equipment purchases shall be either (1) the cleanest available NO_X alternative-fueled engine meeting 0.015 gm/hp-hr for PM or (2) the cleanest available NO_X diesel-fueled engine meeting 0.015 gm/hp-hr for PM. If there are no engines available that meet 0.015 gm/hp-hr for PM, the new engines shall be the cleanest available (either fuel type) and will have the cleanest VDEC.

- By the end of 2012, all equipment less than 750 hp shall meet the USEPA Tier 4 on-road or Tier 4 nonroad engine standards.

- By the end of 2014, all equipment shall meet USEPA Tier 4 nonroad engine standards.

MM AQ-17: Yard Equipment at Berth 97-109 Terminal

Beginning September 30, 2004, all diesel-powered toppicks and sidepicks operated at the Berth 97-109 terminal shall run on emulsified diesel fuel plus a DOC.

Beginning January 1, 2009, all diesel-powered terminal equipment at the Berths 97-109 terminal other than yard tractors shall implement the following measures:

- Beginning January 1, 2009, all RTGs shall be electric.

- Beginning January 1, 2009, all top picks shall have the cleanest available NO_X alternative fueled engines meeting 0.015 gm/hp-hr for PM.

- Beginning in January 1, 2009, all equipment purchases other than yard tractors, RTGs, and top picks shall be either (1) the cleanest available NO_X alternative-fueled engine meeting 0.015 gm/hp-hr for PM or (2) the cleanest available NO_X diesel-fueled engine meeting 0.015 gm/hp-hr for PM. If there are no engines available that meet 0.015 gm/hp-hr for PM, the new engines shall be the cleanest available (either fuel type) and will have the cleanest VDEC.
- By the end of 2012, all terminal equipment less than 750 hp other than yard tractors, RTGs, and top picks shall meet the USEPA Tier 4 on-road or Tier 4 nonroad engine standards.
- By the end of 2014, all terminal equipment other than yard tractors, RTGs, and top picks shall meet USEPA Tier 4 nonroad engine standards.

MM AQ-18: Yard Locomotives at Berth 121-131 Rail Yard

Beginning January 1, 2015, all yard locomotives at the Berth 121-131 Rail yard that handle containers moving through the Berth 97-109 terminal shall be equipped with a diesel particulate filter (DPF).

MM AQ-19: Clean Truck Program

Heavy-duty diesel trucks entering the Berth 97-109 terminal shall meet the USEPA 2007 emission standards for on-road heavy-duty diesel engines (USEPA, 2001a) in the following percentages:

- 50 percent in CY 2009
- 70 percent in CY 2010
- 90 percent in CY 2011
- 100 percent in CY 2012 and thereafter

MM AQ-20: LNG Trucks

Heavy-duty trucks entering the Berth 97-109 terminal shall be LNG fueled in the following percentages:

- 50 percent in CY 2012
- 70 percent in CY 2014
- 100 percent in CY 2018 and thereafter

For Alternative 6 (Omni Terminal), the same construction and operational mitigation measures listed above would apply with the following modifications to Mitigation Measures AQ-9, AQ-15, AQ-16, AQ-17, and AQ-18:

MM AQ-9: AMP (Alternative 6 only)

For Alternative 6, the following AMP requirements will apply to general cargo vessels (break-bulk cargo) and container vessels:

- 10 percent of ship calls starting January 1, 2010
- 40 percent of ship calls starting January 1, 2015
- 80 percent of ship calls starting January 1, 2020

MM AQ-15: Yard Tractors at Berth 97-109 Terminal (Alternative 6 only)

For Alternative 6, beginning January 1, 2015, all yard tractors operated at the Berth 97-109 terminal shall be the cleanest available NO_X alternative-fueled engine meeting 0.015 gm/hp-hr for PM. MM AQ-17 includes additional mitigation for yard tractors prior to 2015.

MM AQ-16: Yard Equipment at Berth 121-131 Rail Yard (Alternative 6 only)

This measure does not apply to Alternative 6 because the Berth 121-131 rail yard would not be used for this alternative.

MM AQ-17: Yard Equipment at Berth 97-109 Terminal (Alternative 6 only)

For Alternative 6, beginning January 1, 2009, all diesel-powered terminal equipment at the Berth 97-109 terminal shall implement the following measures:

- Beginning in January 1, 2009, all equipment purchases shall be either (1) the cleanest available NO_X alternative-fueled engine meeting 0.015 gm/hp-hr for PM or (2) the cleanest available NO_X diesel-fueled engine meeting 0.015 gm/hp-hr for PM. If there are no engines available that meet 0.015 gm/hp-hr for PM, the new engines shall be the cleanest available (either fuel type) and will have the cleanest VDEC.

- By the end of 2012, all terminal equipment less than 750 Hp shall meet the USEPA Tier 4 on-road or Tier 4 nonroad engine standards.

- By the end of 2014, all terminal equipment other than yard tractors shall meet USEPA Tier 4 nonroad engine standards.

MM AQ-18: Yard Locomotives at Berth 121-131 Rail Yard (Alternative 6 only)

This measure does not apply to Alternative 6 because the Berth 121-131 rail yard would not be used for this alternative.

Table E3-7-4 presents a summary of the maximum health impacts that would occur for each receptor type with construction and operation of the proposed Project with mitigation. The mitigation measures would reduce Project maximum cancer risks by about 78 to 87 percent, depending on the receptor location. Chronic hazard indexes would be reduced by about 17 to 33 percent. Acute hazard indices would be reduced by about 9 to 17 percent. The reason chronic and acute hazard indices would have lower reductions compared to cancer risks is because the maximum 1-hour and annual emissions for some source categories would occur in 2005 or 2010, when many of the mitigation measures have not taken full effect.

Table E3-7-4. Maximum Health Impacts Associated with the Proposed Project with Mitigation

Health Impact	Receptor Type	Maximum Predicted Impact					Significance Threshold
		Proposed Project	CEQA Baseline	CEQA Increment	NEPA Baseline	NEPA Increment	
Cancer Risk	Residential	19×10^{-6} (19 in a million)	14×10^{-6} (14 in a million)	11×10^{-6} **(11 in a million)**	9.1×10^{-6} (9.1 in a million)	11×10^{-6} **(11 in a million)**	10×10^{-6} (10 in a million)
	Occupational	13×10^{-6} (13 in a million)	11×10^{-6} (11 in a million)	13×10^{-6} **(13 in a million)**	7.5×10^{-6} (7.5 in a million)	13×10^{-6} **(13 in a million)**	
	Sensitive	8.9×10^{-6} (8.9 in a million)	2.3×10^{-6} (2.3 in a million)	6.6×10^{-6} (6.6 in a million)	2.1×10^{-6} (2.1 in a million)	6.8×10^{-6} (6.8 in a million)	
	Student	0.2×10^{-6} (0.2 in a million)	0.1×10^{-6} (0.1 in a million)	0.2×10^{-6} (0.2 in a million)	0.1×10^{-6} (0.1 in a million)	0.2×10^{-6} (0.2 in a million)	
	Recreational	20×10^{-6} (20 in a million)	18×10^{-6} (18 in a million)	20×10^{-6} **(20 in a million)**	9.9×10^{-6} (9.9 in a million)	19×10^{-6} **(19 in a million)**	
Chronic Hazard Index	Residential	0.18	0.14	0.06	0.12	0.06	1.0
	Occupational	0.59	0.43	0.32	0.39	0.26	
	Sensitive	0.05	0.02	0.03	0.03	0.02	
	Student	0.05	0.02	0.03	0.03	0.02	
	Recreational	0.50	0.43	0.28	0.33	0.22	
Acute Hazard Index	Residential	1.11	0.13	**1.09**	0.24	**1.05**	1.0
	Occupational	1.70	0.22	**1.68**	0.38	**1.61**	
	Sensitive	0.95	0.04	0.91	0.14	0.89	
	Student	0.95	0.04	0.91	0.14	0.89	
	Recreational	1.43	0.22	**1.40**	0.34	**1.32**	

[a] Exceedances of the significance thresholds are in **bold**. The significance thresholds apply to the CEQA and NEPA increments only.

[b] The maximum increments might not occur at the same receptor locations as the maximum impacts. This means that the increments cannot necessarily be determined by subtracting the CEQA baseline or NEPA baseline impacts from the Project impact. Rather, the subtraction must be done at each receptor, for all modeled receptors, and the maximum result selected.

[c] The CEQA Increment represents Project minus CEQA baseline. The NEPA Increment represents Project minus NEPA baseline.

[d] Data represent the receptor locations with the maximum impacts or increments. The impacts or increments at all other modeled receptors would be less than these values for each receptor type.

[e] The NEPA baseline scenario assumes that the Settlement Agreement measures for cargo handling equipment would be implemented, CAAP measure CHE-1 (Performance Standards for Cargo Handling Equipment) would begin January 1, 2009, and 100 percent alternative fueled top picks would be implemented starting 2009.

[f] The cancer risk values reported in this table for the residential receptor are based on the 80th percentile breathing rate. The risks associated with the 65th percentile (average) breathing rate are 17×10^{-6} for the Project impact, 13×10^{-6} for the CEQA baseline impact, 10×10^{-6} for the CEQA increment, 8.2×10^{-6} for the NEPA baseline impact, and 9.8×10^{-6} for the NEPA increment. The risks associated with the 95th percentile (high end) breathing rate are 24×10^{-6} for the Project impact, 19×10^{-6} for the CEQA baseline impact, 15×10^{-6} for the CEQA increment, 12×10^{-6} for the NEPA baseline impact, and 14×10^{-6} for the NEPA increment.

[g] The cancer risk values reported in this table for the maximum student receptor are based on exposure assumptions of 6 hr/day, 180 days/year, for 6 years. The cancer risk values for this same receptor using SCAQMD-recommended exposure assumptions of 6 hr/day, 180 days/year, for 70 years are 2.9×10^{-6} for the Project impact, 0.7×10^{-6} for the CEQA baseline impact, 2.2×10^{-6} for the CEQA increment, 0.7×10^{-6} for the NEPA baseline impact, and 2.2×10^{-6} for the NEPA increment.

The data in Table E3-7-4 show that the maximum CEQA cancer risk increment after mitigation is predicted to be 20 in a million (20×10^{-6}), at a recreational receptor. The maximum residential CEQA cancer risk increment after mitigation is predicted to be 11 in a million (11×10^{-6}), which is still above the significance threshold. The CEQA cancer risk increment would also exceed the threshold at an occupational receptor.

The maximum chronic hazard index increments after mitigation are predicted to be less than the significance threshold at all receptors for both CEQA and NEPA.

The maximum acute hazard index increments after mitigation are predicted to remain greater than the significance threshold at residential, occupational, and recreational receptors for both CEQA and NEPA. The acute hazard index increments at sensitive and student receptors would be reduced to less than the significance threshold.

Figure 7-8 shows the maximum receptor locations for the Mitigated Project. It should be noted that the residential, occupational, and recreational MEIs are not necessarily located directly on existing homes, workplaces, or recreational facilities; rather, they are located in areas that contain these land use types.

Table E3-7-5 presents the contributions from each emission source to the maximum health effects impacts for the mitigated Project. At the maximum residential receptor, the greatest contributors to cancer risk are trucks and terminal equipment. The greatest contributor to the chronic hazard index is terminal equipment. The greatest contributor to the acute hazard index is ships in transit (harbor transit, turning, and docking emissions). Although several mitigation measures requiring AMP, cleaner fuels, and slide valves would substantially reduce long-term emissions from ships, the worst-case hourly emission scenario for ships would occur before most of these mitigation measures fully take effect.

Table E3-7-5. Source Contributions at the Residential and Occupational MEIs for the Mitigated Project

Emission Source	Maximum Residential Receptor			Maximum Occupational Receptor		
	Cancer Risk	Chronic Hazard Index	Acute Hazard Index	Cancer Risk	Chronic Hazard Index	Acute Hazard Index
Ships - Transit	11.6%	0.8%	82.6%	5.3%	0.3%	94.9%
Ships - Hoteling	3.4%	1.2%	15.5%	3.5%	0.4%	3.1%
Tugboats	5.1%	0.4%	0.8%	2.3%	0.2%	0.9%
Terminal Equipment	36.1%	59.4%	0.7%	2.8%	63.8%	0.5%
Rail Yard Equipment	1.4%	0.5%	<0.1%	38.0%	0.2%	0.1%
Locomotives	3.7%	0.3%	0.2%	40.5%	0.1%	0.3%
Trucks - On Terminal	15.8%	9.0%	<0.1%	1.2%	7.6%	<0.1%
Trucks - Off Terminal	22.3%	13.5%	0.1%	6.5%	11.4%	<0.1%
Construction Equipment	0.5%	14.9%	<0.1%	<0.1%	16.0%	<0.1%

At the maximum occupational receptor, the greatest contributors to cancer risk are locomotives and rail yard equipment, as the receptor is located near the Berth 121-131 rail yard. The greatest contributor to the chronic hazard index is terminal equipment. The greatest contributor to the acute hazard index is ships in transit.

