PORT of SAN DIEGO
Environment

# Preliminary Health Risk Assessment and Summary Report

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December 2021

# Table of Contents

## Summary Report



## Health Risk Assessment



# List of Tables



# List of Figures

# Summary Report

## Purpose

The Portside Environmental Justice Community (Portside EJ Community)[1] has some of the poorest air quality in San Diego County. Polluted air can contribute to higher rates of asthma, cardiovascular disease, and a variety of other health related impacts including an increased risk of cancer. Multiple sources contribute to the Portside Community's poor air quality, including freeway traffic, industrial and manufacturing facilities, as well as off-road mobile sources, such as ocean-going vessels (OGVs) and other diesel equipment. On October 12, 2021, the Port of San Diego (Port) Board of Port Commissioners adopted the Maritime Clean Air Strategy (MCAS) to provide goals and a framework for future programs, projects and initiatives to reduce emissions and improve health for all who live, work, and play on and around San Diego Bay. To better translate how the Port's emission reduction efforts may help reduce health-related impacts, Health Objective 1 in the MCAS directs staff to identify existing health risk levels generated from the Port's Tenth Avenue Marine Terminal (TAMT) and the National City Marine Terminal (NCMT) for Diesel Particulate Matter (DPM) and other toxic air contaminant (TAC) emissions by October 2021. The MCAS notes that a quantitative Health Risk Assessment (HRA) may be used to identify existing health risk levels and to inform DPM emission reduction goals and/or cancer risk reduction goals.[2] Based on the fact that almost all equipment at TAMT and NCMT is diesel powered, and because the most prevalent TAC associated with diesel exhaust is DPM, the focus of the HRA is DPM.

This analysis serves three purposes:

1. Establish baseline cancer risk conditions in the Portside Community due to Port activities.
2. Provide a quantified comparison between the baseline and forecasted cancer risk with implementation of near-term and long-term emission reduction goals, programs, and strategies in the MCAS.
3. Inform, enhance, and contribute to the San Diego Air Pollution Control District ("SDAPCD") and CARB Cumulative Health Risk Assessment being developed for the Portside Community.

The following Preliminary Health Risk Assessment Summary Report provides an estimate of current health risk levels associated with the activity at the Port's two marine cargo terminals,[3] based on its

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[1] The Portside EJ Community includes Barrio Logan, Logan Heights, Sherman Heights, and west National City. The California Air Resources Board (CARB) selected it for additional air monitoring in 2018 and to develop a Community Air Emission's Reduction Plan (CERP) in 2019. The Portside Community's CERP was approved by the San Diego Air Pollution Control District Governing Board in July 2021 and was adopted CARB on October 14, 2021. This HRA also analyzes risk to other areas within close proximity to TAMT, NCMT, and ferry activities, including Downtown San Diego and Coronado.

[2] Please note that preparing a health risk assessment at the Port's two marine cargo terminals was also identified as Goal #7 in the Portside Community CERP (Final, July 2021).

[3] Although the Port tenant's shipyard facilities produce localized emissions that also impact nearby community residents, these facilities are subject to the SDAPCD's Toxic Air Contaminant Public Health Risk - Public Notification and Risk Reduction (Rule 1210), which requires them to implement a risk reduction plan if their public health risk assessment shows potential risks above a specified level. On November 4, 2021, the SDAPCD Governing Board voted

2019 MCAS Emissions Inventory. It is Port-centric and estimates how several near-term and long-term reduction goals, policies, programs and strategies identified in the MCAS can help lower health and cancer risk levels for nearby community residents, including those living in the Portside Community. The HRA uses near-term and long-term MCAS measures to be illustrative of potential emissions reductions, but the MCAS measures are not intended to be exhaustive and other measures, programs, and projects may also serve to reduce emissions. This preliminary information is also being reviewed by staff at the CARB and the SDAPCD.[4]

In addition to helping the Port better understand and prioritize emission reduction initiatives, the purpose of this Preliminary Health Risk Assessment Summary Report is to help improve and enhance the accuracy of the Cumulative Health Risk Assessment that CARB and the SDAPCD are preparing for the larger Portside Community, in accordance with the recently approved Community Emissions Reduction Plan (CERP).[5] It is expected that CARB and SDAPCD's Cumulative Health Risk Assessment for the broader Portside Community will incorporate several additional emission sources, including freeway activity, and industrial/ auto repair activities within the community. As such, different modeling methodologies and software are being used and there may be variations with the Port's HRA that is location specific and not a regional model.

Note that baseline and future year risk estimates in this HRA are based on 2019 activity levels. Growth in cargo activity was not assumed as a part of the HRA.

Also, note that there is significant uncertainty in any risk assessment. The assumptions used in this HRA are based on guidelines that are designed to err on the side of health protection to avoid underestimation of risk to the public. Risk estimates generated by an HRA should not be interpreted as the expected rates of disease in the exposed population, but rather as estimates of potential for disease, based on current knowledge and several assumptions.

# Sources Included

The focus of this HRA is on the major emission sources related to cargo movements within and near the Portside Community.[6] Therefore, the focus is on activities within and near the Tenth Avenue Marine Terminal (TAMT) and the National City Marine Terminal (NCMT). Additionally, while it is not

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to amend Rule 1210, which (1) lowered the significant risk threshold for cancer from 100 in one million to 10 in one million, (2) enhanced the public notification protocols and public meeting requirements; and (3) provided additional time for facilities where it is not feasible to reduce health risks within a 5-year timeframe. Because the TAMT and NCMT are not subject to SDAPCD's Rule 1210, the Preliminary Health Risk Assessment Summary Report focuses on emissions at (and near) the Port's two marine cargo terminals.

[4] The Preliminary Health Risk Assessment's Summary Report was submitted to Port staff in October 2021 and was discussed with CARB and SDAPCD staff on November 5, 2021 and November 10, 2021. CARB and SDAPCD staff are currently reviewing the Ports Preliminary Health Risk Summary and will continue to work with Port staff on how to best utilize and/or incorporate the Port's more site specific locational and operational marine cargo information into the Cumulative Health Risk Assessment that they are preparing for the broader Portside Community.

[5] Please note that Goal #7 (c) in the Portside Community CERP (Final, July 2021) acknowledges that the Port will assist SDAPCD and CARB with preparing a Cumulative Health Risk Assessment for the AB 617 Portside Community by providing them with the Port's Health Risk Assessment and the other operational related information.

[6] The Community of Portside Environmental Justice Neighborhoods includes Barrio Logan and portions of National City, Sherman Heights, and Logan Heights. This includes the following census tracts: 6073005000, 6073004900, 6073003902, 6073003601, 6073003901, 6073005100, 6073003603, 6073004000, 6073003502, 6073021900, 6073004700, and 6073011602

specifically related to cargo movement, this HRA includes commuter ferry activity between Coronado and Downtown Broadway Pier/Convention Center, since the ferry service operates immediately adjacent to the Portside Community, with a scheduled, fixed route service.

Specifically, this HRA includes the following and is further summarized in Table 1.

- Ocean going vessel (OGV) transit, maneuvering, and at-berth (or hoteling) emissions associated with OGVs that call on TAMT and NCMT. No activity associated with pass-by trips (i.e., trips that do not enter San Diego Bay and call on TAMT and NCMT) or cruise ships are included.
- Assist tugs activity associated with OGV maneuvering/berthing.
- Heavy duty drayage and non-drayage trucks operating within the TAMT and NCMT boundaries and on-site and traveling within neighborhoods. This HRA does not include any truck activity unrelated to cargo movements at TAMT and NCMT.
- Cargo handling equipment (CHE) at both TAMT and NCMT.
- Freight rail activity, including both train switching and building within the terminal boundaries and line-haul activity moving freight to and from TAMT and NCMT. This HRA does not include any passenger rail (e.g., AMTRAK) or freight rail associated with non-Port freight movements.

This HRA also includes additional information on fixed route ferries, specifically:

- Commuter ferry activity between Coronado and Downtown Broadway Pier/Convention Center.

**Table 1** provides further details of the sources included in the HRA.

**Table 1: Summary of Sources Included in HRA**

| Source Type | Location |
|---|---|
| OGV | Transit and Anchorage Outside of the Bay<br>Maneuvering Inside the Bay<br>Hoteling At- berth |
| Commercial Harbor Craft (Assist Tugs) | Inside the Bay and at terminal during berthing (same geometry as OGV maneuvering) |
| Commercial Harbor Craft (Ferries) | Commuter Ferry Path |
| CHE | Equipment activity within terminals |
| Truck Travel outside of Terminals (Truck Offsite) | Truck travel path on surface streets to freeways |
| Truck Travel within Terminals (Truck Onsite) | Truck Travel within terminals |
| Freight Rail - Line-Haul | BNSF ROW from NCMT and TAMT, through Downtown |
| Freight Rail - Switching | Switching area at NCMT and between BNSF and TAMT |

Given the focus on activities near TAMT and NCMT, activities that occur away from these terminals, including activity at the Cruise Ship Terminal (CST), commercial and sport fishing, excursions, recreational boating, and other harbor craft that do not serve or operate near the cargo terminals, are not included in this HRA. However, the Port staff and consultant team will be providing relevant information on these other vessel emissions to CARB and SDAPCD, as work on the Cumulative Health Risk Assessment proceeds.

Note that the discussion below discusses cancer risk in terms of terminal activity alone, ferry activity alone, and for terminals and ferry activity combined.

# HRA Process

The HRA has three main components: 1) Emissions Inventory, 2) Dispersion Modeling, and 3) Health Risk Calculations. Each of these components is described in detail in Appendix A to this report. The HRA is consistent with methodologies and procedures recommended by the State of California's Office of Environmental Health Hazard Assessment (OEHHA), CARB, and SDAPCD.

Moreover, the approach is consistent with other recent assessments performed by CARB, Bay Area Air Quality Management District, and the Port of Los Angeles.

The HRA quantifies the long-term health risk associated with sources of emissions discussed above. Key definitions, pulled in part from CARB and OEHHA, are as follows:

- Toxic Air Contaminants (TACs) are defined as air pollutants which may cause or contribute to an increase in mortality or an increase in serious illness, or which may pose a present or potential hazard to human health.[7] CARB has identified over 200 TACs. Diesel particulate matter (DPM) was identified as a TAC in 1998. DPM is generally the most impactful TAC in urban areas. CARB estimates that about 70% of total known cancer risk related to air toxics in California is attributable to DPM.[8] The HRA focused on the long-term impacts of DPM exposure. Note that while DPM contains a complex mixture of gases and solid particles, the potency factors developed and recommended by CARB and OEHHA are based on "whole diesel exhaust" (i.e., the sum of all of the gaseous and solid components). Thus, the DPM factors from OEHHA should be used as a surrogate for all TAC emissions from diesel-fueled compression-ignition internal combustion engines.
- Sensitive receptors are defined by CARB as members of the population that are most likely to be affected by air pollution: children younger than 14, the elderly older than 65, athletes, and people with cardiovascular and chronic respiratory diseases. Locations that may contain a high concentration of these sensitive population groups include residential areas, hospitals, daycare facilities, elder-care facilities, elementary schools, and parks. Most health studies indicate that health effects are strongest within 1,000 feet of emission sources.[9] This HRA evaluates health impacts to residences, schools and parks because they may contain high concentrations of sensitive receptors.
- Cancer risk is defined as the probability of developing cancer if an individual is exposed continuously to a TAC(s) over an extended period of time. The duration of an individual's exposure can vary depending on the scenario. For example, OEHHA recommends a 30-year exposure duration for residences. Since cancer risk is a probability, it is often expressed in chances per million people. For example, a cancer risk of one in one million means that in a population of one million people, not more than one additional person would be expected to

[7] See OEHHA's website, here: https://oehha.ca.gov/air/toxic-air-contaminants
[8] See CARB's Diesel Exhaust and Health page, here: https://ww2.arb.ca.gov/resources/overview-diesel-exhaust-and-health
[9] See CARB's Air Quality and Land Use Handbook, here: https://www.arb.ca.gov/ch/handbook.pdf

develop cancer as the result of the exposure to the toxic air pollutant.10 The HRA identified the cancer risk for the maximally exposed individual (MEI) for each receptor analysis. The maximum individual cancer risk threshold for stationary sources in SDAPCD Rule 1210 is 10 in a million.11 For this HRA, when cancer risk is described or presented, the numerical value indicates the chances per million. For example, if the maximum cancer risk is 5.0, this indicates 5.0 chances per million.

- Cancer Burden is an approach used to estimate population risk from exposure to a large facility. Population-wide risk is independent of individual risk (i.e., residential risk), and assumes that a population (not necessarily the same individuals) will live in the impacted zone over a 70-year lifetime. Cancer burden was estimated using census tract receptors and the population within each census tract. The cancer burden value is a single number intended to estimate the number of potential excess cancer cases within the population that was exposed to the emissions for a lifetime (70-years).[12] Cancer burden is based on the census tracts within the zone of impact. Cancer burden was calculated by multiplying the cancer risk at a census tract centroid (i.e., center of census tract) by the number of people who live within the census tract, and then adding up the estimated number of potential cancer cases across the zone of impact. The numerical output of a cancer burden analysis is the potential number of excess cancer cases that could occur in a population from exposure to the sources in question (in this case, the excess cases due to Port terminal and ferry operations). The cancer burden threshold for stationary sources in SDAPCD Rule 1210 is 1.0.
- Zone of impact identifies the geographic boundaries of the area affected by terminal and ferry emissions sources. The zone of impact encompasses the census tract receptors with a cancer risk greater than one per million. Census tracts receptors within the zone of impact contributed to the overall cancer burden, as described above.

# Summary of Results

## Cancer Risk

Cancer risk impacts were evaluated based on the methodology presented in Appendix A. Risk was estimated for residences, and children at schools and parks exposed to 2019 activity levels. The discussion below focuses on residential risk where residences were assumed to be exposed to emissions (2019 activity levels) for a 30-year duration.

**Table 2** presents the maximum residential cancer risk for nearby communities, as well as the contributions from terminals (TAMT and NCMT) and ferries to the maximum risk. Collectively, operations and sources associated with TAMT, NCMT and ferries are referred to as the HRA Sources (the particulars of which are identified in Table 1). As shown in **Table 2**, the overall maximum cancer risk from HRA Sources was 29.33 and was located in Coronado. This was followed by a cancer risk of 29.11 in Downtown, 23.02 in Barrio Logan, and 19.65 in National City.