Table E3-7-6 presents the contributions from each TAC to the maximum health effects values for the mitigated Project. Despite the use of alternative fuels in yard tractors, top picks, and trucks, DPM remains the primary contributor to cancer risk (greater than 90 percent). The greatest chronic hazard index contributors are formaldehyde (primarily from alternative fuels) and DPM. The greatest acute hazard index contributor is arsenic. Because the acute hazard index was calculated using maximum 1-hour concentrations, yet the acute REL for arsenic is based on a maximum 4-hour concentration, this suggests that the acute hazard indices reported in Table E3-7-4 are very conservative.

Table E3-7-6. TAC Contributions at the Residential and Occupational MEIs for the Mitigated Project

Pollutant	Maximum Residential Receptor			Maximum Occupational Receptor		
	Cancer Risk	Chronic Hazard Index [a]	Acute Hazard Index [a]	Cancer Risk	Chronic Hazard Index [a]	Acute Hazard Index[a]
DPM	91.2%	30.2%	0.0%	96.6%	25.2%	0.0%
Acetaldehyde	<0.1%	0.8%	<0.1%	<0.1%	0.9%	<0.1%
Benzene	1.7%	0.4%	0.1%	0.2%	0.5%	0.1%
Formaldehyde	2.6%	65.7%	6.6%	0.3%	70.5%	7.3%
Xylenes	<0.1%	<0.1%	<0.1%	<0.1%	<0.1%	<0.1%
Naphthalene	<0.1%	<0.1%	<0.1%	<0.1%	<0.1%	<0.1%
n-Hexane	<0.1%	<0.1%	<0.1%	<0.1%	<0.1%	<0.1%
Propylene	<0.1%	0.1%	<0.1%	<0.1%	0.1%	<0.1%
Toluene	<0.1%	<0.1%	<0.1%	<0.1%	<0.1%	<0.1%
Ammonia	<0.1%	<0.1%	<0.1%	<0.1%	<0.1%	<0.1%
Arsenic	1.5%	0.7%	85.8%	1.7%	0.2%	85.1%
Bromine	<0.1%	<0.1%	<0.1%	<0.1%	<0.1%	<0.1%
Cadmium	<0.1%	0.1%	<0.1%	<0.1%	<0.1%	<0.1%
Copper	<0.1%	<0.1%	<0.1%	<0.1%	<0.1%	<0.1%
Lead	<0.1%	<0.1%	<0.1%	<0.1%	<0.1%	<0.1%
Manganese	<0.1%	0.3%	<0.1%	<0.1%	0.3%	<0.1%
Mercury	<0.1%	<0.1%	<0.1%	<0.1%	<0.1%	0.1%
Nickel	0.1%	1.1%	0.3%	<0.1%	1.1%	0.3%
Sulfates	<0.1%	1.8%	7.2%	<0.1%	2.0%	7.2%
Vanadium	<0.1%	<0.1%	0.1%	<0.1%	<0.1%	0.1%
Antimony	<0.1%	<0.1%	<0.1%	<0.1%	<0.1%	<0.1%
Chlorine	<0.1%	0.1%	<0.1%	<0.1%	0.1%	<0.1%

Table E3-7-6. TAC Contributions at the Residential and Occupational MEIs for the Mitigated Project

	Maximum Residential Receptor			Maximum Occupational Receptor		
Pollutant	Cancer Risk	Chronic Hazard Index [a]	Acute Hazard Index [a]	Cancer Risk	Chronic Hazard Index [a]	Acute Hazard Index[a]
Hexavalent Chromium	2.9%	<0.1%	<0.1%	1.1%	<0.1%	<0.1%
Phosphorus	<0.1%	0.1%	<0.1%	<0.1%	<0.1%	<0.1%
Zinc	<0.1%	<0.1%	<0.1%	<0.1%	<0.1%	<0.1%

[a] The chemical contributions for the chronic and acute hazard indices include all chemicals regardless of the target organs they affect. As a result, the contributions may add to greater than 100 percent because not all chemicals affect the same target organ.

[b] For diesel internal combustion engines, only DPM emissions were evaluated for cancer risk and chronic hazard indices, because DPM is a surrogate for the combined health effects associated with exposure to diesel exhaust emissions. For all other emission sources (external combustion boilers, alternative fuel engines, tire and brake wear), emissions of the 24 other toxic air contaminants were evaluated for cancer risk and chronic hazard indices. For the acute hazard indices, DPM was not evaluated; rather, emissions of the 24 other toxic air contaminants were evaluated for all emission sources (including diesel ICEs).

To illustrate the geographical extent of health risk impacts associated with the Mitigated Project, a series of health risk isopleths (contours) has been prepared. The isopleths show individual lifetime cancer risks over a map of the surrounding community, assuming residential exposure conditions (24 hours per day, 350 days per year, for 70 years) and an 80th percentile breathing rate.

The risk isopleths are as follows:

Cancer Risk Isopleths Associated with All Emission Sources	
Figure 7-9	Mitigated Project Minus CEQA Baseline
Figure 7-10	Mitigated Project Minus NEPA Baseline

Table E3-7-7 presents results of the 2009-2078 HRA for the Mitigated Project. The results are provided for information purposes only and were not used in this EIS/EIR to determine significance. However, the 2009-2078 HRA results indicate that the mitigation measures imposed by the Port starting in 2009 would reduce the residential cancer risk CEQA and NEPA increments to 7.5 and 7.7 in a million, respectively. These values are less than the significance threshold of 10 in a million.

Figure 7-11 shows the maximum receptor locations for the 2009-2078 HRA for the Mitigated Project. It should be noted that the residential, occupational, and recreational MEIs are not necessarily located directly on existing homes, workplaces, or recreational facilities; rather, they are located in areas that contain these land use types.

Table E3-7-7. Maximum Health Impacts Associated with the Proposed Project with Mitigation – 2009-2078 HRA

Health Impact	Receptor Type	Maximum Predicted Impact					Significance Threshold
		Proposed Project	CEQA Baseline	CEQA Increment	NEPA Baseline	NEPA Increment	
Cancer Risk	Residential	9.3×10^{-6} (9.3 in a million)	14×10^{-6} (14 in a million)	7.5×10^{-6} (7.5 in a million)	3.6×10^{-6} (3.6 in a million)	7.7×10^{-6} (7.7 in a million)	
	Occupational	10×10^{-6} (10 in a million)	11×10^{-6} (11 in a million)	**10×10^{-6} (10 in a million)**	3.0×10^{-6} (3.0 in a million)	**10×10^{-6} (10 in a million)**	
	Sensitive	5.7×10^{-6} (5.7 in a million)	2.3×10^{-6} (2.3 in a million)	4.3×10^{-6} (4.3 in a million)	0.8×10^{-6} (0.8 in a million)	4.9×10^{-6} (4.9 in a million)	10×10^{-6} (10 in a million)
	Student	0.2×10^{-6} (0.2 in a million)	0.1×10^{-6} (0.1 in a million)	0.1×10^{-6} (0.1 in a million)	0.02×10^{-6} (0.02 in a million)	0.1×10^{-6} (0.1 in a million)	
	Recreational	15×10^{-6} (15 in a million)	18×10^{-6} (18 in a million)	**14×10^{-6} (14 in a million)**	4.0×10^{-6} (4.0 in a million)	**15×10^{-6} (15 in a million)**	

[a] Exceedances of the significance thresholds are in **bold**. The significance thresholds apply to the CEQA and NEPA increments only.

[b] The maximum increments might not occur at the same receptor locations as the maximum impacts. This means that the increments cannot necessarily be determined by subtracting the CEQA baseline or NEPA baseline impacts from the project impact. Rather, the subtraction must be done at each receptor, for all modeled receptors, and the maximum result selected.

[c] The CEQA Increment represents Project minus CEQA baseline. The NEPA Increment represents Project minus NEPA baseline.

[d] Data represent the receptor locations with the maximum impacts or increments. The impacts or increments at all other modeled receptors would be less than these values for each receptor type.

[e] The NEPA baseline scenario assumes that the Settlement Agreement measures for cargo handling equipment would be implemented, CAAP measure CHE-1 (Performance Standards for Cargo Handling Equipment) would begin January 1, 2009, and 100 percent alternative fueled top picks would be implemented starting 2009.

[f] The 2009-2078 HRA is for informational purposes only. It shows the risks that would occur over a 70-year exposure period starting in 2009, the first year that the Port of Los Angeles is able to implement a wide array of mitigation measures.

To illustrate the geographical extent of health risk impacts associated with the 2009-2078 HRA for the Mitigated Project, a series of health risk isopleths (contours) has been prepared. The isopleths show individual lifetime cancer risks over a map of the surrounding community, assuming residential exposure conditions (24 hours per day, 350 days per year, for 70 years) and an 80th percentile breathing rate. The risk isopleths are as follows:

Cancer Risk Isopleths Associated with All Emission Sources	
Figure 7-12	Mitigated Project Minus CEQA Baseline, 2009-2078 HRA
Figure 7-13	Mitigated Project Minus NEPA Baseline, 2009-2078 HRA

7.3 Alternative 1 (No Project) Health Impacts

Under the No Project Alternative, the existing wharf at Berth 100 would cease to be used for ship berthing and container loading and unloading operations. Container ships would instead berth and load/unload at the Berth 121-131 terminal (operated by Yang Ming Lines). The No Project Alternative would continue to operate as container backlands on 72 acres, which includes the 11 acres used under CEQA baseline conditions and the 61 acres subsequently constructed during Phase I of project construction, as allowed for in the Amended Stipulated Judgment. As a result, the No Project Alternative would increase container throughput relative to CEQA baseline conditions because of the increase in container backlands acreage.

The analysis for Alternative 1 assumes that the Settlement Agreement measures for cargo handling equipment would be implemented, CAAP measure CHE-1 (Performance Standards for Cargo Handling Equipment) would begin January 1, 2009, and all top picks would be alternative-fueled starting in 2009. These project elements were assumed to be equivalent to MM AQ-15 in its entirety, and MM AQ-17 without the requirement for electric RTGs.

Table E3-7-8 presents a summary of the maximum health impacts that would occur for each receptor type with operation of the No Project Alternative. The data in Table E3-7-8 show that the maximum CEQA cancer risk increment is predicted to be 4.6 in a million (4.6×10^{-6}), at an occupational receptor. The cancer risk values would be less than the significance threshold of 10 in a million at all receptors. A NEPA assessment is not necessary for Alternative 1, as federal action would not be required for this alternative.

The maximum chronic and acute hazard index CEQA increments are predicted to be less than the significance thresholds for all receptors.

Figure 7-14 shows the maximum receptor locations for the No Project Alternative. It should be noted that the residential, occupational, and recreational MEIs are not necessarily located directly on existing homes, workplaces, or recreational facilities; rather, they are located in areas that contain these land use types.

Table E3-7-8. Maximum Health Impacts Associated with Alternative 1

Health Impact	Receptor Type	Maximum Predicted Impact			Significance Threshold
		Alternative 1	CEQA Baseline	CEQA Increment	
Cancer Risk	Residential	8.6×10^{-6} (8.6 in a million)	14×10^{-6} (14 in a million)	0.3×10^{-6} (0.3 in a million)	
	Occupational	7.1×10^{-6} (7.1 in a million)	11×10^{-6} (11 in a million)	4.6×10^{-6} (4.6 in a million)	
	Sensitive	1.7×10^{-6} (1.7 in a million)	2.3×10^{-6} (2.3 in a million)	0.1×10^{-6} (0.1 in a million)	10×10^{-6} (10 in a million)
	Student	0.05×10^{-6} (0.05 in a million)	0.1×10^{-6} (0.1 in a million)	0.003×10^{-6} (0.003 in a million)	
	Recreational	10×10^{-6} (10 in a million)	18×10^{-6} (18 in a million)	2.2×10^{-6} (2.2 in a million)	
Chronic Hazard Index	Residential	0.11	0.14	0.01	
	Occupational	0.34	0.43	0.24	
	Sensitive	0.02	0.02	0.00	1.0
	Student	0.02	0.02	0.00	
	Recreational	0.31	0.43	0.10	
Acute Hazard Index	Residential	0.25	0.13	0.16	
	Occupational	0.33	0.22	0.28	
	Sensitive	0.13	0.04	0.11	1.0
	Student	0.13	0.04	0.09	
	Recreational	0.31	0.22	0.21	

[a] Exceedances of the significance thresholds are in **bold**. The significance thresholds apply to the CEQA increments only.

[b] The maximum increments might not occur at the same receptor locations as the maximum impacts. This means that the increments cannot necessarily be determined by subtracting the CEQA baseline impacts from the project impact. Rather, the subtraction must be done at each receptor, for all modeled receptors, and the maximum result selected.

[c] The CEQA Increment represents Project minus CEQA baseline.

[d] Data represent the receptor locations with the maximum impacts or increments. The impacts or increments at all other modeled receptors would be less than these values for each receptor type.