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[10] See additional discussion on CARB's page, here: https://ww2.arb.ca.gov/resources/documents/health-risk-assessment

[11] See the recently revised San Diego APCD Rule 1210, here: https://www.sdapcd.org/content/dam/sdapcd/documents/rules/current-rules/Rule-1210.pdf

[12] See OEHHA's Guidance, here: https://oehha.ca.gov/media/downloads/crnr/2015guidancemanual.pdf

**Table 2: Summary of Existing Maximum Residential Cancer Risk (per million) by Community (Terminals Plus Ferries)**

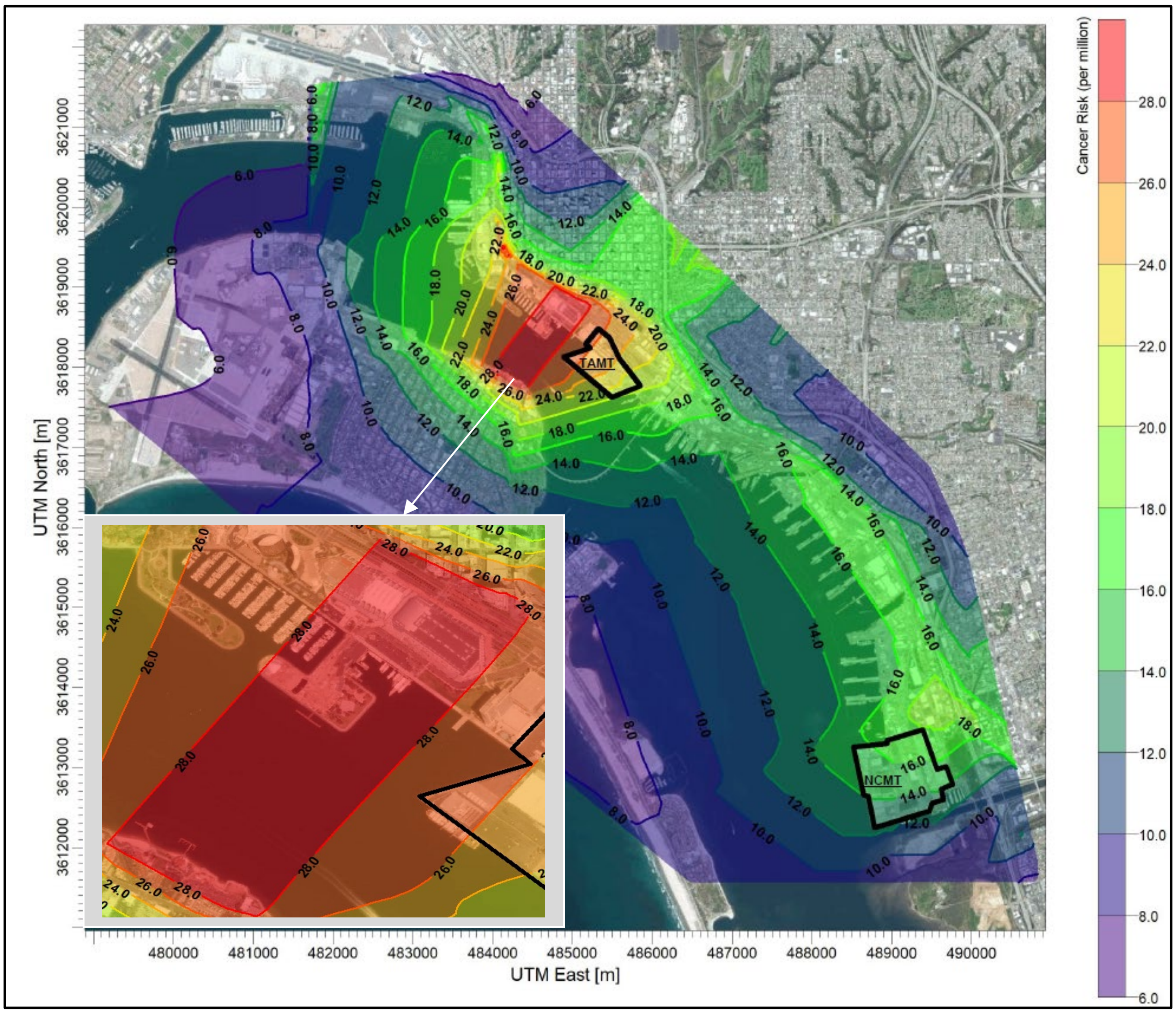
| Community | Maximum Cancer Risk | Contribution from Terminals | Contribution from Ferries |
|---|---|---|---|
| Barrio Logan | 23.02 | 18.96 | 4.06 |
| Downtown | 29.11 | 20.95 | 8.16 |
| Coronado | 29.33 | 15.54 | 13.79 |
| National City | 19.65 | 19.44 | 0.21 |
| As previously noted, the HRA is specific to the terminals and ferries and does not address other sources that may be proximate to these communities. For additional context, a HRA was conducted for the Tenth Avenue Marine Terminal Redevelopment Plan and EIR, based on 2012 data, and included terminal activity and equipment only (i.e., no ferries). That HRA's cancer risk for TAMT and associated sources was 38 in a million based on 2012 data. | | | |

An overview of the existing cancer risk from terminal and ferry activities in nearby residential communities is presented in **Table 2** above and in the figures below for three scenarios: (1) Terminals Plus Ferries, (2) Terminals Only, and (3) Ferries Only. These scenarios were independent scenarios and only evaluated cancer risk for the sources included in the scenario. For example, the Terminals Plus Ferries scenario identified the maximum cancer risk based on exposure to terminal and ferry sources concurrently, whereas the Terminals Only scenario identified the maximum cancer risk based on exposure to terminal sources only.

The results of these scenarios are presented below in **Figure 1** (Terminals Plus Ferries) (results shown in Table 2), **Figure 2** (Terminals Only), and **Figure 3** (Ferries Only). The figures presented are contour maps of cancer risk in chances per million. Each figure includes colored contour lines which indicate cancer risk per million. The contour lines indicate a level of cancer risk within the contour line. The colored scale in each figure represents the values of all contour lines presented.

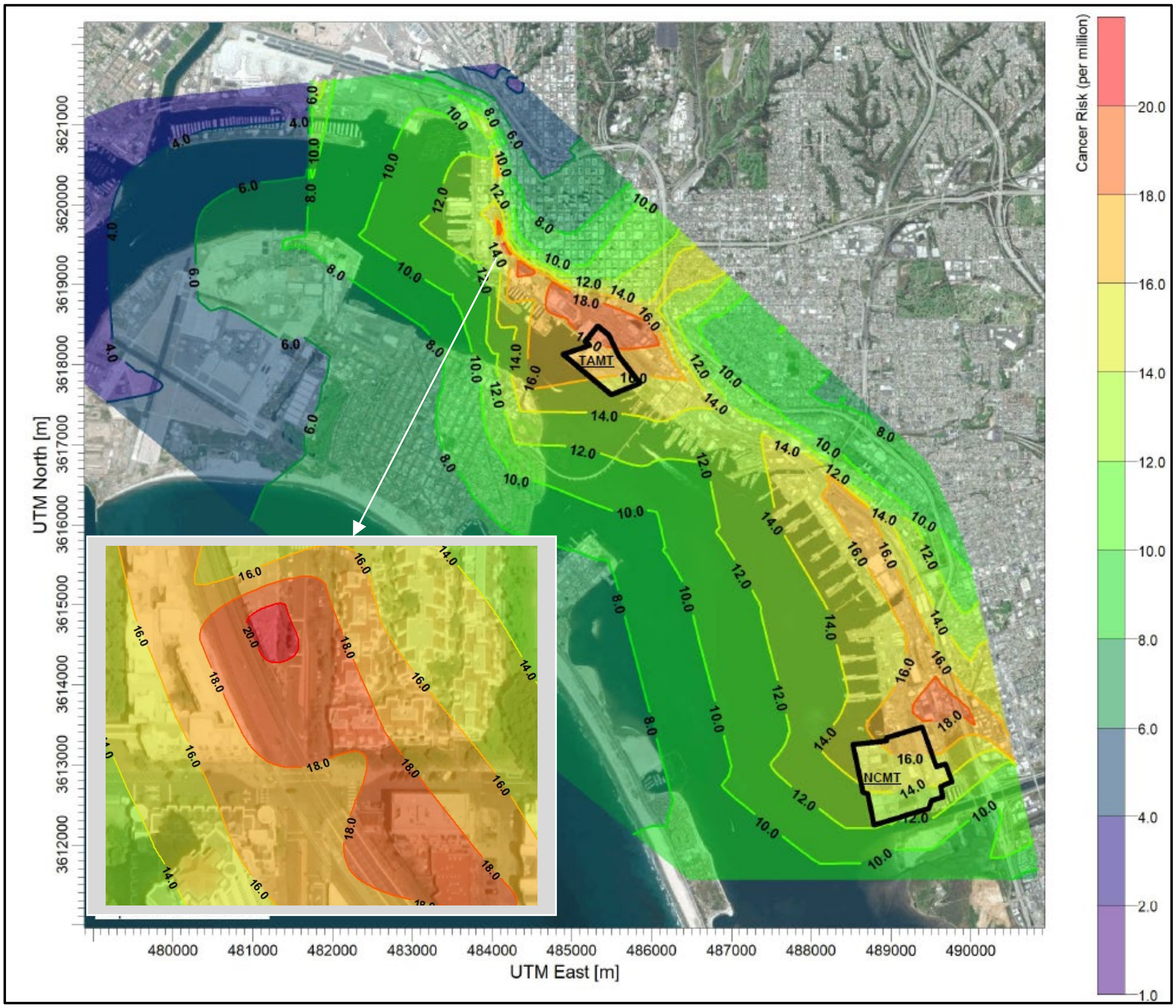
As shown in **Figure 1**, the highest existing cancer risk areas is greater than 28 per million in portions of Downtown and in a small portion in Coronado near the ferry landing. The areas near TAMT and portions of Barrio Logan north of Chicano Park, as well as the southern and western ends of Downtown (those areas near the freight line), and other areas of Coronado also show a risk higher than 20 in a million. Areas where risk is between 10 and 20 in a million stretch from the NCMT to Harbor Island, and includes much of National City, Logan Heights, Barrio Logan, Downtown, East Harbor Island, as well as much of Coronado. Lowest risk in the model includes areas of Silver Strand, Coronado, Shelter Island, Point Loma, and West Harbor Island Areas, where risk from Port sources is less than 10 in a million.

**Figure 1: Existing Residential Cancer Risk Contour Map (Terminals Plus Ferries)**



As shown in **Figure 2** (Terminals Only), the highest risk areas are in the areas near TAMT and include portions of Barrio Logan north of Chicano Park, the southern and western ends of Downtown (those areas near the freight line) that identify a cancer risk of 18 per million, whereas areas of Coronado near the Ferry Landing show a risk of 14 in a million. Cancer risk ranges from 10 to 16 from NCMT to Harbor Island, and includes much of National City, Logan Heights, Barrio Logan, Downtown, a portion of East Harbor Island, and a portion of Coronado. Lowest risk in the model includes areas of Silver Strand, most of Coronado, most of Harbor Island, and the entirely of Shelter Island, Point Loma, and West Harbor Island Areas, where risk from Port sources is less than 8 in a million.

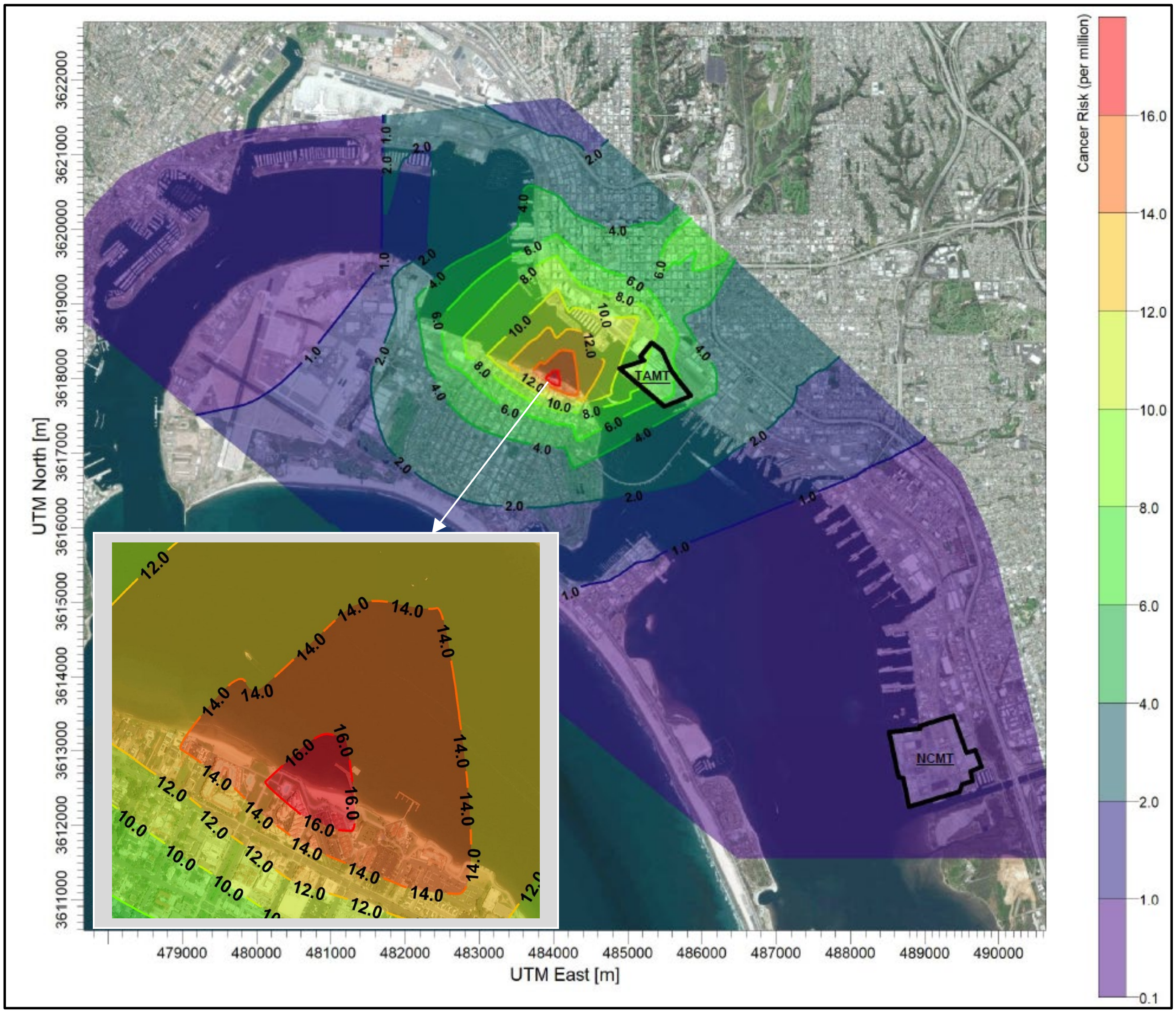
**Figure 2: Existing Residential Cancer Risk Contour Map (Terminals Only)**




**Note:** The cancer risk profile for Terminals Only will vary compared to Terminals plus Ferries because ferry sources are not included.

As shown in **Figure 3**, the highest existing risk areas (shown in red) are near the Ferry Landing that show risk higher than 16 in a million. The highest risk concentrations are near the fixed ferry routes, as risk drops significantly once away from the immediate vicinity of the ferry route and its stops.

**Figure 3: Existing Residential Cancer Risk Contour Map (Ferries Only)**




**Note:** The cancer risk profile for Ferries Only will vary compared to Terminals Plus Ferries because terminal sources are not included.

The primary driver of risk varies by neighborhood for the Terminals Plus Ferries scenario.

- In Barrio Logan, risk is driven by CHE and vessel activity at-berth at TAMT, freight rail, and the ferries. See **Figure 4**.
- In Downtown, risk is driven by freight rail and the ferries. See **Figure 5**.
- In Coronado, risk is driven by the ferries, CHE at TAMT, and tugs. See **Figure 6**.
- In National City, risk is driven by freight rail, including switching, as well as vessel activity at-berth at NCMT. See **Figure 7**.

**Figure 4: Source Contribution to Maximum Cancer Risk in Barrio Logan (Terminal Plus Ferries)**

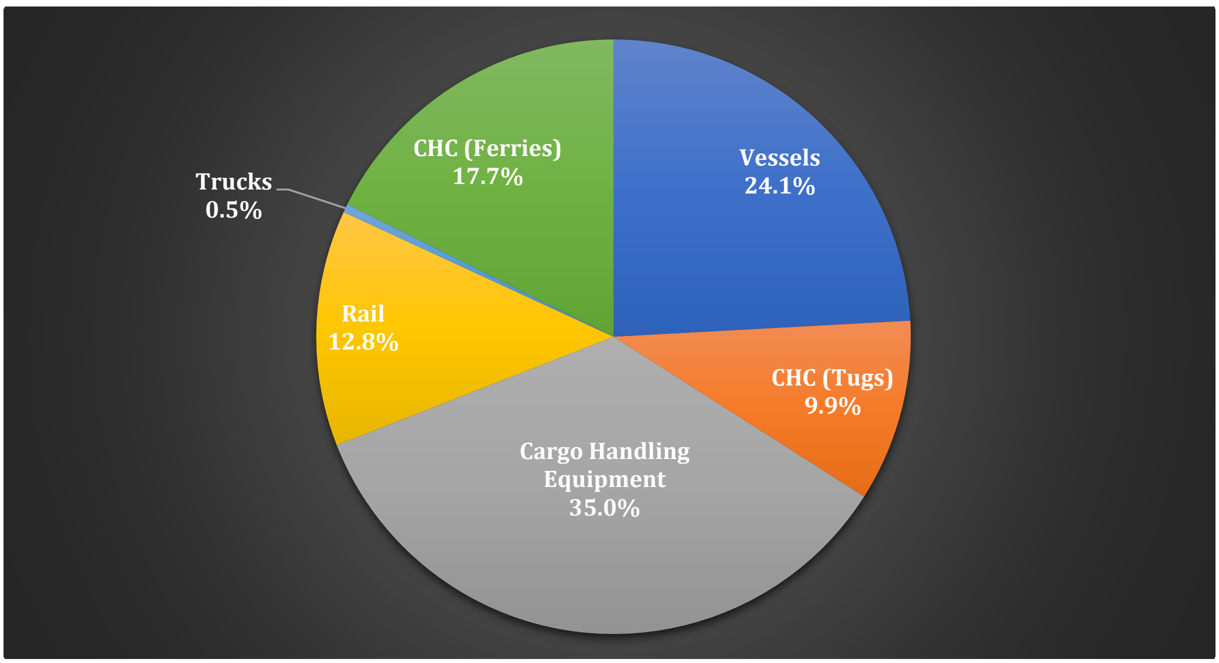


**Figure 5: Source Contribution to Maximum Cancer Risk in Downtown (Terminals Plus Ferries)**

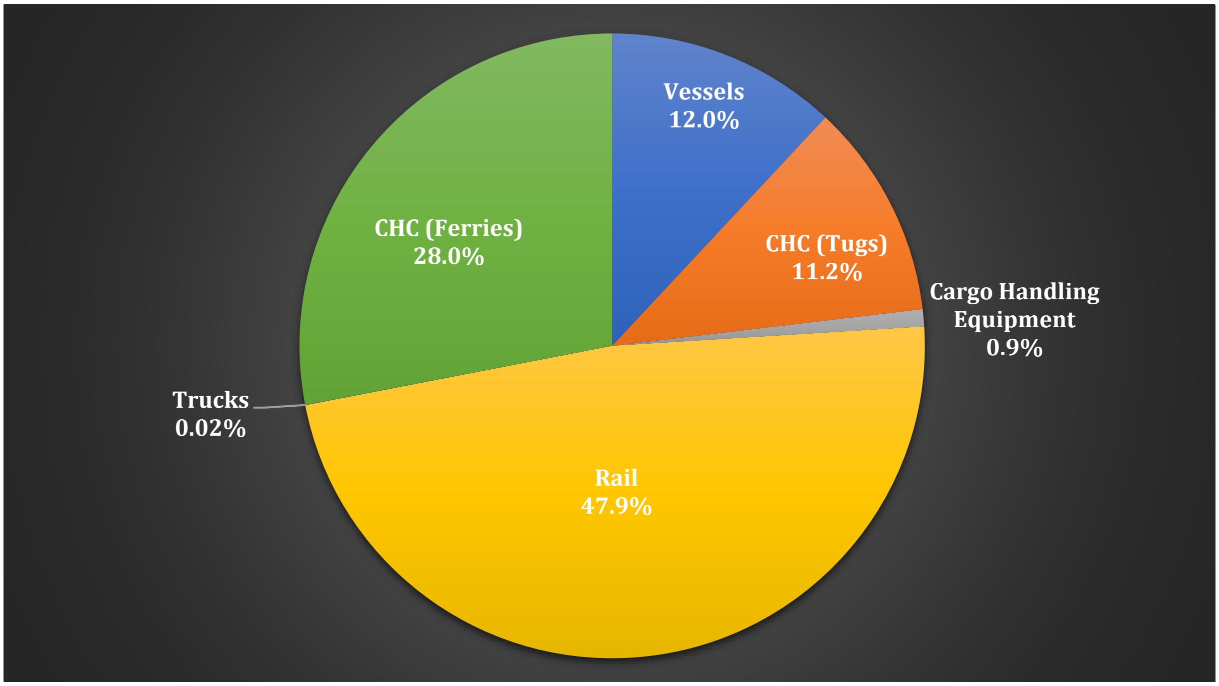



**Figure 6: Source Contribution to Maximum Cancer Risk in Coronado (Terminals Plus Ferries)**

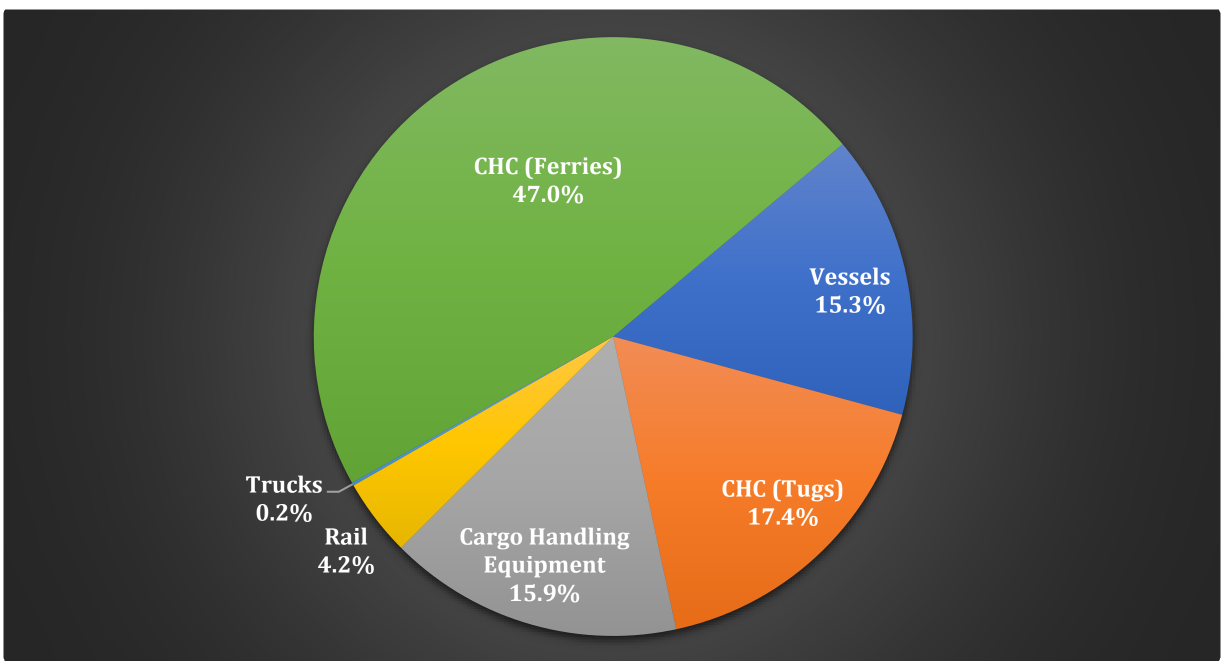
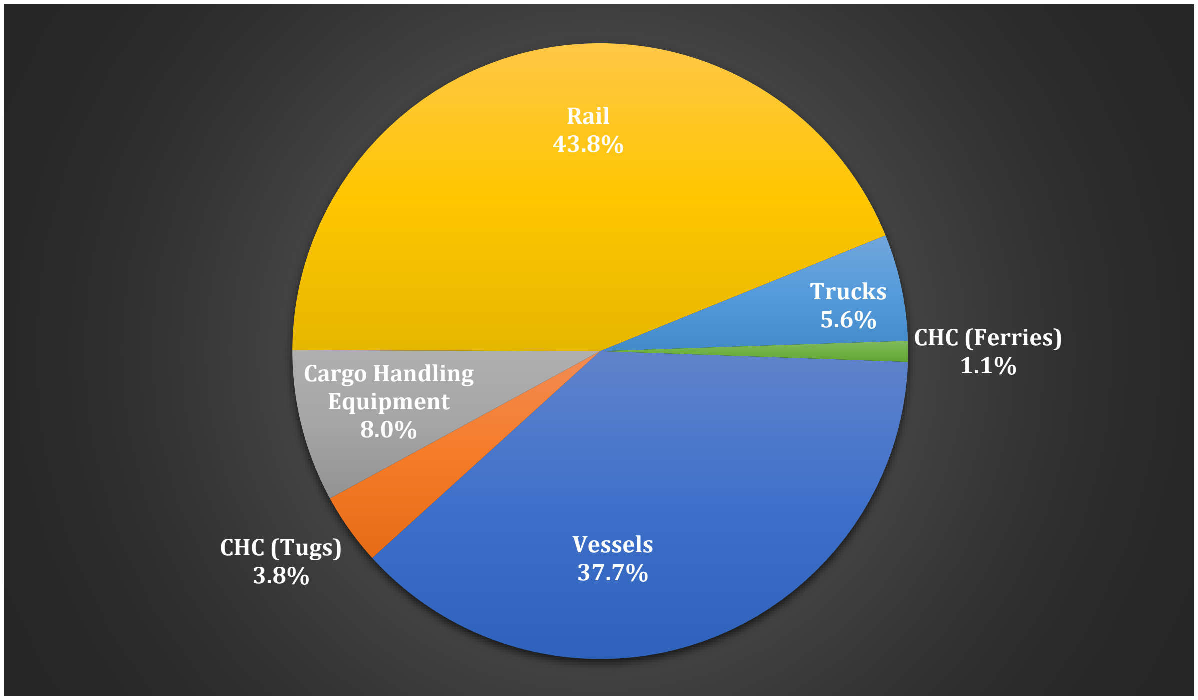


**Figure 7: Source Contribution to Maximum Cancer Risk in National City (Terminals Plus Ferries)**




A summary of risk by MCAS source category (ocean going vessels [OGVs], Commercial Harbor Craft [CHC], CHE, trucks, and rail) by neighborhood is shown in **Table 3** for terminals and ferries and in **Table 4** for terminals only. The relative contribution (percent of total risk) varies by source and by location. For example, TAMT OGV at-berth contributes 3.03 per million to the Maximally Exposed Individual (MEI) in Barrio Logan. For Terminals Plus Ferries, TAMT OGV at-berth contributes 3.03 per million, but this accounts for approximately 13% of the risk (3.03/23.02). For Terminals Only, this 3.03 per million contributes approximately 16 percent of the risk (3.03/18.96).

**Table 3: Contribution by Source to Maximum Residential Cancer Risk - Terminals Plus Ferries**

| Terminal | Source | Barrio Logan | | Downtown | | Coronado | | National City | |
|---|---|---|---|---|---|---|---|---|---|
| | | % of Total | Cancer Risk | % of Total | Cancer Risk | % of Total | Cancer Risk | % of Total | Cancer Risk |
| TAMT | OGV At-Berth | 13.1% | 3.03 | 2.6% | 0.75 | 5.4% | 1.58 | 1.9% | 0.38 |
| | OGV Harbor Movements | 1.2% | 0.27 | 1.5% | 0.43 | 1.3% | 0.39 | 0.3% | 0.06 |
| | CHE | 35.0% | 8.05 | 0.9% | 0.25 | 15.9% | 4.66 | 0.6% | 0.12 |
| | Rail Switching | 0.3% | 0.08 | 0.02% | 0.01 | 0.1% | 0.02 | 0.01% | 0.002 |
| | CHC Tugs | 4.1% | 0.94 | 5.5% | 1.59 | 8.4% | 2.48 | 0.4% | 0.07 |
| | Trucks Offsite | 0.2% | 0.05 | 0.01% | 0.002 | 0.05% | 0.01 | 0.2% | 0.04 |
| | Trucks Onsite | 0.2% | 0.05 | 0.01% | 0.002 | 0.1% | 0.03 | 0.0% | 0.001 |
| NCMT | OGV At-Berth | 2.9% | 0.66 | 1.6% | 0.46 | 2.0% | 0.59 | 29.9% | 5.88 |
| | OGV Harbor Movements | 5.0% | 1.16 | 4.5% | 1.30 | 4.5% | 1.33 | 3.8% | 0.74 |
| | CHE | 0.1% | 0.01 | 0.03% | 0.01 | 0.03% | 0.01 | 7.4% | 1.46 |
| | Rail Switching | 1.3% | 0.29 | 0.7% | 0.20 | 0.9% | 0.27 | 31.4% | 6.17 |
| | CHC Tugs | 5.8% | 1.34 | 5.7% | 1.66 | 9.0% | 2.63 | 3.4% | 0.68 |
| | Trucks Offsite | 0.01% | 0.002 | 0.004% | 0.001 | 0.004% | 0.001 | 4.9% | 0.96 |
| | Trucks Onsite | 0.004% | 0.001 | 0.002% | 0.001 | 0.002% | 0.001 | 0.5% | 0.10 |
| All | OGV Transit Outside Bay | 2.0% | 0.45 | 1.9% | 0.55 | 2.1% | 0.61 | 1.8% | 0.36 |
| | Freight Rail | 11.2% | 2.58 | 47.2% | 13.75 | 3.2% | 0.94 | 12.4% | 2.44 |
| Ferries | Ferry (Cabrillo) | 7.7% | 1.78 | 25.4% | 7.40 | 9.4% | 2.75 | 0.6% | 0.12 |
| | Ferry (Silvergate) | 9.9% | 2.29 | 2.6% | 0.75 | 37.6% | 11.04 | 0.5% | 0.09 |
| **Total** | | **100%** | **23.02** | **100%** | **29.11** | **100%** | **29.33** | **100%** | **19.65** |

**Note:** Totals may not add up exactly due to rounding.
Please refer to Table 1: Summary of Sources Included in HRA for a more detailed discussion of the sources.