[e] Alternative 1 assumes that the Settlement Agreement measures for cargo handling equipment would be implemented, CAAP measure CHE-1 (Performance Standards for Cargo Handling Equipment) would begin January 1, 2009, and 100 percent alternative fueled top picks would be implemented starting 2009.

Figure 7-15 shows isopleths of individual lifetime cancer risk associated with the No Project Alternative minus the CEQA baseline. The cancer risk isopleths were prepared assuming residential exposure conditions (24 hours per day, 350 days per year, for 70 years) and an 80th percentile breathing rate.

Table E3-7-9 presents results of the 2009-2078 HRA for Alternative 1. The results are provided for information purposes only and were not used to determine significance.

Table E3-7-9. Maximum Health Impacts Associated with Alternative 1 – 2009-2078 HRA

Health Impact	Receptor Type	Maximum Predicted Impact			Significance Threshold
		Alternative 1	CEQA Baseline	CEQA Increment	
Cancer Risk	Residential	2.9×10^{-6} (2.9 in a million)	14×10^{-6} (14 in a million)	-0.03×10^{-6} (-0.03 in a million)	
	Occupational	2.4×10^{-6} (2.4 in a million)	11×10^{-6} (11 in a million)	0.6×10^{-6} (0.6 in a million)	
	Sensitive	0.6×10^{-6} (0.6 in a million)	2.3×10^{-6} (2.3 in a million)	-0.03×10^{-6} (-0.03 in a million)	10×10^{-6} (10 in a million)
	Student	0.02×10^{-6} (0.02 in a million)	0.1×10^{-6} (0.1 in a million)	-0.001×10^{-6} (-0.001 in a million)	
	Recreational	3.4×10^{-6} (3.4 in a million)	18×10^{-6} (18 in a million)	-0.01×10^{-6} (-0.01 in a million)	

[a] Exceedances of the significance thresholds are in **bold**. The significance thresholds apply to the CEQA increment only.

[b] The maximum increments might not occur at the same receptor locations as the maximum impacts. This means that the increments cannot necessarily be determined by subtracting the CEQA baseline impacts from the Project impact. Rather, the subtraction must be done at each receptor, for all modeled receptors, and the maximum result selected.

[c] The CEQA Increment represents Project minus CEQA baseline.

[d] Data represent the receptor locations with the maximum impacts or increments. The impacts or increments at all other modeled receptors would be less than these values for each receptor type.

[e] The 2009-2078 HRA is for informational purposes only. It shows the risks that would occur over a 70-year exposure period starting in 2009, the first year that the Port is able to implement a wide array of mitigation measures.

[f] Alternative 1 assumes that the Settlement Agreement measures for cargo handling equipment would be implemented, CAAP measure CHE-1 (Performance Standards for Cargo Handling Equipment) would begin January 1, 2009, and 100 percent alternative fueled top picks would be implemented starting 2009.

7.4 Health Impacts of Other Alternatives

Tables E3-7-10 through E3-7-23 present summaries of the maximum health impacts that would occur for each receptor type with construction (if applicable) and operation of Alternatives 2 through 6. Because the main source of emissions for Alternative 7 would be automobile trips (primarily gasoline powered), this alternative would generate only a small fraction of the DPM emissions that the proposed Project would generate. As a result, the maximum cancer risks and chronic hazard index values associated with this alternative relative to the CEQA and NEPA baselines are expected to be less than the significance thresholds at all receptors.

Table E3-7-10. Maximum Health Impacts Associated with Alternative 2

Health Impact	Receptor Type	Maximum Predicted Impact					Significance Threshold
		Alternative 2	CEQA Baseline	CEQA Increment	NEPA Baseline	NEPA Increment	
Cancer Risk	Residential	9.1×10^{-6} (9.1 in a million)	14×10^{-6} (14 in a million)	0.4×10^{-6} (0.4 in a million)	9.1×10^{-6} (9.1 in a million)	0.005×10^{-6} (0.005 in a million)	10×10^{-6} (10 in a million)
	Occupational	7.5×10^{-6} (7.5 in a million)	11×10^{-6} (11 in a million)	3.3×10^{-6} (3.3 in a million)	7.5×10^{-6} (7.5 in a million)	0.01×10^{-6} (0.01 in a million)	
	Sensitive	2.1×10^{-6} (2.1 in a million)	2.3×10^{-6} (2.3 in a million)	0.2×10^{-6} (0.2 in a million)	2.1×10^{-6} (2.1 in a million)	0.005×10^{-6} (0.005 in a million)	
	Student	0.1×10^{-6} (0.1 in a million)	0.1×10^{-6} (0.1 in a million)	0.004×10^{-6} (0.004 in a million)	0.1×10^{-6} (0.1 in a million)	0.0001×10^{-6} (0.0001 in a million)	
	Recreational	9.9×10^{-6} (9.9 in a million)	18×10^{-6} (18 in a million)	1.5×10^{-6} (1.5 in a million)	9.9×10^{-6} (9.9 in a million)	0.003×10^{-6} (0.003 in a million)	
Chronic Hazard Index	Residential	0.12	0.14	0.01	0.12	0.00	1.0
	Occupational	0.39	0.43	0.20	0.39	0.00	
	Sensitive	0.03	0.02	0.01	0.03	0.00	
	Student	0.03	0.02	0.01	0.03	0.00	
	Recreational	0.33	0.43	0.09	0.33	0.00	
Acute Hazard Index	Residential	0.24	0.13	0.15	0.24	0.05	1.0
	Occupational	0.38	0.22	0.25	0.38	0.07	
	Sensitive	0.15	0.04	0.11	0.14	0.04	
	Student	0.15	0.04	0.11	0.14	0.04	
	Recreational	0.34	0.22	0.19	0.34	0.07	

[a] Exceedances of the significance thresholds are in bold. The significance thresholds apply to the CEQA and NEPA increments only.

[b] The maximum increments might not occur at the same receptor locations as the maximum impacts. This means that the increments cannot necessarily be determined by subtracting the CEQA baseline or NEPA baseline impacts from the Project impact. Rather, the subtraction must be done at each receptor, for all modeled receptors, and the maximum result selected.

[c] The CEQA Increment represents Project minus CEQA baseline. The NEPA Increment represents Project minus NEPA baseline.

[d] Data represent the receptor locations with the maximum impacts or increments. The impacts or increments at all other modeled receptors would be less than these values for each receptor type.

[e] Alternative 2 and the NEPA Baseline assume that the Settlement Agreement measures for cargo handling equipment would be implemented, CAAP measure CHE-1 (Performance Standards for Cargo Handling Equipment) would begin January 1, 2009, and 100 percent alternative fueled top picks would be implemented starting 2009.

Table E3-7-11. Maximum Health Impacts Associated with Alternative 2 – 2009-2078 HRA

Health Impact	Receptor Type	Maximum Predicted Impact					Significance Threshold
		Alternative 2	CEQA Baseline	CEQA Increment	NEPA Baseline	NEPA Increment	
Cancer Risk	Residential	3.6×10^{-6} (3.6 in a million)	14×10^{-6} (14 in a million)	-0.02×10^{-6} (-0.02 in a million)	3.6×10^{-6} (3.6 in a million)	0.005×10^{-6} (0.005 in a million)	
	Occupational	3.0×10^{-6} (3.0 in a million)	11×10^{-6} (11 in a million)	0.5×10^{-6} (0.5 in a million)	3.0×10^{-6} (3.0 in a million)	0.01×10^{-6} (0.01 in a million)	
	Sensitive	0.8×10^{-6} (0.8 in a million)	2.3×10^{-6} (2.3 in a million)	-0.02×10^{-6} (-0.02 in a million)	0.8×10^{-6} (0.8 in a million)	0.005×10^{-6} (0.005 in a million)	10×10^{-6} (10 in a million)
	Student	0.02×10^{-6} (0.02 in a million)	0.1×10^{-6} (0.1 in a million)	-0.001×10^{-6} (-0.001 in a million)	0.02×10^{-6} (0.02 in a million)	0.0001×10^{-6} (0.0001 in a million)	
	Recreational	4.0×10^{-6} (4.0 in a million)	18×10^{-6} (18 in a million)	-0.01×10^{-6} (-0.01 in a million)	4.0×10^{-6} (4.0 in a million)	0.003×10^{-6} (0.003 in a million)	

[a] Exceedances of the significance thresholds are in bold. The significance thresholds apply to the CEQA and NEPA increments only.

[b] The maximum increments might not occur at the same receptor locations as the maximum impacts. This means that the increments cannot necessarily be determined by subtracting the CEQA baseline or NEPA baseline impacts from the Project impact. Rather, the subtraction must be done at each receptor, for all modeled receptors, and the maximum result selected.

[c] The CEQA Increment represents Project minus CEQA baseline. The NEPA Increment represents Project minus NEPA baseline.

[d] Data represent the receptor locations with the maximum impacts or increments. The impacts or increments at all other modeled receptors would be less than these values for each receptor type.

[e] Alternative 2 and the NEPA Baseline assume that the Settlement Agreement measures for cargo handling equipment would be implemented, CAAP measure CHE-1 (Performance Standards for Cargo Handling Equipment) would begin January 1, 2009, and 100 percent alternative fueled top picks would be implemented starting 2009.

[f] The 2009-2078 HRA is for informational purposes only. It shows the risks that would occur over a 70-year exposure period starting in 2009, the first year that the Port is able to implement a wide array of mitigation measures.

Table E3-7-12. Maximum Health Impacts Associated with Alternative 3 without Mitigation

Health Impact	Receptor Type	Maximum Predicted Impact					Significance Threshold
		Alternative 3	CEQA Baseline	CEQA Increment	NEPA Baseline	NEPA Increment	
Cancer Risk	Residential	72×10^{-6} (72 in a million)	14×10^{-6} (14 in a million)	57×10^{-6} **(57 in a million)**	9.1×10^{-6} (9.1 in a million)	63×10^{-6} **(63 in a million)**	10×10^{-6} (10 in a million)
	Occupational	52×10^{-6} (52 in a million)	11×10^{-6} (11 in a million)	43×10^{-6} **(43 in a million)**	7.5×10^{-6} (7.5 in a million)	45×10^{-6} **(45 in a million)**	
	Sensitive	37×10^{-6} (37 in a million)	2.3×10^{-6} (2.3 in a million)	35×10^{-6} **(35 in a million)**	2.1×10^{-6} (2.1 in a million)	35×10^{-6} **(35 in a million)**	
	Student	1.0×10^{-6} (1.0 in a million)	0.1×10^{-6} (0.1 in a million)	1.0×10^{-6} (1.0 in a million)	0.1×10^{-6} (0.1 in a million)	1.0×10^{-6} (1.0 in a million)	
	Recreational	68×10^{-6} (68 in a million)	18×10^{-6} (18 in a million)	59×10^{-6} **(59 in a million)**	9.9×10^{-6} (9.9 in a million)	59×10^{-6} **(59 in a million)**	
Chronic Hazard Index	Residential	0.21	0.14	0.08	0.12	0.09	1.0
	Occupational	0.68	0.43	0.39	0.39	0.34	
	Sensitive	0.06	0.02	0.04	0.03	0.04	
	Student	0.06	0.02	0.04	0.03	0.04	
	Recreational	0.57	0.43	0.35	0.33	0.29	
Acute Hazard Index	Residential	1.14	0.13	1.12	0.24	1.07	1.0
	Occupational	1.99	0.22	1.97	0.38	1.91	
	Sensitive	0.93	0.04	0.90	0.14	0.87	
	Student	0.93	0.04	0.90	0.14	0.87	
	Recreational	1.31	0.22	1.27	0.34	1.19	

[a] Exceedances of the significance thresholds are in **bold**. The significance thresholds apply to the CEQA and NEPA increments only.

[b] The maximum increments might not occur at the same receptor locations as the maximum impacts. This means that the increments cannot necessarily be determined by subtracting the CEQA baseline or NEPA baseline impacts from the Project impact. Rather, the subtraction must be done at each receptor, for all modeled receptors, and the maximum result selected.

[c] The CEQA Increment represents Project minus CEQA baseline. The NEPA Increment represents Project minus NEPA baseline.

[d] Data represent the receptor locations with the maximum impacts or increments. The impacts or increments at all other modeled receptors would be less than these values for each receptor type.

[e] The NEPA baseline scenario assumes that the Settlement Agreement measures for cargo handling equipment would be implemented, CAAP measure CHE-1 (Performance Standards for Cargo Handling Equipment) would begin January 1, 2009, and 100 percent alternative fueled top picks would be implemented starting 2009.