**Table 4: Contribution by Source to Maximum Residential Cancer Risk - Terminals Only**

| Terminal | Activity | Barrio Logan | | Downtown | | Coronado | | National City | |
|---|---|---|---|---|---|---|---|---|---|
| | | % of Total | Cancer Risk | % of Total | Cancer Risk | % of Total | Cancer Risk | % of Total | Cancer Risk |
| TAMT | OGV At-Berth | 16.0% | 3.03 | 3.6% | 0.75 | 10.2% | 1.64 | 2.0% | 0.38 |
| | OGV Harbor Movements | 1.4% | 0.27 | 2.0% | 0.43 | 2.4% | 0.38 | 0.3% | 0.06 |
| | CHE | 42.5% | 8.05 | 1.2% | 0.25 | 32.8% | 5.28 | 0.6% | 0.12 |
| | Rail Switching | 0.4% | 0.08 | 0.03% | 0.01 | 0.1% | 0.02 | 0.01% | 0.002 |
| | Tugs | 5.0% | 0.94 | 7.6% | 1.59 | 15.0% | 2.41 | 0.4% | 0.07 |
| | Trucks Offsite | 0.3% | 0.05 | 0.01% | 0.002 | 0.1% | 0.02 | 0.2% | 0.04 |
| | Trucks Onsite | 0.3% | 0.05 | 0.01% | 0.002 | 0.2% | 0.04 | 0.0% | 0.001 |
| NCMT | OGV At-Berth | 3.5% | 0.66 | 2.2% | 0.46 | 3.7% | 0.59 | 30.2% | 5.88 |
| | OGV Harbor Movements | 6.1% | 1.16 | 6.2% | 1.30 | 8.2% | 1.33 | 3.8% | 0.74 |
| | CHE | 0.1% | 0.01 | 0.04% | 0.01 | 0.1% | 0.01 | 7.5% | 1.46 |
| | Rail Switching | 1.6% | 0.29 | 1.0% | 0.20 | 1.7% | 0.27 | 31.7% | 6.17 |
| | Tugs | 7.0% | 1.34 | 7.9% | 1.66 | 16.0% | 2.58 | 3.5% | 0.68 |
| | Trucks Offsite | 0.01% | 0.002 | 0.005% | 0.001 | 0.01% | 0.001 | 4.9% | 0.96 |
| | Trucks Onsite | 0.01% | 0.001 | 0.003% | 0.001 | 0.004% | 0.001 | 0.5% | 0.10 |
| All | OGV Transit outside Bay | 2.4% | 0.45 | 2.6% | 0.55 | 3.8% | 0.61 | 1.8% | 0.36 |
| | Freight Rail | 13.6% | 2.58 | 65.6% | 13.75 | 5.8% | 0.94 | 12.6% | 2.44 |
| Ferries | Ferry (Cabrillo) | - | - | - | - | - | - | - | - |
| | Ferry (Silvergate) | - | - | - | - | - | - | - | - |
| **Total** | | **100%** | **18.96** | **100%** | **20.95** | **100%** | **16.12** | **100%** | **19.44** |

**Note:** Totals may not add up exactly due to rounding.

Overall, the contribution by MCAS source category by neighborhood is summarized in **Table 5** for Terminals Plus Ferries and **Table 6** for Terminals Only. These tables sum the risk for similar sources (i.e., on-site and off-site trucks from TAMT and NCMT) to provide an overview of risk by activity type (i.e., for all trucks, for all vessel activity). As shown, risk by source varies by area, but in the Portside Community Areas, risk is driven mostly by vessel activity (both in movement and at-berth), CHE (particularly in Barrio Logan), rail, ferries (particularly in Barrio Logan), and tugs. In Barrio Logan, trucks represent the smallest contributor to risk in this HRA.

It is worth noting that the emission sources modeled in this HRA are only a portion of the activities in the area. For example, while trucks that carry cargo to and from both TAMT and NCMT are modeled in this HRA, other trucks and vehicles on public roadways, including all other heavy-duty trucks that operate on regional roads and freeways, are not modeled in this HRA. Those non-Port sources will be included in the modeling CARB is performing as part of its ongoing AB 617 efforts (see the Next Steps section below).

**Table 5: Overview of Contribution to Maximum Residential Cancer Risk - Terminals Plus Ferries**

| Source | Barrio Logan | | Downtown | | Coronado | | National City | |
|---|---|---|---|---|---|---|---|---|
| | % of Total | Cancer Risk | % of Total | Cancer Risk | % of Total | Cancer Risk | % of Total | Cancer Risk |
| Vessels | 24.1% | 5.56 | 12.0% | 3.48 | 15.3% | 4.49 | 37.7% | 7.41 |
| CHC (Tugs) | 9.9% | 2.28 | 11.2% | 3.25 | 17.4% | 5.11 | 3.8% | 0.74 |
| CHC (Ferries) | 17.7% | 4.06 | 28.0% | 8.16 | 47.0% | 13.79 | 1.1% | 0.21 |
| CHE | 35.0% | 8.06 | 0.9% | 0.26 | 15.9% | 4.67 | 8.0% | 1.57 |
| Rail | 12.8% | 2.95 | 47.9% | 13.96 | 4.2% | 1.22 | 43.8% | 8.61 |
| Trucks | 0.5% | 0.11 | 0.02% | 0.01 | 0.2% | 0.05 | 5.6% | 1.10 |
| **Total** | **100%** | **23.02** | **100%** | **29.11** | **100%** | **29.33** | **100%** | **19.65** |

**Note:** Totals may not add up exactly due to rounding.

**Table 6: Overview of Contribution to Maximum Residential Cancer Risk – Terminals Only**

| Source | Barrio Logan | | Downtown | | Coronado | | National City | |
|---|---|---|---|---|---|---|---|---|
| | % of Total | Cancer Risk | % of Total | Cancer Risk | % of Total | Cancer Risk | % of Total | Cancer Risk |
| Vessels | 29.3% | 5.56 | 16.6% | 3.48 | 28.2% | 4.55 | 38.1% | 7.41 |
| CHC (Tugs) | 12.0% | 2.28 | 15.5% | 3.25 | 31.0% | 4.99 | 3.8% | 0.74 |
| CHC (Ferries) | - | - | - | - | - | - | - | - |
| CHE | 42.5% | 8.06 | 1.2% | 0.26 | 32.8% | 5.29 | 8.1% | 1.57 |
| Rail | 15.6% | 2.95 | 66.6% | 13.96 | 7.6% | 1.23 | 44.3% | 8.61 |
| Trucks | 0.6% | 0.11 | 0.03% | 0.01 | 0.3% | 0.05 | 5.7% | 1.10 |
| **Total** | **100%** | **18.96** | **100%** | **20.95** | **100%** | **16.12** | **100%** | **19.44** |

**Note:** Totals may not add up exactly due to rounding.

## Cancer Burden

As discussed previously, the cancer burden approach was used to estimate a population-wide risk from exposure to a large facility, such as Port sources. Cancer burden was evaluated based on the methodology presented in Appendix A. Census tract data was based on values from the 2010 U.S. Census. The cancer burden calculation was estimated for the Terminals Plus Ferries scenario to account for Port-related sources. The zone of impact was established by identifying the census tract receptors that had a cancer risk greater than 1 per million. It should be noted that cancer risk calculations are based on a 70-year exposure duration for the cancer burden analysis, compared to a 30-year exposure duration for the maximum cancer risk analysis for individual receptor locations.[13] **Figure 8** shows the zone of impact which had a population of 1,270,479. **Table 7** presents cancer burden estimates for the zone of impact and the communities near the terminal and ferry emissions sources. As shown, cancer burden for the zone of impact was 4.22, which indicated there could be potentially 4.22 excess cancer cases within the zone of impact. Cancer burden estimates for each community were also presented and all were less than 1.0. For context, the SDAPCD's cancer burden threshold is 1.0.

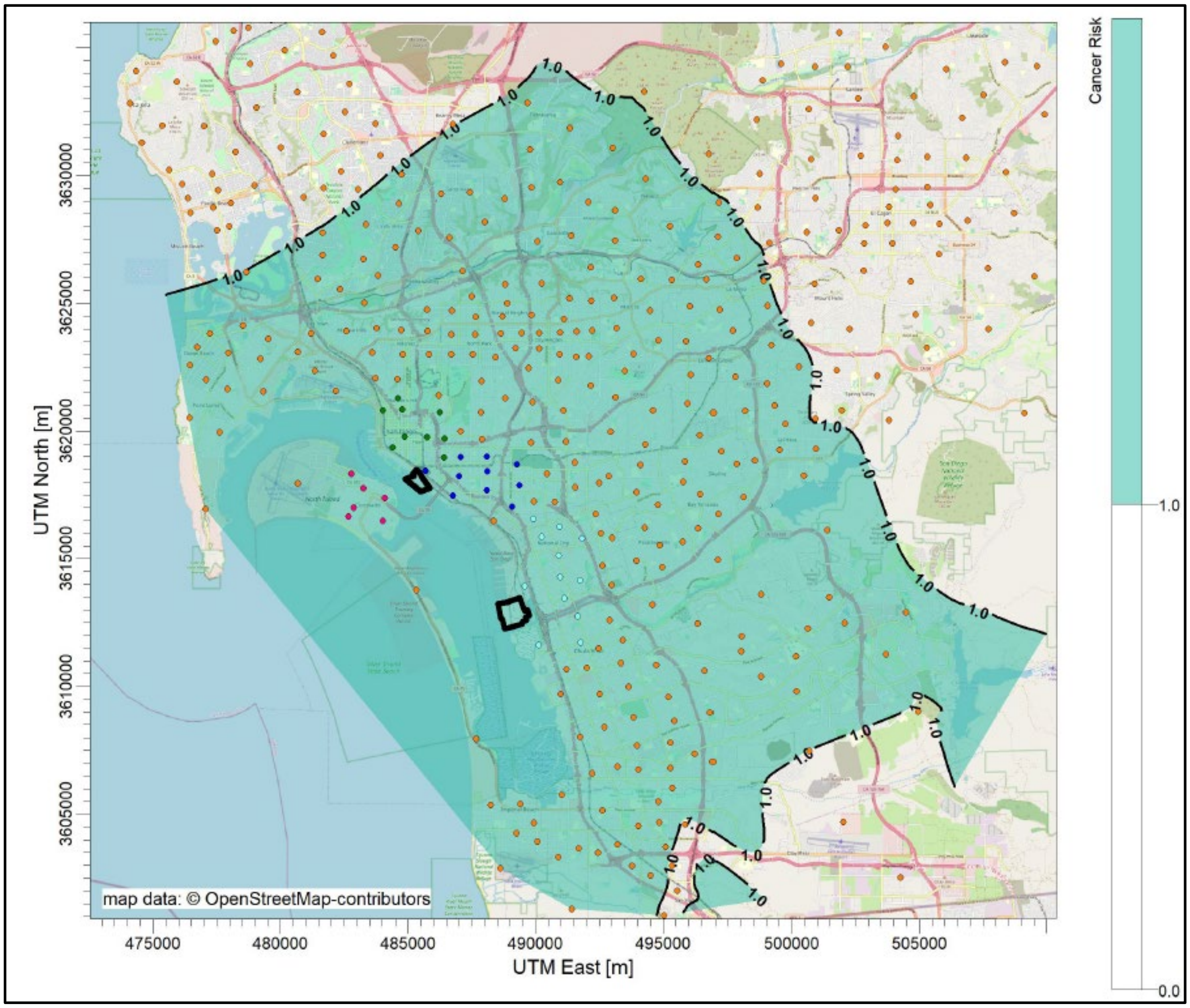
**Table 7: Summary of Cancer Burden**

| Community | Cancer Burden | Population Exposed |
|---|---|---|
| ***Zone of Impact (Regional Scale)*** | **4.22** | ***1,270,479*** |
| Barrio Logan | 0.62 | 49,899 |
| Downtown | 0.45 | 37,172 |
| Coronado | 0.16 | 13,128 |
| National City | 0.54 | 60,904 |
| All Other Census Tracts within Zone of Impact | 2.46 | 1,109,376 |

**Note:** Totals may not add up exactly due to rounding.

[13] The cancer burden is calculated on the basis of lifetime (70-year) risks (whereas individual cancer risk at the MEIR is based on 30-year residential exposure). Cancer burden is independent of how many people move in or out of the vicinity of an individual facility. Thus, a 70-year exposure duration is required for estimates of population-wide risks. The Maximum Exposed Individual (MEI) is more focused on individual, rather than population-wide, estimates, thus a 30-year residential exposure duration is assumed based on an assume 30-year exposure time at a single residence. Both exposure durations are consistent with OEHHA's *Guidance Manual for Preparation of Health Risk Assessments.*

**Figure 8: Zone of Impact for Cancer Burden**




**Note:** Colored dots represent census tract receptors.

# MCAS Reductions

While there are several pathways to reduce the health risk, this next section estimates reductions associated with some of the near- and long-term goals and objectives identified in the MCAS. More specifically, this section quantifies the potential health benefits of some key emission reduction initiatives by assuming necessary action is taken to implement the following near-term MCAS objectives. However, it should be noted that this HRA uses the MCAS measures, programs, and initiatives that may be implemented, if approved, as a means to illustrate emission and risk reduction potential. There are potential additional or alternative measures, programs, projects or initiatives that may be pursued that could facilitate additional or supplemental reductions.

The following were assumed to be in place by 2025 include:

- CHE
  - 20 zero emission (ZE) electric pieces of CHE at TAMT, including one mobile harbor crane, one reach stacker, two top handlers, and 15 yard trucks.
- OGV
  - Two shore power plugs at NCMT.
  - Vessel Speed Reduction (VSR) compliance at 90% and 40nm.

In addition, the following were assumed to be in place by 2026:

- CHC
  - One all-electric ZE tugboat.
  - Two ZE ferries.
- Truck
  - 40 percent of truck trips will be ZE.

Finally, this section quantifies the potential health benefits of some key emission reduction initiatives by assuming the following long-term MCAS measures, assumed to be in place by 2030:

- CHE
  - 100 percent of CHE at both TAMT and NCMT is ZE.
- Truck
  - 100 percent of truck trips are ZE.

A summary of MCAS measures and the associated emission reductions are shown in **Table 8**. As shown, each MCAS measure would contribute to emission reductions, although the reduction has variability based on source affected and proximity to receptors. Moreover, the measures would be implemented over time, with near-term measures starting in either 2025 or 2026, and long-term measures starting in 2030.

A summary of the cancer risk reduction for each quantified MCAS measure is presented in **Table 9** by community based on the measure specifics and timeframes shown in **Table 8**. A summary of the health risk trends and results is provided after **Table 9**.