Table E3-7-13. Maximum Health Impacts Associated with Alternative 3 with Mitigation

Health Impact	Receptor Type	Maximum Predicted Impact					Significance Threshold
		Alternative 3	CEQA Baseline	CEQA Increment	NEPA Baseline	NEPA Increment	
Cancer Risk	Residential	15×10^{-6} (15 in a million)	14×10^{-6} (14 in a million)	8.4×10^{-6} (8.4 in a million)	9.1×10^{-6} (9.1 in a million)	8.2×10^{-6} (8.2 in a million)	10×10^{-6} (10 in a million)
	Occupational	11×10^{-6} (11 in a million)	11×10^{-6} (11 in a million)	**10×10^{-6} (10 in a million)**	7.5×10^{-6} (7.5 in a million)	**10×10^{-6} (10 in a million)**	
	Sensitive	6.9×10^{-6} (6.9 in a million)	2.3×10^{-6} (2.3 in a million)	4.6×10^{-6} (4.6 in a million)	2.1×10^{-6} (2.1 in a million)	4.8×10^{-6} (4.8 in a million)	
	Student	0.2×10^{-6} (0.2 in a million)	0.1×10^{-6} (0.1 in a million)	0.1×10^{-6} (0.1 in a million)	0.1×10^{-6} (0.1 in a million)	0.1×10^{-6} (0.1 in a million)	
	Recreational	16×10^{-6} (16 in a million)	18×10^{-6} (18 in a million)	**16×10^{-6} (16 in a million)**	9.9×10^{-6} (9.9 in a million)	**15×10^{-6} (15 in a million)**	
Chronic Hazard Index	Residential	0.16	0.14	0.05	0.12	0.04	1.0
	Occupational	0.53	0.43	0.28	0.39	0.21	
	Sensitive	0.05	0.02	0.02	0.03	0.02	
	Student	0.05	0.02	0.02	0.03	0.02	
	Recreational	0.45	0.43	0.23	0.33	0.17	
Acute Hazard Index	Residential	1.13	0.13	**1.11**	0.24	**1.07**	1.0
	Occupational	1.99	0.22	**1.97**	0.38	**1.90**	
	Sensitive	0.93	0.04	0.90	0.14	0.87	
	Student	0.93	0.04	0.90	0.14	0.87	
	Recreational	1.31	0.22	**1.28**	0.34	**1.20**	

[a] Exceedances of the significance thresholds are in **bold**. The significance thresholds apply to the CEQA and NEPA increments only.

[b] The maximum increments might not occur at the same receptor locations as the maximum impacts. This means that the increments cannot necessarily be determined by subtracting the CEQA baseline or NEPA baseline impacts from the Project impact. Rather, the subtraction must be done at each receptor, for all modeled receptors, and the maximum result selected.

[c] The CEQA Increment represents Project minus CEQA baseline. The NEPA Increment represents Project minus NEPA baseline.

[d] Data represent the receptor locations with the maximum impacts or increments. The impacts or increments at all other modeled receptors would be less than these values for each receptor type.

[e] The NEPA baseline scenario assumes that the Settlement Agreement measures for cargo handling equipment would be implemented, CAAP measure CHE-1 (Performance Standards for Cargo Handling Equipment) would begin January 1, 2009, and 100 percent alternative fueled top picks would be implemented starting 2009.

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Table E3-7-14. Maximum Health Impacts Associated with Alternative 3 with Mitigation – 2009-2078 HRA

Health Impact	Receptor Type	Maximum Predicted Impact					Significance Threshold
		Alternative 3	CEQA Baseline	CEQA Increment	NEPA Baseline	NEPA Increment	
Cancer Risk	Residential	6.2×10^{-6} (6.2 in a million)	14×10^{-6} (14 in a million)	4.8×10^{-6} (4.8 in a million)	3.6×10^{-6} (3.6 in a million)	5.1×10^{-6} (5.1 in a million)	10×10^{-6} (10 in a million)
	Occupational	7.9×10^{-6} (7.9 in a million)	11×10^{-6} (11 in a million)	7.6×10^{-6} (7.6 in a million)	3.0×10^{-6} (3.0 in a million)	7.7×10^{-6} (7.7 in a million)	
	Sensitive	3.8×10^{-6} (3.8 in a million)	2.3×10^{-6} (2.3 in a million)	2.8×10^{-6} (2.8 in a million)	0.8×10^{-6} (0.8 in a million)	3.0×10^{-6} (3.0 in a million)	
	Student	0.1×10^{-6} (0.1 in a million)	0.1×10^{-6} (0.1 in a million)	0.1×10^{-6} (0.1 in a million)	0.02×10^{-6} (0.02 in a million)	0.1×10^{-6} (0.1 in a million)	
	Recreational	11×10^{-6} (11 in a million)	18×10^{-6} (18 in a million)	**11×10^{-6} (11 in a million)**	4.0×10^{-6} (4.0 in a million)	**11×10^{-6} (11 in a million)**	

[a] Exceedances of the significance thresholds are in **bold**. The significance thresholds apply to the CEQA and NEPA increments only.

[b] The maximum increments might not occur at the same receptor locations as the maximum impacts. This means that the increments cannot necessarily be determined by subtracting the CEQA baseline or NEPA baseline impacts from the Project impact. Rather, the subtraction must be done at each receptor, for all modeled receptors, and the maximum result selected.

[c] The CEQA Increment represents Project minus CEQA baseline. The NEPA Increment represents Project minus NEPA baseline.

[d] Data represent the receptor locations with the maximum impacts or increments. The impacts or increments at all other modeled receptors would be less than these values for each receptor type.

[e] The NEPA baseline scenario assumes that the Settlement Agreement measures for cargo handling equipment would be implemented, CAAP measure CHE-1 (Performance Standards for Cargo Handling Equipment) would begin January 1, 2009, and 100 percent alternative fueled top picks would be implemented starting 2009.

[f] The 2009-2078 HRA is for informational purposes only. It shows the risks that would occur over a 70-year exposure period starting in 2009, the first year that the Port is able to implement a wide array of mitigation measures.

Table E3-7-15. Maximum Health Impacts Associated with Alternative 4 without Mitigation

Health Impact	Receptor Type	Maximum Predicted Impact					Significance Threshold
		Alternative 4	CEQA Baseline	CEQA Increment	NEPA Baseline	NEPA Increment	
Cancer Risk	Residential	92×10^{-6} (92 in a million)	14×10^{-6} (14 in a million)	**78×10^{-6} (78 in a million)**	9.1×10^{-6} (9.1 in a million)	**83×10^{-6} (83 in a million)**	10×10^{-6} (10 in a million)
	Occupational	60×10^{-6} (60 in a million)	11×10^{-6} (11 in a million)	**50×10^{-6} (50 in a million)**	7.5×10^{-6} (7.5 in a million)	**52×10^{-6} (52 in a million)**	
	Sensitive	49×10^{-6} (49 in a million)	2.3×10^{-6} (2.3 in a million)	**47×10^{-6} (47 in a million)**	2.1×10^{-6} (2.1 in a million)	**47×10^{-6} (47 in a million)**	
	Student	1.4×10^{-6} (1.4 in a million)	0.1×10^{-6} (0.1 in a million)	1.3×10^{-6} (1.3 in a million)	0.1×10^{-6} (0.1 in a million)	1.3×10^{-6} (1.3 in a million)	
	Recreational	83×10^{-6} (83 in a million)	18×10^{-6} (18 in a million)	**66×10^{-6} (66 in a million)**	9.9×10^{-6} (9.9 in a million)	**74×10^{-6} (74 in a million)**	
Chronic Hazard Index	Residential	0.22	0.14	0.09	0.12	0.09	1.0
	Occupational	0.62	0.43	0.39	0.39	0.26	
	Sensitive	0.07	0.02	0.05	0.03	0.04	
	Student	0.07	0.02	0.05	0.03	0.04	
	Recreational	0.56	0.43	0.30	0.33	0.25	
Acute Hazard Index	Residential	1.11	0.13	**1.09**	0.24	**1.05**	1.0
	Occupational	1.69	0.22	**1.67**	0.38	**1.60**	
	Sensitive	0.94	0.04	0.90	0.14	0.88	
	Student	0.94	0.04	0.90	0.14	0.88	
	Recreational	1.38	0.22	**1.35**	0.34	**1.27**	

[a] Exceedances of the significance thresholds are in **bold**. The significance thresholds apply to the CEQA and NEPA increments only.

[b] The maximum increments might not occur at the same receptor locations as the maximum impacts. This means that the increments cannot necessarily be determined by subtracting the CEQA baseline or NEPA baseline impacts from the Project impact. Rather, the subtraction must be done at each receptor, for all modeled receptors, and the maximum result selected.

[c] The CEQA Increment represents Project minus CEQA baseline. The NEPA Increment represents Project minus NEPA baseline.

[d] Data represent the receptor locations with the maximum impacts or increments. The impacts or increments at all other modeled receptors would be less than these values for each receptor type.

[e] The NEPA baseline scenario assumes that the Settlement Agreement measures for cargo handling equipment would be implemented, CAAP measure CHE-1 (Performance Standards for Cargo Handling Equipment) would begin January 1, 2009, and 100 percent alternative fueled top picks would be implemented starting 2009.

Table E3-7-16. Maximum Health Impacts Associated with Alternative 4 with Mitigation

Health Impact	Receptor Type	Maximum Predicted Impact					Significance Threshold
		Alternative 4	CEQA Baseline	CEQA Increment	NEPA Baseline	NEPA Increment	
Cancer Risk	Residential	18×10^{-6} (18 in a million)	14×10^{-6} (14 in a million)	**11×10^{-6} (11 in a million)**	9.1×10^{-6} (9.1 in a million)	**10×10^{-6} (10 in a million)**	10×10^{-6} (10 in a million)
	Occupational	13×10^{-6} (13 in a million)	11×10^{-6} (11 in a million)	**13×10^{-6} (13 in a million)**	7.5×10^{-6} (7.5 in a million)	**12×10^{-6} (12 in a million)**	
	Sensitive	8.4×10^{-6} (8.4 in a million)	2.3×10^{-6} (2.3 in a million)	6.2×10^{-6} (6.2 in a million)	2.1×10^{-6} (2.1 in a million)	6.3×10^{-6} (6.3 in a million)	
	Student	0.2×10^{-6} (0.2 in a million)	0.1×10^{-6} (0.1 in a million)	0.2×10^{-6} (0.2 in a million)	0.1×10^{-6} (0.1 in a million)	0.2×10^{-6} (0.2 in a million)	
	Recreational	19×10^{-6} (19 in a million)	18×10^{-6} (18 in a million)	**19×10^{-6} (19 in a million)**	9.9×10^{-6} (9.9 in a million)	**18×10^{-6} (18 in a million)**	
Chronic Hazard Index	Residential	0.18	0.14	0.06	0.12	0.05	1.0
	Occupational	0.52	0.43	0.30	0.39	0.18	
	Sensitive	0.05	0.02	0.03	0.03	0.02	
	Student	0.05	0.02	0.03	0.03	0.02	
	Recreational	0.48	0.43	0.22	0.33	0.16	
Acute Hazard Index	Residential	1.11	0.13	**1.09**	0.24	**1.05**	1.0
	Occupational	1.70	0.22	**1.68**	0.38	**1.61**	
	Sensitive	0.95	0.04	0.91	0.14	0.89	
	Student	0.95	0.04	0.91	0.14	0.89	
	Recreational	1.44	0.22	**1.40**	0.34	**1.32**	

[a] Exceedances of the significance thresholds are in **bold**. The significance thresholds apply to the CEQA and NEPA increments only.

[b] The maximum increments might not occur at the same receptor locations as the maximum impacts. This means that the increments cannot necessarily be determined by subtracting the CEQA baseline or NEPA baseline impacts from the Project impact. Rather, the subtraction must be done at each receptor, for all modeled receptors, and the maximum result selected.

[c] The CEQA Increment represents Project minus CEQA baseline. The NEPA Increment represents Project minus NEPA baseline.

[d] Data represent the receptor locations with the maximum impacts or increments. The impacts or increments at all other modeled receptors would be less than these values for each receptor type.

[e] The NEPA baseline scenario assumes that the Settlement Agreement measures for cargo handling equipment would be implemented, CAAP measure CHE-1 (Performance Standards for Cargo Handling Equipment) would begin January 1, 2009, and 100 percent alternative fueled top picks would be implemented starting 2009.

Table E3-7-17. Maximum Health Impacts Associated with Alternative 4 with Mitigation – 2009-2078 HRA

Health Impact	Receptor Type	Maximum Predicted Impact					Significance Threshold
		Alternative 4	CEQA Baseline	CEQA Increment	NEPA Baseline	NEPA Increment	
Cancer Risk	Residential	8.5×10^{-6} (8.5 in a million)	14×10^{-6} (14 in a million)	6.9×10^{-6} (6.9 in a million)	3.6×10^{-6} (3.6 in a million)	7.1×10^{-6} (7.1 in a million)	
	Occupational	9.9×10^{-6} (9.9 in a million)	11×10^{-6} (11 in a million)	9.6×10^{-6} (9.6 in a million)	3.0×10^{-6} (3.0 in a million)	9.7×10^{-6} (9.7 in a million)	
	Sensitive	5.3×10^{-6} (5.3 in a million)	2.3×10^{-6} (2.3 in a million)	3.9×10^{-6} (3.9 in a million)	0.8×10^{-6} (0.8 in a million)	4.5×10^{-6} (4.5 in a million)	10×10^{-6} (10 in a million)
	Student	0.1×10^{-6} (0.1 in a million)	0.1×10^{-6} (0.1 in a million)	0.1×10^{-6} (0.1 in a million)	0.02×10^{-6} (0.02 in a million)	0.1×10^{-6} (0.1 in a million)	
	Recreational	14×10^{-6} (14 in a million)	18×10^{-6} (18 in a million)	**14×10^{-6} (14 in a million)**	4.0×10^{-6} (4.0 in a million)	**14×10^{-6} (14 in a million)**	

[a] Exceedances of the significance thresholds are in **bold**. The significance thresholds apply to the CEQA and NEPA increments only.

[b] The maximum increments might not occur at the same receptor locations as the maximum impacts. This means that the increments cannot necessarily be determined by subtracting the CEQA baseline or NEPA baseline impacts from the Project impact. Rather, the subtraction must be done at each receptor, for all modeled receptors, and the maximum result selected.

[c] The CEQA Increment represents Project minus CEQA baseline. The NEPA Increment represents Project minus NEPA baseline.

[d] Data represent the receptor locations with the maximum impacts or increments. The impacts or increments at all other modeled receptors would be less than these values for each receptor type.

[e] The NEPA baseline scenario assumes that the Settlement Agreement measures for cargo handling equipment would be implemented, CAAP measure CHE-1 (Performance Standards for Cargo Handling Equipment) would begin January 1, 2009, and 100 percent alternative fueled top picks would be implemented starting 2009.

[f] The 2009-2078 HRA is for informational purposes only. It shows the risks that would occur over a 70-year exposure period starting in 2009, the first year that the Port is able to implement a wide array of mitigation measures.

Table E3-7-18. Maximum Health Impacts Associated with Alternative 5 without Mitigation

Health Impact	Receptor Type	Maximum Predicted Impact					Significance Threshold
		Alternative 5	CEQA Baseline	CEQA Increment	NEPA Baseline	NEPA Increment	
Cancer Risk	Residential	61 × 10^{-6} (61 in a million)	14 × 10^{-6} (14 in a million)	**47 × 10^{-6} (47 in a million)**	9.1 × 10^{-6} (9.1 in a million)	**52 × 10^{-6} (52 in a million)**	10 × 10^{-6} (10 in a million)
	Occupational	40 × 10^{-6} (40 in a million)	11 × 10^{-6} (11 in a million)	**37 × 10^{-6} (37 in a million)**	7.5 × 10^{-6} (7.5 in a million)	**34 × 10^{-6} (34 in a million)**	
	Sensitive	29 × 10^{-6} (29 in a million)	2.3 × 10^{-6} (2.3 in a million)	**27 × 10^{-6} (27 in a million)**	2.1 × 10^{-6} (2.1 in a million)	**27 × 10^{-6} (27 in a million)**	
	Student	0.8 × 10^{-6} (0.8 in a million)	0.1 × 10^{-6} (0.1 in a million)	0.8 × 10^{-6} (0.8 in a million)	0.1 × 10^{-6} (0.1 in a million)	0.8 × 10^{-6} (0.8 in a million)	
	Recreational	59 × 10^{-6} (59 in a million)	18 × 10^{-6} (18 in a million)	**48 × 10^{-6} (48 in a million)**	9.9 × 10^{-6} (9.9 in a million)	**49 × 10^{-6} (49 in a million)**	
Chronic Hazard Index	Residential	0.22	0.14	0.09	0.12	0.10	1.0
	Occupational	0.64	0.43	0.51	0.39	0.31	
	Sensitive	0.06	0.02	0.04	0.03	0.03	
	Student	0.06	0.02	0.04	0.03	0.03	
	Recreational	0.61	0.43	0.37	0.33	0.31	
Acute Hazard Index	Residential	1.14	0.13	**1.12**	0.24	**1.07**	1.0
	Occupational	1.99	0.22	**1.97**	0.38	**1.91**	
	Sensitive	0.93	0.04	0.90	0.14	0.87	
	Student	0.93	0.04	0.90	0.14	0.87	
	Recreational	1.31	0.22	**1.27**	0.34	**1.19**	

[a] Exceedances of the significance thresholds are in **bold**. The significance thresholds apply to the CEQA and NEPA increments only.

[b] The maximum increments might not occur at the same receptor locations as the maximum impacts. This means that the increments cannot necessarily be determined by subtracting the CEQA baseline or NEPA baseline impacts from the Project impact. Rather, the subtraction must be done at each receptor, for all modeled receptors, and the maximum result selected.

[c] The CEQA Increment represents Project minus CEQA baseline. The NEPA Increment represents Project minus NEPA baseline.

[d] Data represent the receptor locations with the maximum impacts or increments. The impacts or increments at all other modeled receptors would be less than these values for each receptor type.

[e] The NEPA baseline scenario assumes that the Settlement Agreement measures for cargo handling equipment would be implemented, CAAP measure CHE-1 (Performance Standards for Cargo Handling Equipment) would begin January 1, 2009, and 100 percent alternative fueled top picks would be implemented starting 2009.

Table E3-7-19. Maximum Health Impacts Associated with Alternative 5 with Mitigation

Health Impact	Receptor Type	Maximum Predicted Impact					Significance Threshold
		Alternative 5	CEQA Baseline	CEQA Increment	NEPA Baseline	NEPA Increment	
Cancer Risk	Residential	14×10^{-6} (14 in a million)	14×10^{-6} (14 in a million)	7.1×10^{-6} (7.1 in a million)	9.1×10^{-6} (9.1 in a million)	6.9×10^{-6} (6.9 in a million)	10×10^{-6} (10 in a million)
	Occupational	9.5×10^{-6} (9.5 in a million)	11×10^{-6} (11 in a million)	8.8×10^{-6} (8.8 in a million)	7.5×10^{-6} (7.5 in a million)	8.6×10^{-6} (8.6 in a million)	
	Sensitive	5.9×10^{-6} (5.9 in a million)	2.3×10^{-6} (2.3 in a million)	3.7×10^{-6} (3.7 in a million)	2.1×10^{-6} (2.1 in a million)	3.8×10^{-6} (3.8 in a million)	
	Student	0.2×10^{-6} (0.2 in a million)	0.1×10^{-6} (0.1 in a million)	0.1×10^{-6} (0.1 in a million)	0.1×10^{-6} (0.1 in a million)	0.1×10^{-6} (0.1 in a million)	
	Recreational	14×10^{-6} (14 in a million)	18×10^{-6} (18 in a million)	**13×10^{-6} (13 in a million)**	9.9×10^{-6} (9.9 in a million)	**13×10^{-6} (13 in a million)**	
Chronic Hazard Index	Residential	0.15	0.14	0.04	0.12	0.03	1.0
	Occupational	0.43	0.43	0.30	0.39	0.15	
	Sensitive	0.04	0.02	0.02	0.03	0.01	
	Student	0.04	0.02	0.02	0.03	0.01	
	Recreational	0.42	0.43	0.21	0.33	0.14	
Acute Hazard Index	Residential	1.13	0.13	**1.11**	0.24	**1.07**	1.0
	Occupational	1.98	0.22	**1.96**	0.38	**1.90**	
	Sensitive	0.93	0.04	0.90	0.14	0.87	
	Student	0.93	0.04	0.90	0.14	0.87	
	Recreational	1.31	0.22	**1.27**	0.34	**1.19**	

[a] Exceedances of the significance thresholds are in **bold**. The significance thresholds apply to the CEQA and NEPA increments only.

[b] The maximum increments might not occur at the same receptor locations as the maximum impacts. This means that the increments cannot necessarily be determined by subtracting the CEQA baseline or NEPA baseline impacts from the Project impact. Rather, the subtraction must be done at each receptor, for all modeled receptors, and the maximum result selected.

[c] The CEQA Increment represents Project minus CEQA baseline. The NEPA Increment represents Project minus NEPA baseline.

[d] Data represent the receptor locations with the maximum impacts or increments. The impacts or increments at all other modeled receptors would be less than these values for each receptor type.

[e] The NEPA baseline scenario assumes that the Settlement Agreement measures for cargo handling equipment would be implemented, CAAP measure CHE-1 (Performance Standards for Cargo Handling Equipment) would begin January 1, 2009, and 100 percent alternative fueled top picks would be implemented starting 2009.

Table E3-7-20. Maximum Health Impacts Associated with Alternative 5 with Mitigation – 2009-2078 HRA

Health Impact	Receptor Type	Maximum Predicted Impact					Significance Threshold
		Alternative 5	CEQA Baseline	CEQA Increment	NEPA Baseline	NEPA Increment	
Cancer Risk	Residential	4.9×10^{-6} (4.9 in a million)	14×10^{-6} (14 in a million)	3.6×10^{-6} (3.6 in a million)	3.6×10^{-6} (3.6 in a million)	3.9×10^{-6} (3.9 in a million)	10×10^{-6} (10 in a million)
	Occupational	6.2×10^{-6} (6.2 in a million)	11×10^{-6} (11 in a million)	5.9×10^{-6} (5.9 in a million)	3.0×10^{-6} (3.0 in a million)	6.0×10^{-6} (6.0 in a million)	
	Sensitive	3.0×10^{-6} (3.0 in a million)	2.3×10^{-6} (2.3 in a million)	2.1×10^{-6} (2.1 in a million)	0.8×10^{-6} (0.8 in a million)	2.3×10^{-6} (2.3 in a million)	
	Student	0.1×10^{-6} (0.1 in a million)	0.1×10^{-6} (0.1 in a million)	0.1×10^{-6} (0.1 in a million)	0.02×10^{-6} (0.02 in a million)	0.1×10^{-6} (0.1 in a million)	
	Recreational	8.7×10^{-6} (8.7 in a million)	18×10^{-6} (18 in a million)	8.3×10^{-6} (8.3 in a million)	4.0×10^{-6} (4.0 in a million)	8.5×10^{-6} (8.5 in a million)	

[a] Exceedances of the significance thresholds are in **bold**. The significance thresholds apply to the CEQA and NEPA increments only.

[b] The maximum increments might not occur at the same receptor locations as the maximum impacts. This means that the increments cannot necessarily be determined by subtracting the CEQA baseline or NEPA baseline impacts from the Project impact. Rather, the subtraction must be done at each receptor, for all modeled receptors, and the maximum result selected.

[c] The CEQA Increment represents Project minus CEQA baseline. The NEPA Increment represents Project minus NEPA baseline.

[d] Data represent the receptor locations with the maximum impacts or increments. The impacts or increments at all other modeled receptors would be less than these values for each receptor type.

[e] The NEPA baseline scenario assumes that the Settlement Agreement measures for cargo handling equipment would be implemented, CAAP measure CHE-1 (Performance Standards for Cargo Handling Equipment) would begin January 1, 2009, and 100 percent alternative fueled top picks would be implemented starting 2009.

[f] The 2009-2078 HRA is for informational purposes only. It shows the risks that would occur over a 70-year exposure period starting in 2009, the first year that the Port is able to implement a wide array of mitigation measures

Table E3-7-21. Maximum Health Impacts Associated with Alternative 6 without Mitigation

Health Impact	Receptor Type	Maximum Predicted Impact					Significance Threshold
		Alternative 6	CEQA Baseline	CEQA Increment	NEPA Baseline	NEPA Increment	
Cancer Risk	Residential	155×10^{-6} (155 in a million)	14×10^{-6} (14 in a million)	**141×10^{-6} (141 in a million)**	9.1×10^{-6} (9.1 in a million)	**146×10^{-6} (146 in a million)**	10×10^{-6} (10 in a million)
	Occupational	128×10^{-6} (128 in a million)	11×10^{-6} (11 in a million)	**118×10^{-6} (118 in a million)**	7.5×10^{-6} (7.5 in a million)	**120×10^{-6} (120 in a million)**	
	Sensitive	58×10^{-6} (58 in a million)	2.3×10^{-6} (2.3 in a million)	**56×10^{-6} (56 in a million)**	2.1×10^{-6} (2.1 in a million)	**56×10^{-6} (56 in a million)**	
	Student	1.6×10^{-6} (1.6 in a million)	0.1×10^{-6} (0.1 in a million)	1.6×10^{-6} (1.6 in a million)	0.1×10^{-6} (0.1 in a million)	1.6×10^{-6} (1.6 in a million)	
	Recreational	166×10^{-6} (166 in a million)	18×10^{-6} (18 in a million)	**153×10^{-6} (153 in a million)**	9.9×10^{-6} (9.9 in a million)	**157×10^{-6} (157 in a million)**	
Chronic Hazard Index	Residential	0.52	0.14	0.38	0.12	0.40	1.0
	Occupational	1.78	0.43	**1.41**	0.39	**1.39**	
	Sensitive	0.14	0.02	0.11	0.03	0.11	
	Student	0.14	0.02	0.11	0.03	0.11	
	Recreational	1.50	0.43	**1.19**	0.33	**1.19**	
Acute Hazard Index	Residential	1.10	0.13	**1.08**	0.24	**1.04**	1.0
	Occupational	1.71	0.22	**1.69**	0.38	**1.62**	
	Sensitive	0.94	0.04	0.90	0.14	0.88	
	Student	0.94	0.04	0.90	0.14	0.88	
	Recreational	1.36	0.22	**1.32**	0.34	**1.24**	

[a] Exceedances of the significance thresholds are in **bold**. The significance thresholds apply to the CEQA and NEPA increments only.