**Table 8: Summary of Near-Term MCAS Measure Reductions**

| Source Category | Measure | Overview | DPM reduction | Percentage Reduction in Source Category | Date Objective is Targeted for Completion |
|---|---|---|---|---|---|
| CHC | Commercial Harbor Craft Objective #1: All-Electric Tugboat | Reduces diesel consumption from assist tug activity 30,000 gallons per year. Assumes proportionately displaces existing Crowley operations (both tugs are 2015 model year Tier 3 tugs). | 0.0828 tons of DPM reduced, which reduces assist tug DPM by 35%. | 35% | June 30, 2026 |
| | Commercial Harbor Craft Objective #2: Electric Short-Run Ferries | Eliminates all diesel DPM from ferry operations. | 0.2646 ton of DPM reduced, which is 100% of ferry DPM. | 100% | January 1, 2026 |
| CHE | Cargo Handling Equipment Objective #1: Electric CHE at TAMT | Assumes 80% reduction in DPM per year (replacement of 20 diesel pieces with electric models) at TAMT. | 0.077 tons of DPM reduced from TAMT. | 80% | January 1, 2025 |
| | Long-term Goal for Cargo Handling Equipment: 100% ZE CHE by 2030 at TAMT and NCMT | Assumes 100% reduction in DPM at both TAMT and NCMT per year starting in 2030. | 0.096 tons of DPM reduced from TAMT, 0.030 tons of DPM reduced from NCMT | 100% | January 1, 2030 |
| Truck | Truck Objective #1: Electric Trucks | Assumes 40% of all truck trips are ZE. Assumes one-to-one reduction with emissions. | 0.0041 tons of DPM reduced from local roads | 40% | June 30, 2026 |
| | Long-term Goal for Trucks: 100% ZE Trucks by 2030 | Assumes 100% of all truck trips are ZE. Assumes one-to-one reduction with emissions. | 0.0102 tons of DPM reduced from local roads | 100% | January 1, 2030 |
| OGV | Ocean-Going Vessels in-Transit Objective #1: Vessel Speed Reduction | VSR reduces OGV emissions from activity outside of the Bay. Objective pursues a 90% compliance rate within 40 nautical miles. | 4.3 tons of DPM reduced for all OGV types. | Negligible and not quantified | January 1, 2022 |
| | Ocean Going Vessels At-Berth Objective #2b: Shore Power at NCMT | Assume two shore power plugs at NCMT, which captures all calls. | 0.872 of DPM, which is an 88% reduction in at-berth emissions at NCMT. | 88% | January 1, 2025 |

**Table 9: Summary of Health Risk Reductions Associated with MCAS Measures**

| Source Category | Measure (Year Implemented) | Reduction in Maximum Cancer Risk from 2019 Baseline. By Year, By Community | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | In 2025 | | | | In 2026 | | | | In 2030 | | | |
| | | Barrio Logan | Downtown | Coronado | National City | Barrio Logan | Downtown | Coronado | National City | Barrio Logan | Downtown | Coronado | National City |
| CHC | Electric Tugboat (2026) | - | - | - | - | -0.79 | -1.12 | -1.76 | -0.26 | -0.79 | -1.12 | -1.76 | -0.26 |
| | Electric Short-Run Ferries (2026) | - | - | - | - | -4.06 | -8.16 | -13.79 | -0.21 | -4.06 | -8.16 | -13.79 | -0.21 |
| CHE | Electric CHE at TAMT (2025) | -6.44 | -0.20 | -3.73 | -0.09 | -6.44 | -0.20 | -3.73 | -0.09 | - | - | - | - |
| | Electric CHE at TAMT and NCMT (2030) | - | - | - | - | - | - | - | - | -8.06 | -0.26 | -4.67 | -1.57 |
| Truck | 40% Electric Trucks (2026) | - | - | - | - | -0.04 | -0.002 | -0.02 | -0.44 | - | - | - | - |
| | 100% Electric Trucks (2030) | - | - | - | - | - | - | - | - | -0.11 | -0.01 | -0.05 | -1.10 |
| OGV | Vessel Speed Reduction (2022) | - | - | - | - | - | - | - | - | - | - | - | - |
| | Shore Power at NCMT (2025) | -0.58 | -0.40 | -0.52 | -5.18 | -0.58 | -0.40 | -0.52 | -5.18 | -0.58 | -0.40 | -0.52 | -5.18 |
| Total Reduction by Neighborhood | | -7.02 | -0.60 | -4.24 | -5.27 | -11.92 | -9.88 | -19.82 | -6.18 | -13.60 | -9.94 | -20.79 | -8.32 |
| Percent Reduction from Baseline | | -30% | -2% | -14% | -27% | -52% | -34% | -68% | -31% | -59% | -34% | -71% | -42% |
| Resultant Risk Level | | 16.00 | 28.50 | 25.09 | 14.39 | 11.11 | 19.22 | 9.51 | 13.47 | 9.42 | 19.16 | 8.54 | 11.33 |

Assuming approval and implementation of the MCAS measures, programs, and initiatives, **Table 9** demonstrates that there is a path towards reducing health risk in the communities, and each measure shows some health risk benefit. As noted above, however, the MCAS measures are not considered exhaustive and alternative or supplemental measures, programs, or projects can also contribute to emissions reductions. Overall, replacing the ferries leads to the maximum overall reduction, which occurs in Coronado. Moreover, replacing the ferries results in a large reduction Downtown, specifically in those areas that are near the ferry path and landing area near Broadway Pier. In addition, while replacing the ferries leads to a substantial reduction in Barrio Logan, short- and long-term CHE replacement strategies lead to the largest health risk reductions in Barrio Logan, followed by the ferry replacements.

In National City, at-berth measures (shore power) at NCMT lead to the largest reductions from any measure in National City. The health benefit from electric trucks is larger in National City than any other community, but the overall reduction from trucks is smaller overall than most other measures in the context of this HRA because the overall effect of trucks on human health is fairly small. Note that the cumulative health risk analysis being prepared by CARB may yield different regional results.

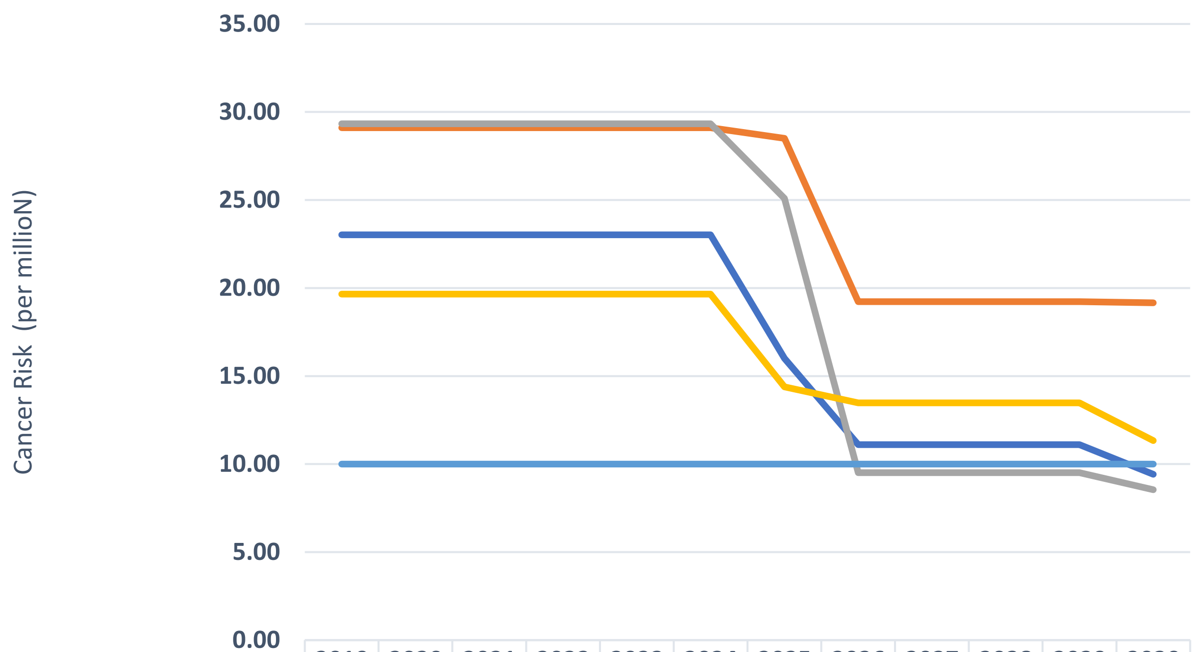
With implementation of the short- and long-term MCAS measures included in this analysis, the maximum overall risk within the modeling area shifts from Coronado (under baseline 2019 conditions) to Downtown once all measures are implemented (in 2030). Moreover, this modeling shows a potential path towards reducing the maximum cancer risk in all communities. As Figure 9 demonstrates, the modeling demonstrates future implementation of the MCAS measures would reduce maximum cancer risk in Barrio Logan and Coronado to below 10 in a million once these MCAS measures are implemented.[14] Based on this modeling, Downtown and National City remain above the 10 in a million proxy.

As the MCAS measures are implemented risk will reduce over time, since reductions will not all occur at once. As shown in **Figure 9**, risk will incrementally drop over time (based on the dates shown in **Table 8**), dropping below 10 in a million in Coronado by 2026 and in Barrio Logan by 2030. Additional measures will be needed beyond the near- and long-term measures assumed herein to further reduce risk in Downtown and National City. Also, note the forecasted cancer risk after implementation of MCAS strategies for this HRA will be predominantly associated with the terminals, as the ferries are assumed to be zero emissions in this future scenario. Again, there may be alternative strategies and pathways that may be employed to achieve cancer risk reductions equal to or greater than the near-term objectives identified in the MCAS.

Note that the values in **Table 9** and **Figure 9** represent the cancer risk associated with the emissions inventory for each year and exposure beginning in the same year. For example, 2019 values represent the cancer risk from exposure to the 2019 emissions inventory with a 30-year exposure duration beginning in 2019. Similarly, 2030 values represent the cancer risk in each community exposed to the 2030 emissions inventory (which includes MCAS measures) with a 30-year exposure duration beginning in 2030.

[14] The 10 in a million standard is reflective of the SDAPCD Rule 1210 standard applicable to stationary sources, and is used as a proxy for reference to understand reductions that may be achievable.

**Figure 9: Forecasted Maximum Cancer Risk Assuming Implementation of MCAS Measures**




| | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Barrio Logan | 23.02 | 23.02 | 23.02 | 23.02 | 23.02 | 23.02 | 16.00 | 11.11 | 11.11 | 11.11 | 11.11 | 9.42 |
| Downtown | 29.11 | 29.11 | 29.11 | 29.11 | 29.11 | 29.11 | 28.50 | 19.22 | 19.22 | 19.22 | 19.22 | 19.16 |
| Coronado | 29.33 | 29.33 | 29.33 | 29.33 | 29.33 | 29.33 | 25.09 | 9.51 | 9.51 | 9.51 | 9.51 | 8.54 |
| National City | 19.65 | 19.65 | 19.65 | 19.65 | 19.65 | 19.65 | 14.39 | 13.47 | 13.47 | 13.47 | 13.47 | 11.33 |
| Rule 1210 Standard | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |

## Next Steps

The Preliminary Health Risk Summary Report is currently being reviewed by staff at CARB and SDAPCD. Over the next several weeks, Port staff will collaborate with CARB and the SDAPCD on ways to clarify and/or improve this preliminary analysis. Once Port staff finalize the HRA's existing cancer risk analysis, Port staff and its consultant team will use this information to help develop potential new emissions reduction strategies that may help to reduce emissions from Port sources, as well as assist with future MCAS updates.

Concurrently, Port staff and its consultant team will continue to collaborate with CARB and SDAPCD staff on ways that this assessment can be incorporated into the broader, Cumulative Health Risk Assessment being prepared for the Portside Community.

# Health Risk Assessment

# Appendix A Modeling Methodology

This modeling protocol discusses the approach and methodology used to conduct the health risk assessment (HRA) for the Port of San Diego's (Port) Maritime Clean Air Strategy (MCAS). The protocol provides additional information on the methods, assumptions and modeling software that was used to complete the HRA. The HRA has three main components, which are described in further detail in the following sections. The three main components are as follows:

1. Emissions Inventory (i.e., the amount of emissions emitted by a source, represented here in tons during the 2019 calendar year)
2. Dispersion Modeling (i.e., use of mathematical formulations to characterize the atmospheric processes that disperse a pollutant emitted by a source, resulting in predicted pollutant concentrations at selected downwind receptor locations).
3. Health Risk calculations (i.e., assess the risk associated with pollutants at pre-defined sensitive receptor locations based on the amount and type of pollutant)

Each of these steps is described below.

Data sources for this HRA include the emissions inventory from the Port's MCAS (particularly for TAMT, NCMT, and ferry operations, which are the subject of this HRA (the HRA Sources)), meteorological data obtained from the SDAPCD, and land use data from SANDAG. The spatial and temporal representation of sources is based on discussions with Port staff and research from other similar analyses.

# 1. Emissions Inventory

## Pollutants of Concern

A majority of the HRA Sources emissions would be emitted from diesel-powered sources resulting in diesel particulate matter (DPM) emissions. DPM is typically composed of carbon particles also known as soot or black carbon, and numerous organic compounds, including known cancer-causing organic substances including polycyclic aromatic hydrocarbons, benzene, formaldehyde, acetaldehyde, acrolein, and 1,3-butadiene (CARB 2021). The Office of Environmental Health Hazard Assessment (OEHHA) has developed health risk values (cancer potency factors and/or reference exposure levels) for numerous toxic air contaminants (TACs), including DPM. Health risk values were discussed further under *Dose-Response Assessment*. Although the Port's has emission sources powered by non-diesel sources (e.g., gasoline, liquefied petroleum gas, etc.), these sources represent a minority of the Port's sources. Therefore, this HRA focuses only on diesel emissions sources and health risks related to DPM exposure.

# Emissions Sources

This section describes the Port's diesel emissions sources included in the HRA. A summary of the emission sources included in the HRA, the activity the sources represent, and their general location, are shown in **Table A-1.**

**Table A-1: Summary of Sources Included in HRA**

| Source Type | Activity | Location |
|---|---|---|
| Ocean Going Vessels | Transit and Anchorage | Outside of the Bay |
| | Maneuvering | Inside the Bay |
| | At-Berth | At terminal berths |
| Commercial Harbor Craft (Assist Tugs) | Maneuvering | Inside the Bay and at terminal during berthing (same geometry as OGV maneuvering) |
| Commercial Harbor Craft (Ferries) | Passenger Transit | Commuter Ferry Path |
| Cargo Handling Equipment | Cargo Movement on Terminal | Equipment activity within terminals |
| Trucks Outside of Terminals | Cargo Transport | Truck travel path on surface streets to freeways |
| Truck Travel within Terminals | Cargo Movement | Within terminals only, same geometry as CHE |
| Line-Haul Locomotives | Cargo Transport | BNSF ROW from NCMT and TAMT, through Downtown |
| Switching Locomotives | Train Assembly | Switching area between BNSF and TAMT |

## Ocean Going Vessels

Ocean going vessels (OGVs) are used to transport goods and people to and from domestic and international ports. OGVs are defined as vessels that move cargo and people over the open ocean and have a Category 3 propulsion engine and two or more Category 2 auxiliary engines. OGV engine categories are defined by United States Environmental Protection Agency (EPA) and are based upon displacement per cylinder as shown in **Table A-2**. OGVs vary greatly in speed and engine sizes based on the ship type. Descriptions of the OGV ship types are provided in **Table A-3.**

OGVs travel in and out of the San Diego Bay (Bay) to the Tenth Avenue Marine Terminal (TAMT) and National City Marine Terminal (NCMT). OGVs traveling to TAMT handle a variety of cargo including bulk cargo, general cargo, and containers. OGVs traveling to NCMT handle mostly automobiles and wheeled cargo. OGV emissions were estimated for OGVs traveling outside of the Bay, inside the Bay, and while at berth at TAMT and NCMT.