[b] The maximum increments might not occur at the same receptor locations as the maximum impacts. This means that the increments cannot necessarily be determined by subtracting the CEQA baseline or NEPA baseline impacts from the Project impact. Rather, the subtraction must be done at each receptor, for all modeled receptors, and the maximum result selected.

[c] The CEQA Increment represents Project minus CEQA baseline. The NEPA Increment represents Project minus NEPA baseline.

[d] Data represent the receptor locations with the maximum impacts or increments. The impacts or increments at all other modeled receptors would be less than these values for each receptor type.

[e] The NEPA baseline scenario assumes that the Settlement Agreement measures for cargo handling equipment would be implemented, CAAP measure CHE-1 (Performance Standards for Cargo Handling Equipment) would begin January 1, 2009, and 100 percent alternative fueled top picks would be implemented starting 2009.

Table E3-7-22. Maximum Health Impacts Associated with Alternative 6 with Mitigation

Health Impact	Receptor Type	Maximum Predicted Impact					Significance Threshold
		Alternative 6	CEQA Baseline	CEQA Increment	NEPA Baseline	NEPA Increment	
Cancer Risk	Residential	97×10^{-6} (97 in a million)	14×10^{-6} (14 in a million)	**83×10^{-6} (83 in a million)**	9.1×10^{-6} (9.1 in a million)	**88×10^{-6} (88 in a million)**	10×10^{-6} (10 in a million)
	Occupational	86×10^{-6} (86 in a million)	11×10^{-6} (11 in a million)	**76×10^{-6} (76 in a million)**	7.5×10^{-6} (7.5 in a million)	**79×10^{-6} (79 in a million)**	
	Sensitive	26×10^{-6} (26 in a million)	2.3×10^{-6} (2.3 in a million)	**24×10^{-6} (24 in a million)**	2.1×10^{-6} (2.1 in a million)	**24×10^{-6} (24 in a million)**	
	Student	0.7×10^{-6} (0.7 in a million)	0.1×10^{-6} (0.1 in a million)	0.7×10^{-6} (0.7 in a million)	0.1×10^{-6} (0.1 in a million)	0.7×10^{-6} (0.7 in a million)	
	Recreational	111×10^{-6} (111 in a million)	18×10^{-6} (18 in a million)	**99×10^{-6} (99 in a million)**	9.9×10^{-6} (9.9 in a million)	**102×10^{-6} (102 in a million)**	
Chronic Hazard Index	Residential	0.28	0.14	0.14	0.12	0.16	1.0
	Occupational	0.96	0.43	0.62	0.39	0.57	
	Sensitive	0.07	0.02	0.05	0.03	0.04	
	Student	0.07	0.02	0.05	0.03	0.04	
	Recreational	0.81	0.43	0.55	0.33	0.50	
Acute Hazard Index	Residential	1.10	0.13	**1.08**	0.24	**1.04**	1.0
	Occupational	1.71	0.22	**1.69**	0.38	**1.62**	
	Sensitive	0.94	0.04	0.90	0.14	0.88	
	Student	0.94	0.04	0.90	0.14	0.88	
	Recreational	1.36	0.22	**1.32**	0.34	**1.24**	

[a] Exceedances of the significance thresholds are in **bold**. The significance thresholds apply to the CEQA and NEPA increments only.

[b] The maximum increments might not occur at the same receptor locations as the maximum impacts. This means that the increments cannot necessarily be determined by subtracting the CEQA baseline or NEPA baseline impacts from the Project impact. Rather, the subtraction must be done at each receptor, for all modeled receptors, and the maximum result selected.

[c] The CEQA Increment represents Project minus CEQA baseline. The NEPA Increment represents Project minus NEPA baseline.

[d] Data represent the receptor locations with the maximum impacts or increments. The impacts or increments at all other modeled receptors would be less than these values for each receptor type.

[e] The NEPA baseline scenario assumes that the Settlement Agreement measures for cargo handling equipment would be implemented, CAAP measure CHE-1 (Performance Standards for Cargo Handling Equipment) would begin January 1, 2009, and 100 percent alternative fueled top picks would be implemented starting 2009.

Table E3-7-23. Maximum Health Impacts Associated with Alternative 6 with Mitigation – 2009-2078 HRA

Health Impact	Receptor Type	Maximum Predicted Impact					Significance Threshold
		Alternative 6	CEQA Baseline	CEQA Increment	NEPA Baseline	NEPA Increment	
Cancer Risk	Residential	67×10^{-6} (67 in a million)	14×10^{-6} (14 in a million)	**52×10^{-6} (52 in a million)**	3.6×10^{-6} (3.6 in a million)	**63×10^{-6} (63 in a million)**	
	Occupational	59×10^{-6} (59 in a million)	11×10^{-6} (11 in a million)	**49×10^{-6} (49 in a million)**	3.0×10^{-6} (3.0 in a million)	**56×10^{-6} (56 in a million)**	
	Sensitive	18×10^{-6} (18 in a million)	2.3×10^{-6} (2.3 in a million)	**16×10^{-6} (16 in a million)**	0.8×10^{-6} (0.8 in a million)	**18×10^{-6} (18 in a million)**	10×10^{-6} (10 in a million)
	Student	0.5×10^{-6} (0.5 in a million)	0.1×10^{-6} (0.1 in a million)	0.5×10^{-6} (0.5 in a million)	0.02×10^{-6} (0.02 in a million)	0.5×10^{-6} (0.5 in a million)	
	Recreational	76×10^{-6} (76 in a million)	18×10^{-6} (18 in a million)	**64×10^{-6} (64 in a million)**	4.0×10^{-6} (4.0 in a million)	**73×10^{-6} (73 in a million)**	

[a] Exceedances of the significance thresholds are in **bold**. The significance thresholds apply to the CEQA and NEPA increments only.

[b] The maximum increments might not occur at the same receptor locations as the maximum impacts. This means that the increments cannot necessarily be determined by subtracting the CEQA baseline or NEPA baseline impacts from the Project impact. Rather, the subtraction must be done at each receptor, for all modeled receptors, and the maximum result selected.

[c] The CEQA Increment represents Project minus CEQA baseline. The NEPA Increment represents Project minus NEPA baseline.

[d] Data represent the receptor locations with the maximum impacts or increments. The impacts or increments at all other modeled receptors would be less than these values for each receptor type.

[e] The NEPA baseline scenario assumes that the Settlement Agreement measures for cargo handling equipment would be implemented, CAAP measure CHE-1 (Performance Standards for Cargo Handling Equipment) would begin January 1, 2009, and 100 percent alternative fueled top picks would be implemented starting 2009.

[f] The 2009-2078 HRA is for informational purposes only. It shows the risks that would occur over a 70-year exposure period starting in 2009, the first year that the Port is able to implement a wide array of mitigation measures.

8.0 Risk Uncertainty

By their nature, risk estimates cannot be completely accurate because they are predictions of risk. Scientists, medical experts, regulators, and practitioners do not completely understand how toxic air pollutants harm human cells or how different pollutants might interact with each other in the human body. The exposure assessment often relies on computer models that are based on a multitude of assumptions, both in terms of present and future conditions.

When information is missing or uncertain, risk analysts generally make assumptions that tend to prevent them from underestimating the potential risk. These assumptions provide a margin of safety in the protection of human health. Again, to protect public health, these assumptions are very conservative. For example, most people do not stay in one place for 24 hours a day, 350 days a year and 70 years.

Additionally, no single universal way exists of doing health risk assessments, leading to possible problems in comparing different risks. Assumptions also change over time, and even HRAs completed using the same models can produce different results.

OEHHA has provided a discussion of risk uncertainty, which is reiterated here (OEHHA, 2003).

> *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 either 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. Uncertainty may be defined as what is not known and may be reduced with further scientific studies. In addition to uncertainty, there is a natural range or variability in the human population in such properties as height, weight, and susceptibility to chemical toxicants. Scientific studies with representative individuals and large enough sample size can characterize this variability.*

> *Interactive effects of exposure to more than one carcinogen or toxicant are also not necessarily quantified in the HRA. Cancer risks from all emitted carcinogens are typically added, and hazard quotients for substances impacting the same target organ system are added to determine the hazard index (HI). Many examples of additivity and 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. Adjustment for tumors at multiple sites induced by some carcinogens could result in a higher potency. Other uncertainties arise 1) in the assumptions underlying the dose-response model used, and 2) in extrapolating from large experimental doses, where, for example, other toxic effects may compromise the assessment of carcinogenic potential, to usually much smaller environmental doses. Also, only single tumor sites induced by a substance are usually considered. When epidemiological data are used to generate a*

> *carcinogenic potency, less uncertainty is involved in the extrapolation from workplace exposures to environmental exposures. However, children, a subpopulation whose hematological, nervous, endocrine, and immune systems, for example, are still developing and who may be more sensitive to the effects of carcinogens on their developing systems, are not included in the worker population and risk estimates based on occupational epidemiological data are more uncertain for children than adults. Finally, the quantification of each uncertainty applied in the estimate of cancer potency is itself uncertain.*
>
> *Thus, 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 risk, based on current knowledge and a number of assumptions. Additionally, the uncertainty factors integrated within the estimates of noncancer RELs are meant to err on the side of public health protection in order to avoid underestimation of risk. Risk assessment is best used as a ruler to compare one source with another and to prioritize concerns. Consistent approaches to risk assessment are necessary to fulfill this function.*

Additionally, Appendix E6 provides a brief primer on Health Risk Assessments at the Port of Los Angeles.

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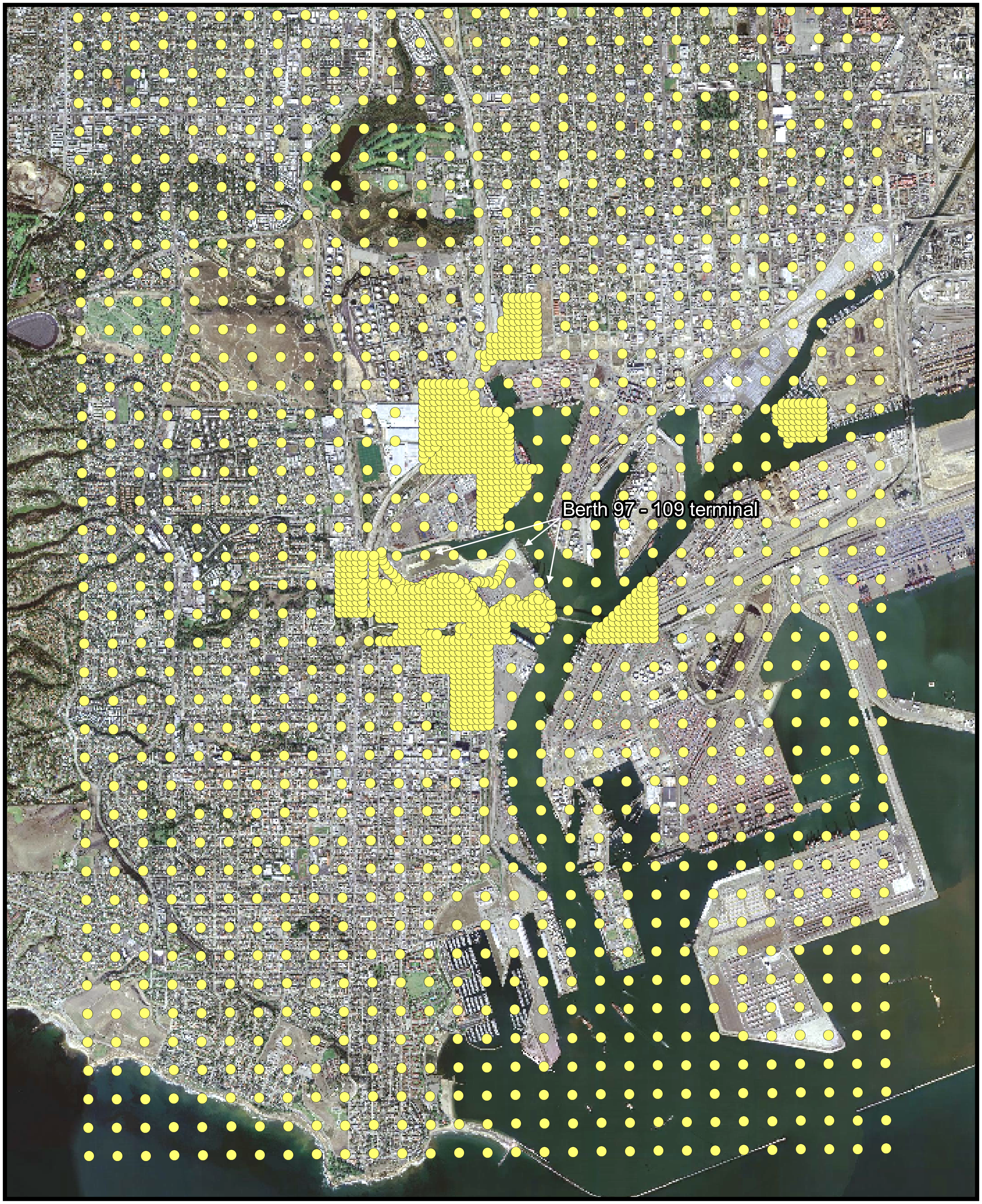
Figures