**Table A-2: EPA Marine Compression Ignition Engine Categories**

| Category | Specification | Use |
|---|---|---|
| 1 | Gross Engine Power ≥ 37 kW<br>Displacement < 7 liters per cylinder | Small harbor craft and recreational propulsion |
| 2 | Displacement ≥ 7 and < 30 liters per cylinder | OGV auxiliary engines, harbor craft, and smaller OGV propulsion |
| 3 | Displacement ≥ 30 liters | OGV propulsion |
| Source: POSD 2018.<br>kW = kilowatt<br>OGV = ocean going vessel | | |

**Table A-3: OGV Ship Types**

| Ship Type | Description |
|---|---|
| Auto Carrier | Self-propelled dry-cargo vessel that carries containerized automobiles. These call primarily at NCMT, with infrequent but occasional calls at TAMT. |
| Bulk Carrier | Self-propelled dry-cargo ship that carries loose cargo. These call solely at TAMT. |
| Container Ship | Self-propelled dry-cargo vessel that carries containerized cargo. These call solely at TAMT. |
| General Cargo | Self-propelled cargo vessel that carries a variety of dry cargo. These call solely at TAMT. |
| Passenger Ships | Self-propelled cruise ship. These call solely at CST. |
| Source: POSD 2018. | |

## Commercial Harbor Craft

Commercial harbor craft (CHC) includes a variety of vessel and boat types that serve many functions within and near the Bay. CHC emissions were evaluated for tugboats and ferries. Tugboats help OGVs maneuver in the Bay during arrival and departure, and shifts from berth, as well as provide an escort for OGVs. Ferries transport people and property within the Bay. The two ferry routes evaluated were the Broadway Pier-Coronado Landing route and Convention Center-Coronado Landing route.

## Cargo Handling Equipment

Cargo handling equipment (CHE) is used to support terminal activities and move cargo on and off OGVs, harbor craft, rail, and trucks. A wide range of CHE types operate at the Port due to the diversity of cargo handled at each maritime terminal, which ranges from large containers to dry bulk. The types of CHE at TAMT and NCMT include container handling equipment (e.g., reach stackers), yard tractors (or yard trucks or hostlers), forklifts, construction equipment (e.g., rubber-tired loaders), and general industrial equipment.

## Heavy-Duty Trucks

Heavy-duty trucks are used to transport Port-related cargo between TAMT and NCMT and regional destinations, as well as vehicle on-loading and off-loading at NCMT. At TAMT, trucks mainly consist of refrigerated container trucks, dry bulk and unibody trucks to move dry bulk (e.g., cement, bauxite, and fertilizers) and multi-purpose general cargo (e.g., windmill parts), as well as other miscellaneous deliveries. At NCMT, trucks mainly consist of car carriers, along with some flatbeds and trailers to move project (general) cargo, and material (parts) deliveries for automobile services.

### Freight Rail

Rail locomotives carry freight cargo between the Port and regional destinations. Activity associated with locomotives includes activity at or near the terminals to load and unload cargo as well as rail activity regionally to and from the terminals. Freight rail service at the Port is provided exclusively by Burlington Northern Santa Fe (BNSF) Railway. Freight movements are made to and from both TAMT and NCMT along the north-south BNSF right-of-way. Commodities moved by rail include automobiles moved in and out of NCMT, as well as bulk and multi-purpose cargo moved in and out of TAMT, such as soda ash. Emissions from rail activity is split between switching (or switch-duty) and regional travel (or line-haul).

## Emissions Scenarios

Emissions scenario included a baseline scenario and reduction conditions scenario(s), which modeled reductions assuming approval and implementation of MCAS measures, objectives, or initiatives to provide an illustrative example of the reductions that may be achieved through implementation of source-based measures. The baseline scenario emissions were estimated based on the 2019 air emissions inventory, developed as part of the MCAS. The future scenario takes into account short-term MCAS measures. These scenarios were used to estimate the reduction in health risk from implementation of MCAS measures.

A summary of emissions (tons of DPM), emission rates (grams per second), and the temporal profiles for each source category in the HRA are shown in **Table A-4**.

**Table A-4: Emissions, Emission Rates, and Temporal Profile, by Source for Baseline Case**

| Source Category | Source Description | Annual DPM (tons/year) | Emission Rate (g/s) | Emissions Profile |
|---|---|---|---|---|
| OGV | OGV Transit Outside Bay | 0.5426 | 1.561E-02 | 24 hours/365 days |
| | OGV Maneuvering Inside Bay-TAMT | 0.1022 | 2.939E-03 | 24 hours/365 days |
| | OGV Maneuvering Inside Bay-NCMT | 0.4494 | 1.293E-02 | 24 hours/365 days |
| | TAMT-Berth 10-1 | 0.0207 | 5.942E-04 | 24 hours/365 days |
| | TAMT-Berth 10-2 | 0.0207 | 5.942E-04 | 24 hours/365 days |
| | TAMT-Berth 10-3 | 0.0207 | 5.942E-04 | 24 hours/365 days |
| | TAMT-Berth 10-4 | 0.0207 | 5.942E-04 | 24 hours/365 days |
| | TAMT-Berth 10-5 | 0.1487 | 4.277E-03 | 24 hours/365 days |
| | TAMT-Berth 10-6 | 0.1487 | 4.277E-03 | 24 hours/365 days |
| | TAMT-Berth 10-7 | 0.0262 | 7.532E-04 | 24 hours/365 days |
| | TAMT-Berth 10-8 | 0.0262 | 7.532E-04 | 24 hours/365 days |
| | NCMT-Berth-24-1 | 0.1768 | 5.086E-03 | 24 hours/365 days |
| | NCMT-Berth-24-2 | 0.1768 | 5.086E-03 | 24 hours/365 days |
| | NCMT-Berth-24-3 | 0.1768 | 5.086E-03 | 24 hours/365 days |
| | NCMT-Berth-24-4 | 0.1768 | 5.086E-03 | 24 hours/365 days |
| | NCMT-Berth-24-5 | 0.1768 | 5.086E-03 | 24 hours/365 days |
| | NCMT-Berth-24-10 | 0.1768 | 5.086E-03 | 24 hours/365 days |
| | NCMT-Berth-24-11 | 0.1768 | 5.086E-03 | 24 hours/365 days |
| Ferries | Broadway Ave-Coronado (Cabrillo) | 0.1711 | 6.564E-03 | 5AM-11 PM (18 hours)/365 days |
| | Convention Ctr-Coronado (Silvergate) | 0.0935 | 4.610E-03 | 9AM-11 PM (14 hours)/365 days |
| Tugs | Assist Tug at TAMT | 0.0902 | 2.594E-03 | 24 hours/365 days |
| | Assist Tug at NCMT | 0.1494 | 4.298E-03 | 24 hours/365 days |

| Source Category | Source Description | Annual DPM (tons/year) | Emission Rate (g/s) | Emissions Profile |
|---|---|---|---|---|
| CHE | CHE at TAMT | 0.0963 | 2.769E-03 | 24 hours/365 days |
| | CHE at NCMT | 0.0305 | 8.767E-04 | 24 hours/365 days |
| Rail | Switchers at TAMT-Daytime | 0.0007 | 4.152E-05 | 7AM-7PM (12 hours)/365 days |
| | Switchers at TAMT-Nighttime | 0.0007 | 4.152E-05 | 7PM-7AM (12 hours)/365 days |
| | Switchers at NCMT-Daytime | 0.1480 | 8.516E-03 | 7AM-7PM (12 hours)/365 days |
| | Switchers at NCMT-Nighttime | 0.1480 | 8.516E-03 | 7PM-7AM (12 hours)/365 days |
| | Line-Haul Travel-Daytime | 0.0527 | 3.033E-03 | 7AM-7PM (12 hours)/365 days |
| | Line-Haul Travel-Nighttime | 0.0527 | 3.033E-03 | 7PM-7AM (12 hours)/365 days |
| Trucks | TAMT Truck Route 1-Gates to 32nd to I-15 N | 0.0010 | 2.769E-05 | 24 hours/365 days |
| | TAMT Truck Route 2-Harbor to 28th to I-5 N | 0.0007 | 2.094E-05 | 24 hours/365 days |
| | TAMT Truck Route 3-Harbor to Civic to I-5 S | 0.0003 | 7.432E-06 | 24 hours/365 days |
| | TAMT Truck Route 4-Harbor to 32nd to Main to Yard | 0.0002 | 4.974E-06 | 24 hours/365 days |
| | TAMT Truck Route 5-Harbor from TAMT to NDC | 0.0010 | 2.863E-05 | 24 hours/365 days |
| | NCMT Truck Routes 6 & 7-Bay Marina | 0.0043 | 1.232E-04 | 24 hours/365 days |
| | TAMT Onsite Truck Emissions | 0.0006 | 1.869E-05 | 24 hours/365 days |
| | NCMT Onsite Truck Emissions | 0.0022 | 6.224E-05 | 24 hours/365 days |

# 2. Dispersion Modeling

Dispersion modeling was conducted using the EPA's AERMOD dispersion model, version 21112. AERMOD was used to estimate pollutant concentrations from the HRA Sources at offsite locations. AERMOD is a steady-state,[15] multiple-source, Gaussian dispersion model designed for use with emission sources and is suitable for assessing both elevated point sources and low-level emissions sources. AERMOD is EPA's regulatory dispersion model specified in the EPA Guideline for Air Quality Methods (Code of Federal Regulations, Title 40, Part 51, Appendix W) (EPA 2017). AERMOD requires a variety of input parameters to provide a comprehensive analysis, these include:

- Emission Source Characterization
- Meteorological Data
- Temporal Distributions
- Terrain and Dispersion Coefficients
- Receptor Location Data

## Emission Source Characterization

This section provides the information used to characterize the Port's emission sources in AERMOD. Figure A-3: Overall AERMOD Setup provides visual context to the narrative description of HRA Source emissions characteristics that follows.

### OGV Travel Outside the San Diego Bay

OGVs traveling outside the San Diego Bay (Bay) were represented using a line volume source, which is a series of volumes sources. The travel path outside of the Bay was based on ship positions in 2017 provided by the National Oceanic and Atmospheric Administration (NOAA 2017). OGV source parameters were based on similar OGVs analyzed in the San Pedro Waterfront Project (POLA 2008). Each volume source had a width of 100 meters and the volume sources had an adjacent configuration. OGVs were modeled using source parameters consistent with a Type 3 OGV, which was assumed to have a stack height of 61.0 meters. The release height for OGVs traveling outside the Bay was assumed to be 25 percent higher than the stack height. Therefore, the release height was equivalent to the stack height plus 25 percent of the stack height (plume rise increment), which resulted in 76.25 meters. The initial horizontal dimension was based on the volume source width (100 meters) divided by 2.15, which resulted in 46.51 meters. The initial vertical dimension was based on the release height divided by 2.15, which resulted in 35.47 meters. **Table A-5** summarizes the input parameters for OGVs traveling outside of the Bay.

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[15] Steady-state means that the model assumes no variability in meteorological parameters over a 1-hour time period.

**Table A-5: AERMOD Parameters for OGV Travel Outside the Bay**

| Source Type | Source Width (m) | Initial Lateral Dimension (m)[a] | Stack Height (m) | Plume Rise Factor[b] | Release Height (m)[c] | Initial Vertical Dimension (m)[d] |
|---|---|---|---|---|---|---|
| Line Volume | 100 | 46.51 | 61.0 | 25% | 76.25 | 35.47 |

Source: POLA 2008
Notes:
[a] Initial lateral dimension is based on the volume source width divided by 2.15.
[b] Based on OGV activity at the Port of LA, the plume height was observed to be 25% above the stack height for OGVs traveling outside the harbor.
[c] Release height is estimated based on [Stack Height + (Stack Height x Plume Rise Factor)]
[d] Initial vertical dimension is based on the release height divided by 2.15.

## OGV Travel Inside the Bay

OGVs traveling inside the Bay were represented using a line volume source. OGV source parameters were based on similar OGVs analyzed in the San Pedro Waterfront Project (POLA 2008). Each volume source had a width of 100 meters and the volume sources had an adjacent configuration. OGVs were modeled using source parameters consistent with a Type 3 OGV which was assumed to have a stack height of 61.0 meters. The release height for OGVs traveling inside the Bay were assumed to be 50 percent higher than that stack height. Therefore, the release height was equivalent to the stack height plus the 50 percent of the stack height (plume rise increment), which resulted in 91.5 meters. The initial horizontal dimension was based on the volume source width (100 meters) divided by 2.15, which resulted in 46.51 meters. The initial vertical dimension was based on the release height divided by 2.15, which resulted in 42.56 meters. **Table A-6** summarizes the input parameters for OGVs traveling outside of the Bay.

**Table A-6: AERMOD Parameters for OGV Travel Inside the Bay**

| Source Type | Source Width (m) | Initial Lateral Dimension (m)[a] | Stack Height (m) | Plume Rise Factor[b] | Release Height (m)[c] | Initial Vertical Dimension (m)[d] |
|---|---|---|---|---|---|---|
| Line Volume | 100 | 46.51 | 61.0 | 50% | 91.5 | 42.56 |

Source: POLA 2008.
Notes:
[a] Initial lateral dimension is based on the volume source width divided by 2.15.
[b] Based on OGV activity at the Port of LA, the plume height was observed to be 50% above the stack height for OGVs traveling inside the harbor.
[c] Release height is estimated based on [Stack Height + (Stack Height x Plume Rise Factor)]
[d] Initial vertical dimension is based on the release height divided by 2.15.

## OGVs At Berth

OGV emissions while at berth were represented as point sources. Point sources were placed at locations that represented the berths at TAMT and NCMT for each vessel and cargo type. TAMT has eight berth locations and NCMT had seven berth locations. **Table A-7** summarizes the point source parameters for OGVs at berth.

**Table A-7: AERMOD Parameters for OGVs At Berth**

| Source Type | Release Height (m) | Gas Exit Temperature (K) | Stack Diameter (m) | Exit Velocity (m/s) | Exit Flow Rate ($m^3$/s) |
|---|---|---|---|---|---|
| Point | 43 | 618 | 0.50 | 16.0 | 3.14 |
| Source: CARB 2018 | | | | | |

A summary of berth assignments by ship type is as follows for TAMT:

- Container Ships call on Berths 10/1 – 10/4
- General Cargo Ships call on Berths 10/5 – 10/6
- Bulk Cargo Ships call on Berths 10/7 – 10/8

At NCMT, auto carrier and Roll-on/Roll-off or RoRo ships call to each berth. At-berth emissions are spread evenly among the seven berths at NCMT.