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Legend

Receptor Location

N

0 1 Miles

0 1 Kilometers

1:48,000

Figure 3-1
Coarse and Fine Receptor Grids

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Legend

- Sensitive Location Non-School
- School
- Proposed Project Terminal Area

N

0 1 Miles

0 1 Kilometers

1:48,000

Figure 3-2
Sensitive Receptor Locations

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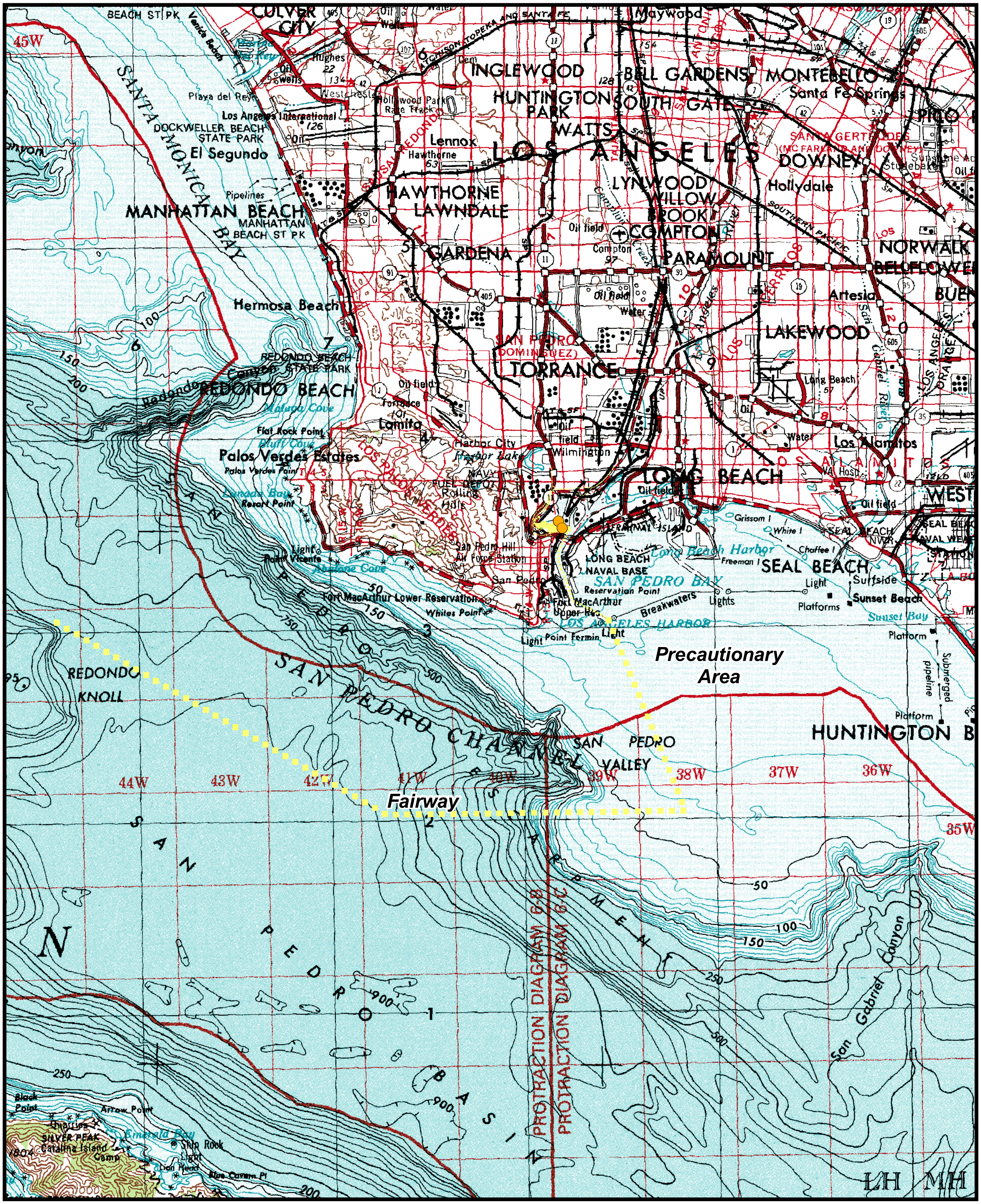

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Legend

- Point Source
- Volume Source

N

0 2.25 4.5 Miles

0 3.5 7 Km

1:285,120

Note:
Precautionary Area Boundary taken from the Final Draft of the Port-Wide Baseline Air Emissions Inventory, Port of LA, June 2004.

Figure 4-1
Source Representation in AERMOD

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Figure4_1.pdf

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Legend

- Point Source
- Inner/Outer Harbor Transition
- Volume Source

N

0 — 0.5 Miles

0 — 0.5 Kilometers

1:24,000

Figure 4-2
Source Representation in AERMOD - Near Terminal Sources

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Legend

- Maximum Receptor Location
- CEQA Baseline Terminal Area

N

0 — 0.5 Miles

0 — 0.5 Kilometers

1:24,000

Figure 7-1
Maximum Receptor Locations Associated with CEQA Baseline Conditions

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Figure7_1.pdf

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Legend

- Maximum Receptor Location
- NEPA Baseline Terminal Area

N

0 — 0.5 Miles

0 — 0.5 Kilometers

1:24,000

Figure 7-2
Maximum Receptor Locations Associated with NEPA Baseline Conditions

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Figure7_2.pdf

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Legend

- Maximum Receptor Location
- Proposed Project Terminal Area

N

0 0.5 Miles

0 0.5 Kilometers

1:24,000

Figure 7-3
Maximum Receptor Locations Associated with the Proposed Project

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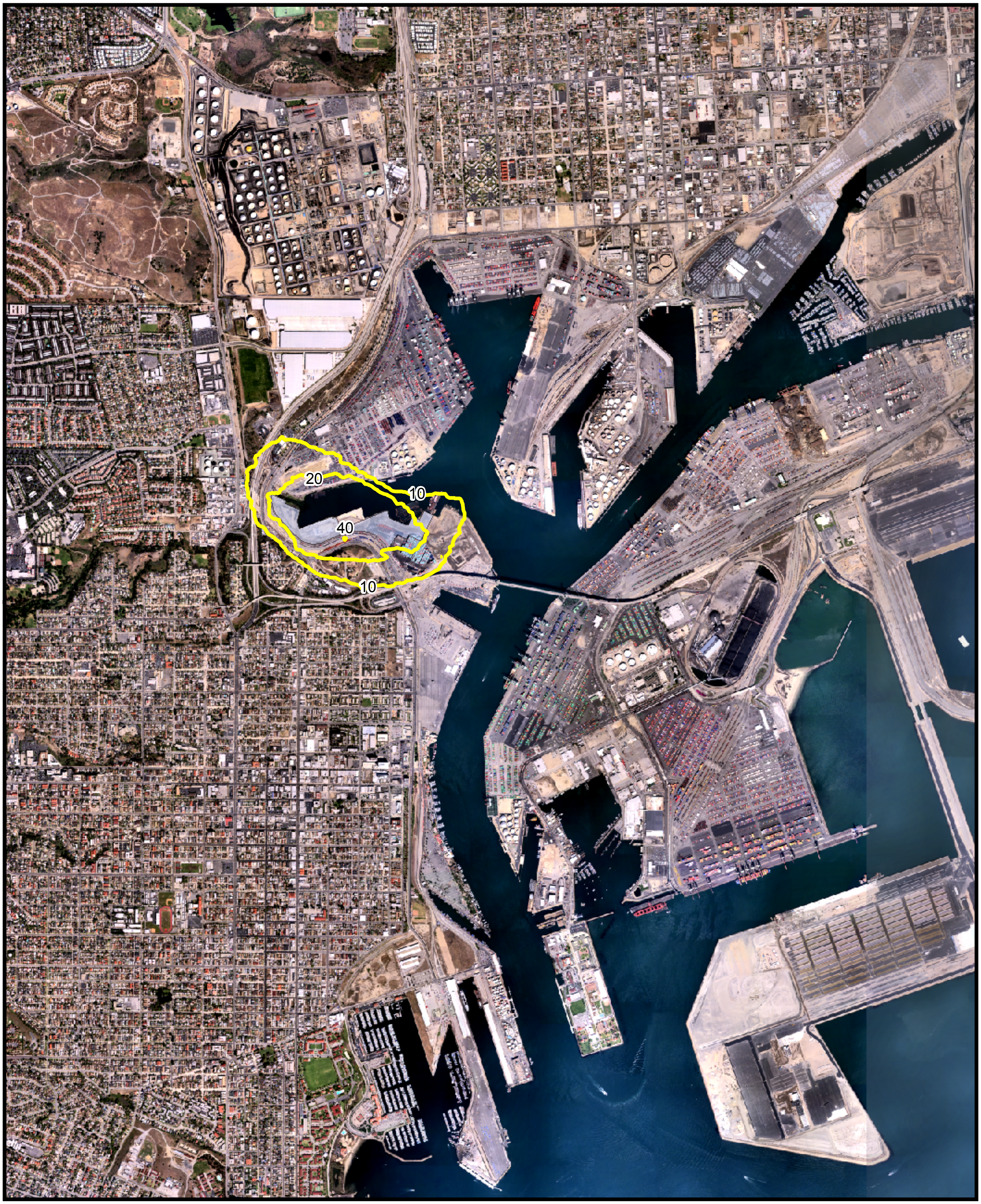

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Legend

Positive values (net increase)

CEQA Baseline Terminal Area

N

0 3,000 Feet

0 1,000 Meters

1:36,000

Figure 7-4
CEQA Baseline

Residential Individual Lifetime Cancer Risk (per Million)
80th Percentile Breathing Rate

CH2MHILL

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Legend

- Positive values (net increase)
- NEPA Baseline Terminal Area

N

0 3,000 Feet

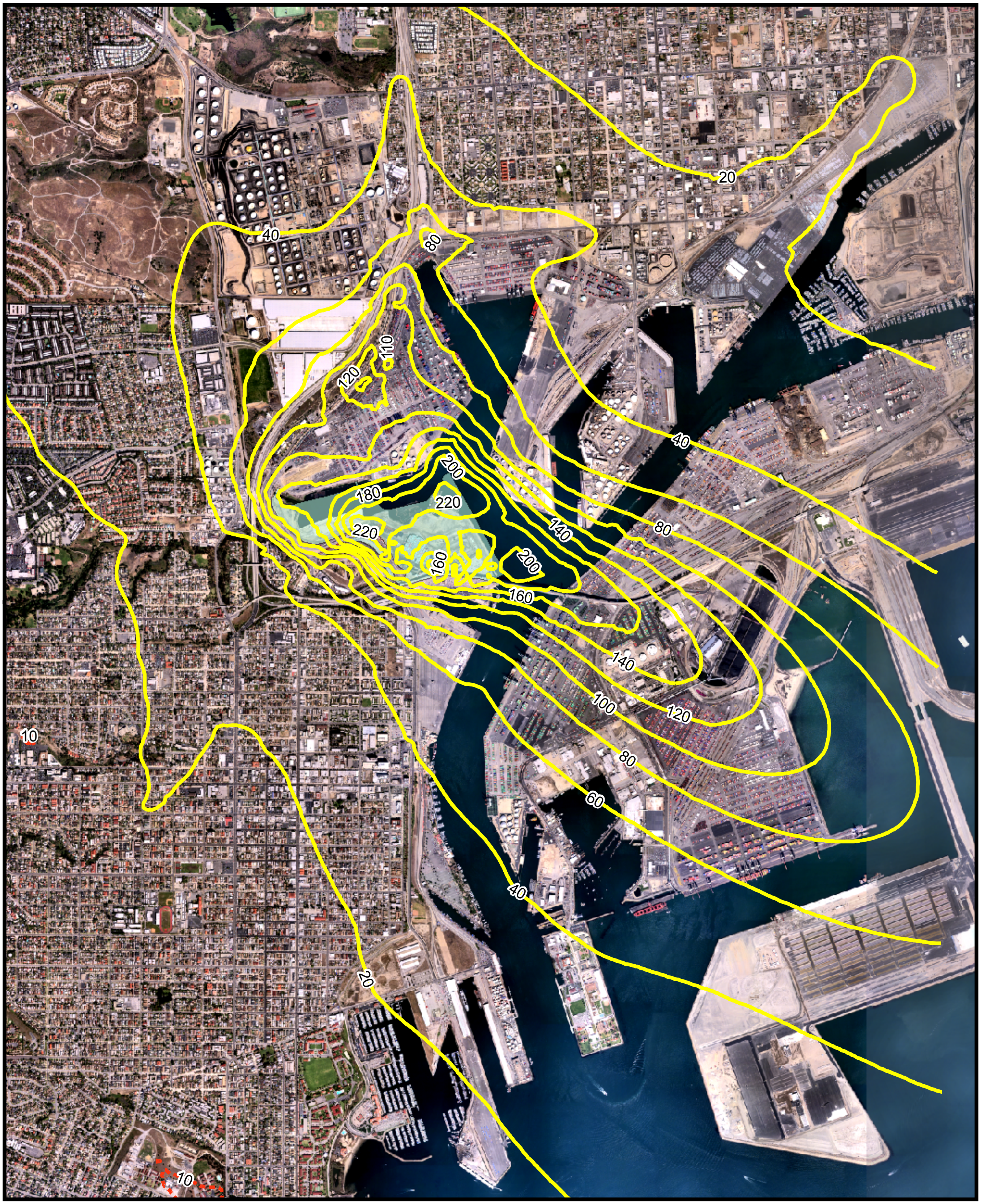
0 1,000 Meters

1:36,000

Figure 7-5
NEPA Baseline

Residential Individual Lifetime Cancer Risk (per Million)
80th Percentile Breathing Rate