## Heavy-Duty Truck Onroad Travel

Heavy-duty trucks traveling on roads in the vicinity of TAMT and NCMT were represented as line area sources for road segments between the terminals and regional freeways. Source parameters for modeling mobile sources were based on guidance from EPA's Transportation Conformity Guidance for Particulate Matter (EPA 2015). Source width was based on the road width plus 6 meters to account for vehicle-induced turbulence. Road width was based on the average number of lanes along the road segments. Lane widths were based on collector and arterial roads which have a lane width of 3.3 meters (EPA 2015). Based on this, the road width was equivalent to 13.2 meters, and the overall source width was 19.2 meters.

The release height for heavy-duty truck segments was based on half of the plume height. Plume height was equal to the vehicle height multiplied by a factor of 1.7 to account for vehicle-induced turbulence. Heavy-duty trucks had a vehicle height of 4.0 meters, which resulted in a plume height of 6.8 meters. Using a plume height of 6.8, the release height was 3.4 meters. The initial vertical dimension was based on the plume height divided by 2.15, which resulted in 3.16 meters. **Table A-8** summarizes the input parameters for heavy-duty truck onroad travel.

**Table A-8: AERMOD Parameters for Heavy-Duty Onroad Truck Travel**

| Source Type | Source Width (m)[a] | Road Width (m)[b] | Vehicle Height (m) | Factor | Plume Height (m) | Release Height (m) | Initial Vertical Dimension (m) |
|---|---|---|---|---|---|---|---|
| Line Area | 19.2 | 13.2 | 4.0 | 1.7 | 6.8 | 3.4 | 3.16[c] |

Source: BAAQMD 2019, p. A.I-83
Notes:
[a] Source width equal to road wight plus 6 meters to account for vehicle-induced turbulence effects.
[b] Road width equal to 4 lanes with a land width of 3.3 meters.
[c] Initial vertical dimension based on release height divided by 2.15.

## Heavy-Duty Truck Activity within the TAMT and NCMT Boundary

Heavy-duty truck activity within TAMT and NCMT was represented as polygon area sources. The area sources encompassed the boundaries of TAMT and NCMT and had a release height of 5.5 meters. The initial vertical dimension was based on the release height divided by 2.15, which resulted in 2.56 meters. **Table A-9** summarizes the input parameters for heavy-duty truck activity within the terminal boundaries.

**Table A-9: AERMOD Parameters for Heavy-Duty Truck Activity at TAMT and NCMT**

| Source Type | Release Height (m) | Initial Vertical Dimension (m)[a] |
|---|---|---|
| Polygon Area | 5.5 | 2.56 |

Source: BAAQMD 2019, p. A.I-81
[a] Initial vertical dimension based on release height divided by 2.15.

## Tugboats

Tugboat emissions were represented using the same route configuration as OGVs, but different release parameters due to the smaller sizes of tugboats. Tugboats had a release height of 6.0 meters. The initial vertical dimension was based on the release height divided by 2.15, which resulted in 2.79 meters. **Table A-10** summarizes the input parameters for tugboats.

**Table A-10: AERMOD Parameters for Tugboats**

| Source Type | Source Dimensions | Release Height (m) | Initial Vertical Dimension (m)[a] |
|---|---|---|---|
| Polygon Area | Followed same path as OGV travel | 6.0 | 2.79 |

Source: POLA 2008. (San Pedro Waterfront)
Notes:
[a] Initial vertical dimension based on release height divided by 2.15.

## Ferry Travel

Ferry emissions from the Cabrillo and Silvergate ferries were represented using polygon area sources. The polygon area sources encompassed the boundaries of where the Cabrillo and Silvergate travel during their routes, based on travel data provided by Port staff. Ferries had a release height of 6.0 meters. The initial vertical dimension was based on the release height divided by 2.15, which resulted in 2.79 meters. **Table A-11** summarizes the parameters for ferry travel.

**Table A-11: AERMOD Parameters for Ferry Travel**

| Source Type[a] | Release Height (m) | Initial Vertical Dimension (m)[b] |
|---|---|---|
| Polygon Area | 6.0 | 2.79 |

Source: CARB 2006.
[a] Ferry sources reflect actual area where ferry travel would occur for the Cabrillo and Silvergate ferries.
[b] Initial vertical dimension based on release height divided by 2.15.

## Cargo Handling Equipment

CHE at TAMT and NCMT were represented as polygon area sources. The area sources encompassed the boundaries of TAMT and NCMT and had a release height of 5.5 meters. The initial vertical dimension is based on the release height divided by 2.15, which resulted in 2.56 meters. **Table A-12** summarizes the input parameters for CHE operating at TAMT and NCMT.

**Table A-12: AERMOD Parameters for Cargo Handling Equipment**

| Source Type | Release Height (m) | Initial Vertical Dimension (m)[a] |
|---|---|---|
| Polygon Area | 5.5 | 2.56 |

Source: BAAQMD 2019, p. A.I-81
[a] Initial vertical dimension based on release height divided by 2.15.

## Line-Haul Locomotive Travel

Line-haul (freight rail) locomotives carrying cargo from TAMT and NCMT were represented as a line volume source with an alignment along the BNSF right-of-way, stretching from NCMT to the Downtown San Diego area. Source parameters were consistent with guidance from CARB's railyard study for the BNSF San Diego yard (CARB 2008). Freight rail sources accounted for daytime (7AM-7PM) and nighttime (7PM-7AM) conditions to account for varying meteorological effects. The source width and initial lateral dimension would be the same under daytime and nighttime conditions. The line volume source had a width of 5.01 meters. The initial later dimension was based on the source width divided by 2.15, which resulted in 2.33 meters.

For daytime conditions, the release height was 4.76 meters. The daytime initial vertical dimension was based on the release height divided by 2.15, which resulted in 2.21 meters. For nighttime conditions, the release height was 11.25 meters. The nighttime initial vertical dimension was based on the release height divided by 2.15, which resulted in 5.23 meters. **Table A-13** summarizes the input parameters for line-haul locomotives.

**Table A-13: AERMOD Parameters for Line-Haul Locomotive Travel**

| Source Type | Time of Day | Source Width (m) | Initial Lateral Dimension (m)[a] | Release Height (m) | Initial Vertical Dimension (m)[b] |
|---|---|---|---|---|---|
| Line Volume | Daytime (7 AM to 7 PM) | 5.01 | 2.33 | 4.76 | 2.21 |
| | Nighttime (7 PM to 7 AM) | 5.01 | 2.33 | 11.25 | 5.23 |

Source: CARB 2008.
[a] Initial lateral dimension based on source width divided by 2.15.
[b] Initial vertical dimension based on release height divided by 2.15.

## Rail Switching

Rail switching activities at TAMT and NCMT were represented as multiple volume sources. The volume sources were placed in the areas where switching activities would occur within TAMT and NCMT. Source parameters were consistent with guidance from CARB's railyard study for the BNSF San Diego yard (CARB 2008). Switching activity sources accounted for daytime (7AM-7PM) and nighttime (7PM-7AM) conditions to account for varying meteorological effects. The source width and initial lateral dimension would be the same under daytime and nighttime conditions. Volume sources at TAMT and NCMT had source widths of 45 meters and 35 meters, respectively. The initial lateral dimensions were based on the source width divided by 2.15 meters, which resulted in 10.47 meters for TAMT and 8.14 meters for NCMT. Note that rail switching only accounted for Port-related switching activity, and did not account for switching that occurs for non-Port cargo movements.

For daytime conditions, the release height was 37.76 meters. The daytime initial vertical dimension was based on the release height divided by 2.15, which resulted in 17.56 meters. For nighttime conditions, the release height was 37.30 meters. The nighttime initial vertical dimension was based on the release height divided by 2.15, which resulted in 17.35 meters. **Table A-14** summarizes the input parameters for switching activities.

**Table A-14: AERMOD Parameters for Switching Activities at TAMT and NCMT**

| Location | Source Type | Time of Day | Plume Width (m) | Initial Lateral Dimension (m)[a] | Release Height (m) | Initial Vertical Dimension (m)[b] |
|---|---|---|---|---|---|---|
| TAMT | Multiple Volume | Daytime (7AM-7PM) | 45 | 10.47 | 37.76 | 17.56 |
| | | Nighttime (7PM-7AM) | 45 | 10.47 | 37.30 | 17.35 |
| NCMT | Multiple Volume | Daytime (7AM-7PM) | 35 | 8.14 | 37.76 | 17.56 |
| | | Nighttime (7PM-7AM) | 35 | 8.14 | 37.30 | 17.35 |

Source: CARB 2008.

[a] Initial lateral dimension based on source width divided by 2.15.

[b] Initial vertical dimension based on release height divided by 2.15.

## Averaging Time and Unitized Emission Rate

For evaluating cancer risk, the PERIOD averaging time was used to estimate annual average concentrations.

Each source in AERMOD was modeled using a unitized emission rate, or 1 gram per second (g/s) to estimate ground level concentrations (GLCs) in micrograms per cubic meter (μm/m$^3$) at each receptor. Since a unitized emission rate is used for all sources, the output concentrations from AERMOD can be used as dispersion factors (or scaling factors). The dispersion factor ([μm/m$^3$]/[1 g/s]) represents the AERMOD output concentration based on an emission rate of 1 g/s. The dispersion factor ([μm/m$^3$]/[1 g/s]) and the actual emission rate of the source (g/s) are multiplied together to estimate the GLC (μm/m$^3$) at a receptor. An example calculation for estimating GLCs is provided below.

**Annual GLC (μm/m$^3$)** = Actual Emission Rate (g/s) x [Dispersion Factor (μm/m$^3$)/ 1 (g/s)]

Where:

- Actual Emission Rate: 10 g/s
- Dispersion Factor: 5 μm/m$^3$

50 μm/m$^3$ = 10 g/s x 5 ([μm/m$^3$]/[1 g/s])

A unitized emission rate was used for the analysis to 1) to be compatible with HARP2's ADMRT, 2) reduce the amount of modeling runs, and 3) provide the ability to estimate GLCs for a large number of sources efficiently. This approach is consistent with methods in the OEHHA Guidelines.

# Meteorological Data

To run AERMOD, the following hourly surface meteorological data are required: wind speed, wind direction, ambient temperature, and opaque cloud cover. In addition, the daily morning upper air sounding data are required.

These meteorological variables are used to estimate air dispersion of pollutants in the atmosphere. Wind speed determines how rapidly pollutants are transported away from the source, while wind direction determines where pollutants are transported. The difference in ambient temperature and the exhaust temperature determines the initial buoyancy of emissions from point sources. The opaque cloud cover, upper air sounding data and surface roughness, Bowen ratio (ratio of sensible to latent heat flux) and albedo (reflectiveness of the earth's surface back to space without absorption) are all used in determining other dispersion parameters using similarity theory to develop profiles of the boundary layer parameters and determine the rate of turbulent mixing. These parameters include atmospheric stability (a measure of atmospheric turbulence that determines the rate at which pollutants are mixed laterally and vertically), the aloft vertical temperature gradient, the convective and mechanical boundary layer height (the vertical depth through which pollutants may be dispersed).

Meteorological data for the dispersion modeling was based on SDAPCD's monitoring station at Perkins Elementary School, which is located less than a mile from the Port boundaries as shown in **Figure A-1**.[16] The pre-processed meteorological data from this station was collected for the years between 2010–2012. **Figure A-2** through **Figure A-4** shows wind roses for the Perkins Elementary School station. The wind roses show predominant winds from the west and southwest throughout the entire day (1.91 meters per second [m/s] on average) (**Figure A-2**) and during the daytime hours (2.50 m/s on average) (**Figure A-3**), with less dominant patterns at night (1.26 m/s on average) (**Figure A-4**). Moreover, winds tend to be higher in the daytime, and nighttime winds show much more calm periods (calm winds 4.06% of the time during the day, and calm winds 16.28% of the time at night).

# Temporal Distributions

Meteorological conditions can affect how pollutants are dispersed based on atmospheric stability. Unstable conditions occur during the day when there is solar heating of the surface and air near the surface, which allows air to move freely up and down. Stable conditions begin at sunset and occur throughout the night and early morning hours prior to sunrise. During stable conditions, the surface cools due to the release of radiative heat to the atmosphere and conditions can be stagnant resulting results in less movement of air. Unstable conditions increase air dispersion for sources operating during daytime hours and typically results in lower pollutant concentrations compared to sources operating during nighttime hours.

The cargo terminals are open year-round, and sources operate at various times throughout a 24-hour period. Based on this, a majority of the emission sources in AERMOD were modeled with an operating schedule of 24 hours per day, 7 days per week with the exception of rail sources (freight and switching activities) which had a daytime (7AM to 7PM) and nighttime (7PM to 7AM) profiles and ferry travel. The Cabrillo ferry operated from operated from 5 AM to 11PM and the Silvergate ferry operated from 9AM to 11PM. Although some sources realistically operate more frequently during daytime hours, using this operating schedule for all sources is likely to result in conservative results since sources would operate during nighttime hours where air dispersion decreases, resulting in higher concentrations at locations near the Port.

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[16] While the Perkins monitoring station was closed in 2016, the meteorological data for the 2010-2012 period remains the best available data for use at the Port.

# Terrain and Dispersion Coefficients

The dispersion modeling analysis also included terrain data to accurately assess impacts in three dimensions. The terrain data used for the analysis consisted of the United States Geological Survey's (USGS) National Elevation Dataset (NED) data that was downloaded in AERMOD for the project area. The urban dispersion coefficient was selected in AERMOD based on the urban location setting. In addition to account for the effect of increased nighttime surface heating the urban heat island option was included. The urban heat island enhances the turbulence above that found in a rural stable boundary layer. This effect is dependent on a number of factors but has been parameterized in AERMOD as a function of urban population and the surface friction velocity. Based on population data from the U.S. Census, we used the 2017 population for the City of San Diego of 1,419,516 (City of San Diego 2018).

# Modeling Domain and Receptor Network

The modeling domain includes the Port, the ocean surrounding the Port, and locations of various receptors within the vicinity of the Port. Consistent with CARB modeling, all receptors in the analysis use a 0 meter receptor height (i.e., ground level). The HRA receptor grids for each analysis scenario (i.e., residents, children at schools and parks) were developed based on land use data provided by GIS. The receptors grid for each scenario used a cartesian grid that encompassed the project area with 50-meter spacing. Using the land use data generated by GIS, residences, schools, and park land uses were identified. All receptors that did correlate to these land uses were removed from the receptor grid. Additionally, individual receptors were placed in locations where the cartesian grids did not capture the land use of interest.

**Figure A-5** through **Figure A-13** depict the modeling domain and model setup, along with the residential, school, and park receptors grids used in the HRA.