CH2MHILL



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Legend

- Positive values (net increase)
- Significance threshold of 10 per million
- Proposed Project Terminal Area

N

0 3,000 Feet

0 1,000 Meters

1:36,000

Figure 7-6
Proposed Project Minus CEQA Baseline

Residential Individual Lifetime Cancer Risk (per Million)
80th Percentile Breathing Rate

CH2MHILL

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Legend

Positive values (net increase)

Proposed Project Terminal Area

N

0 3,000 Feet

0 1,000 Meters

1:36,000

Figure 7-7
Proposed Project Minus NEPA Baseline

Residential Individual Lifetime Cancer Risk (per Million)
80th Percentile Breathing Rate

CH2MHILL

Figure7-7.pdf

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Legend

Maximum Receptor Location

Proposed Project Terminal Area

N

0 0.5 Miles

0 0.5 Kilometers

1:24,000

Figure 7-8
Maximum Receptor Locations Associated with the Mitigated Project

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Figure7_8.pdf

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Legend

- Positive values (net increase)
- Significance threshold of 10 per million
- Proposed Project Terminal Area

N

0 3,000 Feet

0 1,000 Meters

1:36,000

Figure 7-9
Mitigated Project minus CEQA Baseline

Residential Individual Lifetime Cancer Risk (per Million)
80th Percentile Breathing Rate

CH2MHILL

Figure7-9.pdf

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Legend

- Positive values (net increase)
- Significance threshold of 10 per million
- Proposed Project Terminal Area

N

0 3,000 Feet

0 1,000 Meters

1:36,000

Figure 7-10
Mitigated Project minus NEPA Baseline

Residential Individual Lifetime Cancer Risk (per Million)
80th Percentile Breathing Rate

CH2MHILL

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Legend

- Maximum Receptor Location
- Proposed Project Terminal Area

N

0 0.5 Miles

0 0.5 Kilometers

1:24,000

Figure 7-11
Maximum Receptor Locations Associated with the Mitigated Project, 2009 - 2078 HRA

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Figure7_11.pdf

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Legend

- Negative values (net decrease)
- Zero contours (no change)
- Positive values (net increase)
- Significance threshold of 10 per million
- Proposed Project Terminal Area

N

0 3,000 Feet

0 1,000 Meters

1:36,000

Figure 7-12
Mitigated Project minus CEQA Baseline, 2009-2078 HRA

Residential Individual Lifetime Cancer Risk (per Million)
80th Percentile Breathing Rate

CH2MHILL

Figure7-12.pdf

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Legend

Positive values (net increase)

Significance threshold of 10 per million

Proposed Project Terminal Area

N

0 3,000 Feet

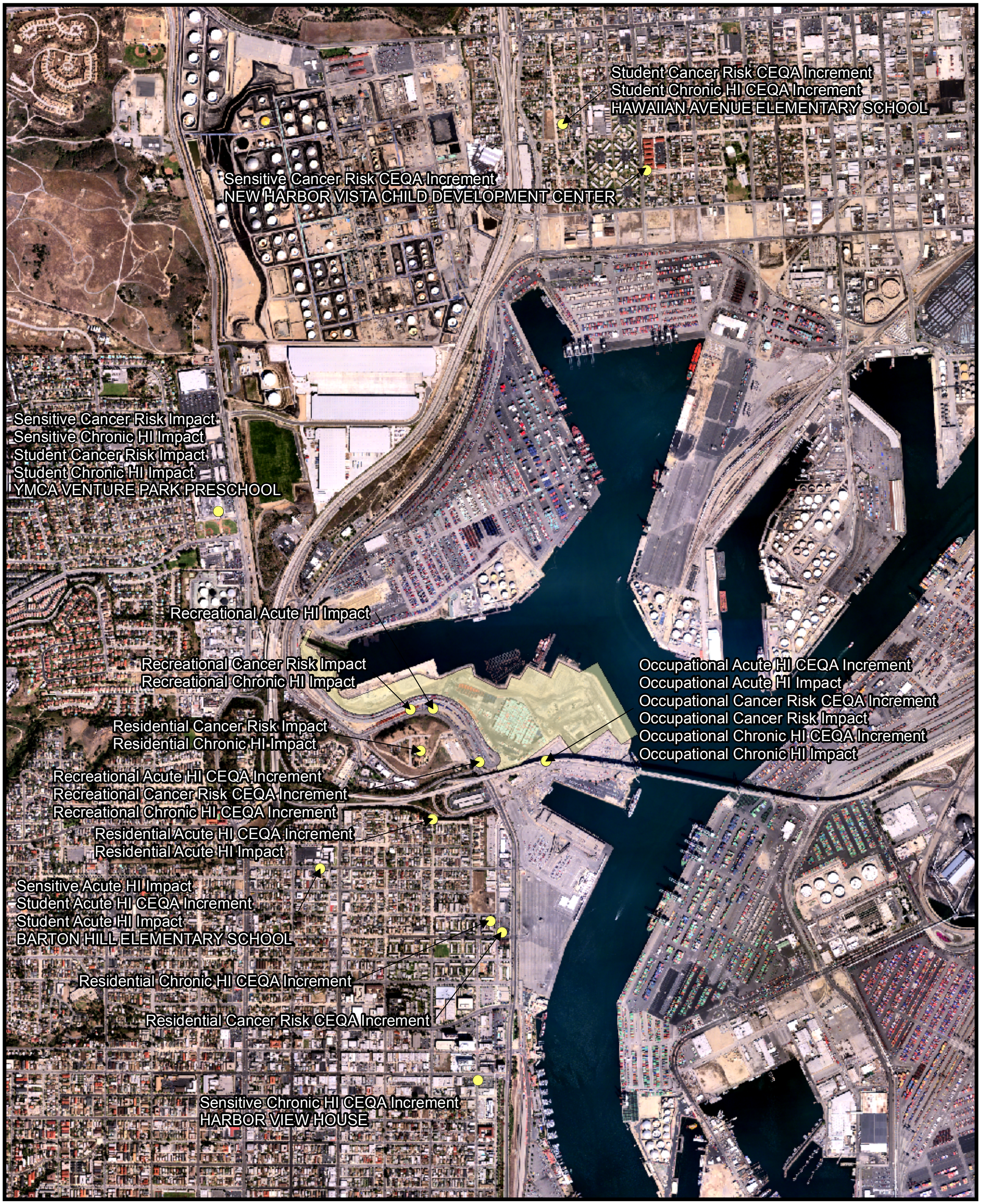
0 1,000 Meters

1:36,000

Figure 7-13
Mitigated Project minus NEPA Baseline, 2009-2078 HRA

Residential Individual Lifetime Cancer Risk (per Million)
80th Percentile Breathing Rate

CH2MHILL



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Legend

- Maximum Receptor Location
- No Project Terminal Area

N

0 — 0.5 Miles

0 — 0.5 Kilometers

1:24,000

Figure 7-14
Maximum Receptor Locations Associated with Alternative 1 (No Project)

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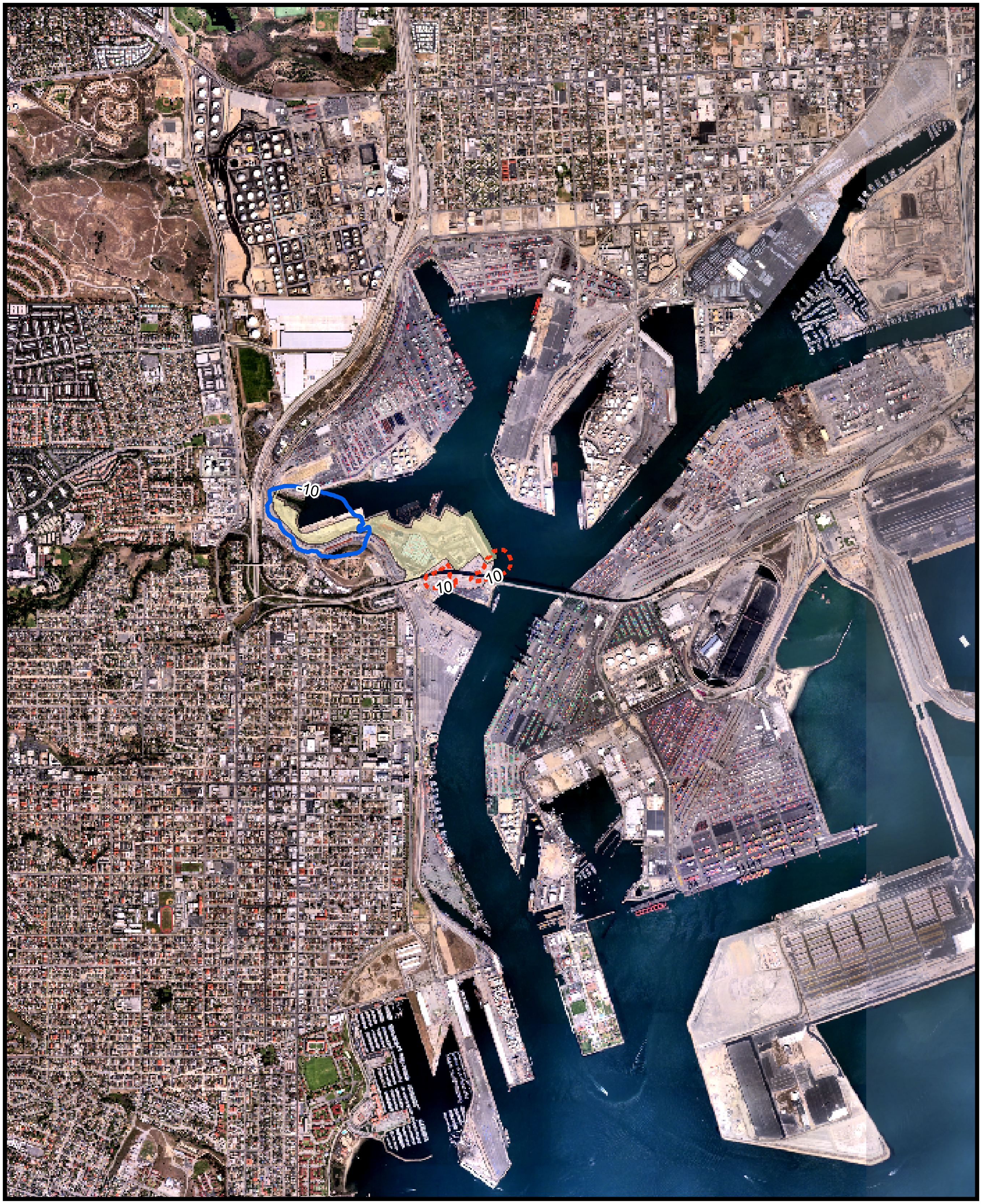
CH2MHILL

Figure7_14.pdf



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Legend

- Negative values (net decrease)
- Significance threshold of 10 per million
- No Project Terminal Area

N

0 3,000 Feet

0 1,000 Meters

1:36,000

Figure 7-15
Alternative 1 (No Project) minus CEQA Baseline

Residential Individual Lifetime Cancer Risk (per Million)
80th Percentile Breathing Rate

CH2MHILL