**Figure A-1: Perkins Elementary School Monitoring Station**

**Figure A-2: Perkins Elementary School Monitoring Station – 24-Hour Wind Conditions**

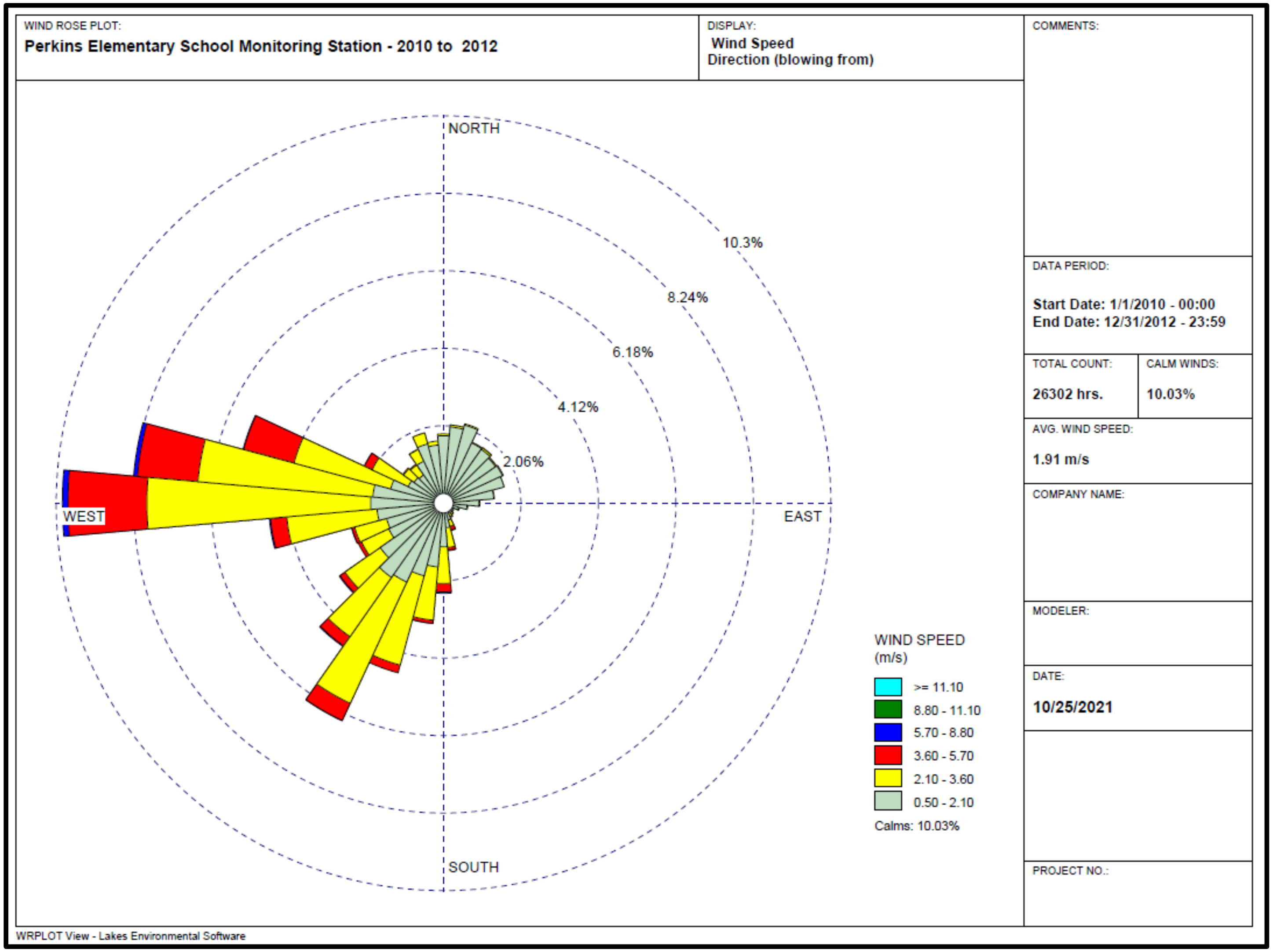


**Figure A-3: Perkins Elementary School Monitoring Station – Daytime Hours Wind Conditions**

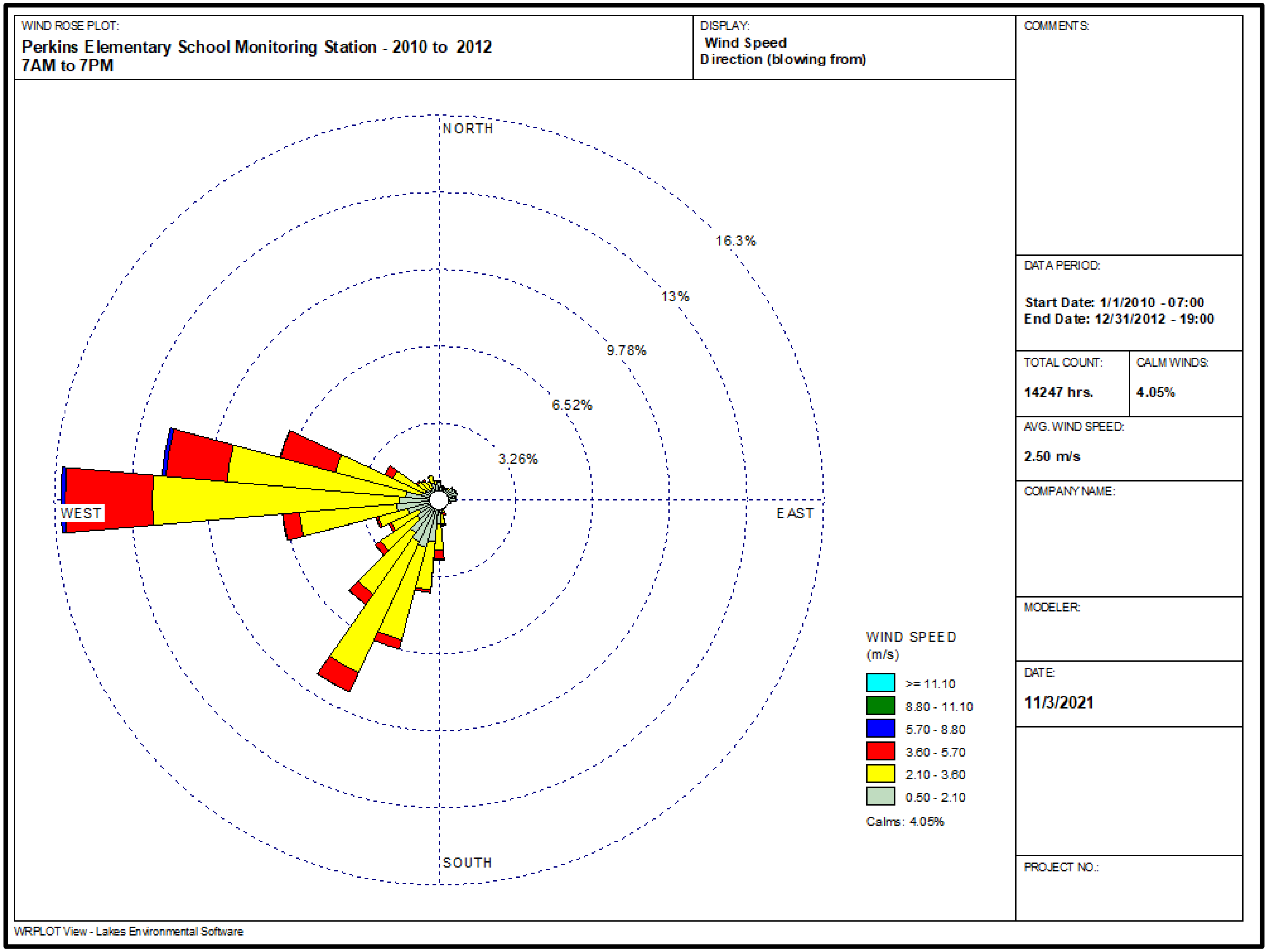


**Figure A-4: Perkins Elementary School Monitoring Station – Nighttime Hours Wind Conditions**

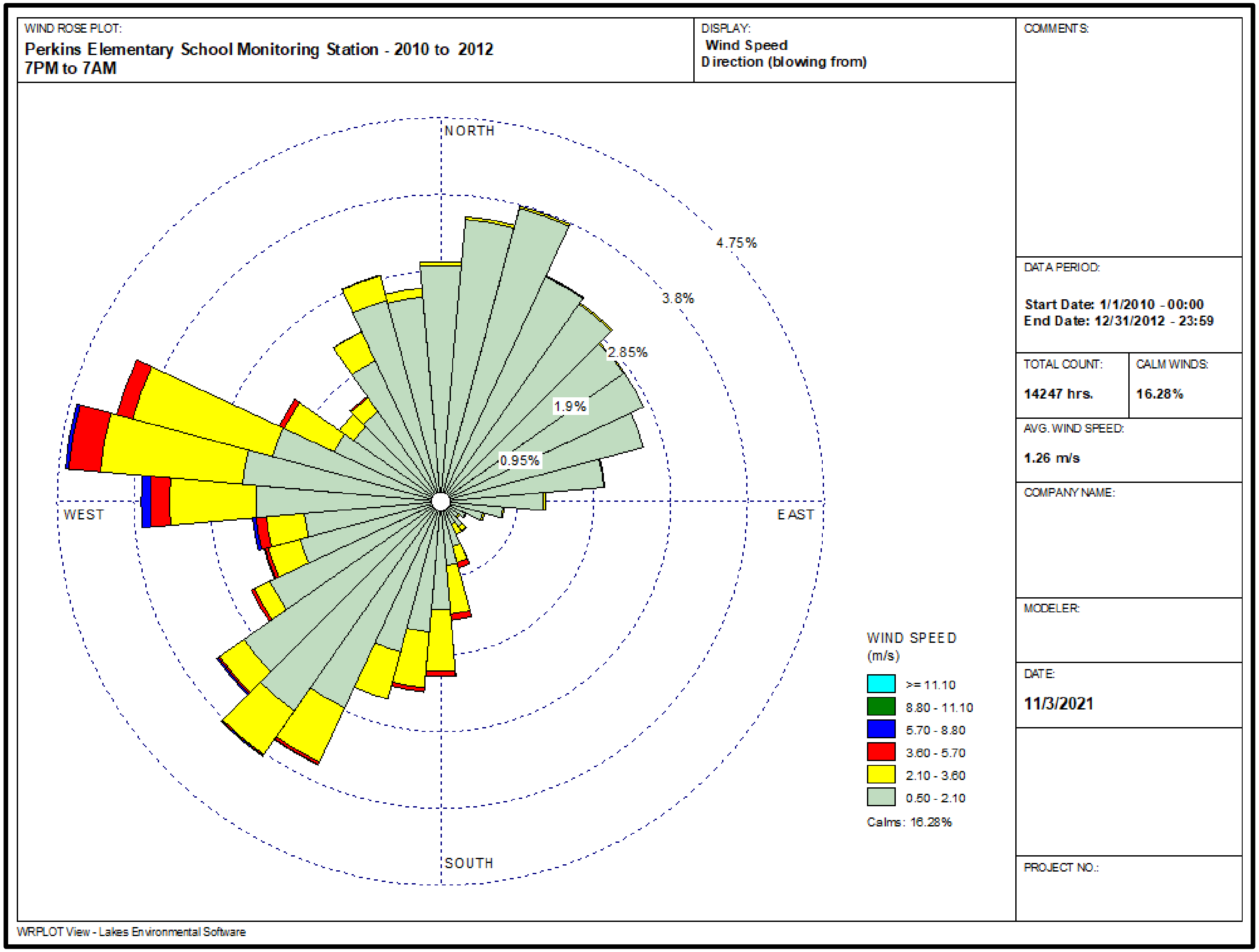


**Figure A-5: Overall AERMOD Setup**

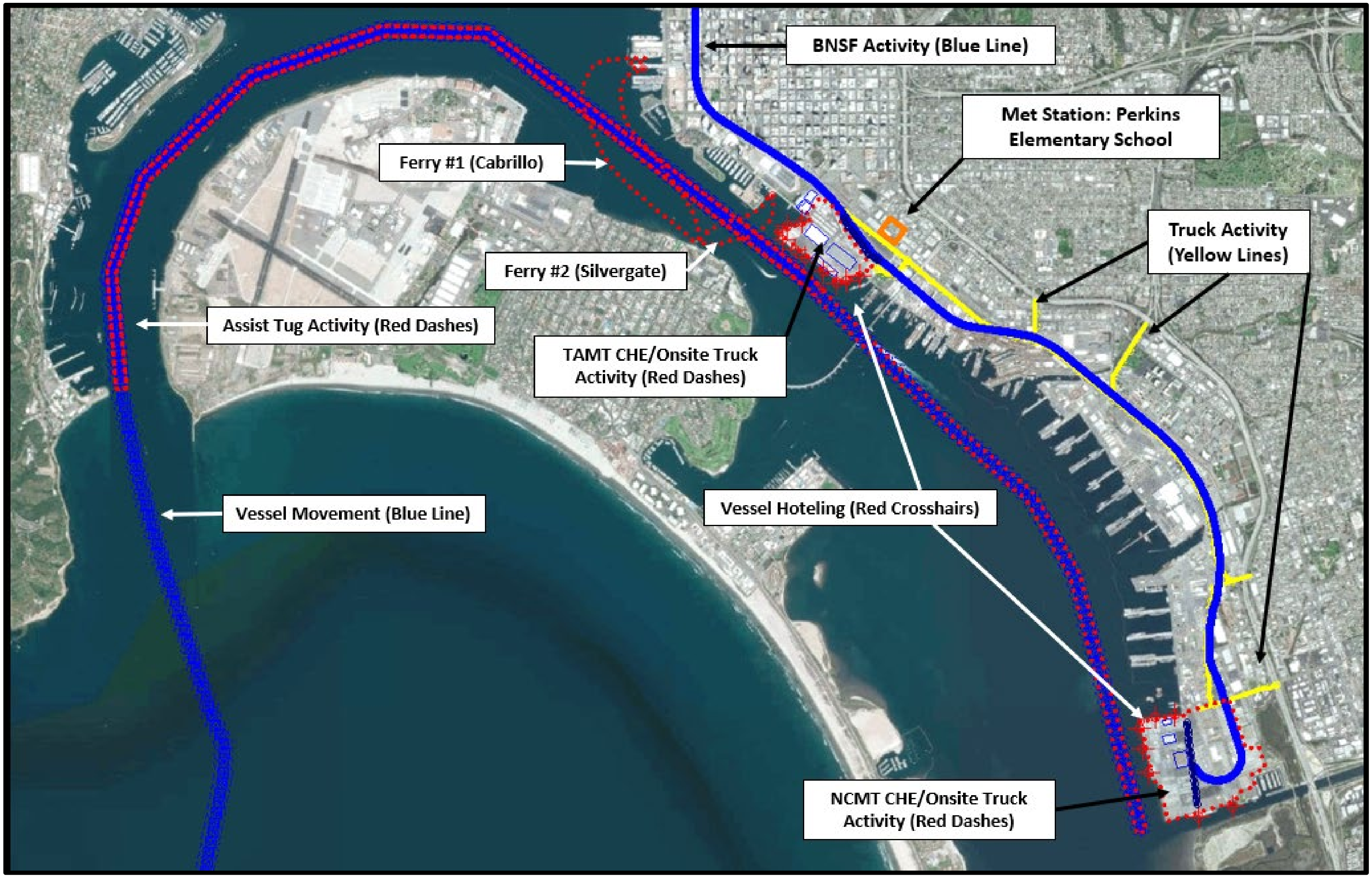


**Figure A-6: AERMOD Setup for TAMT**

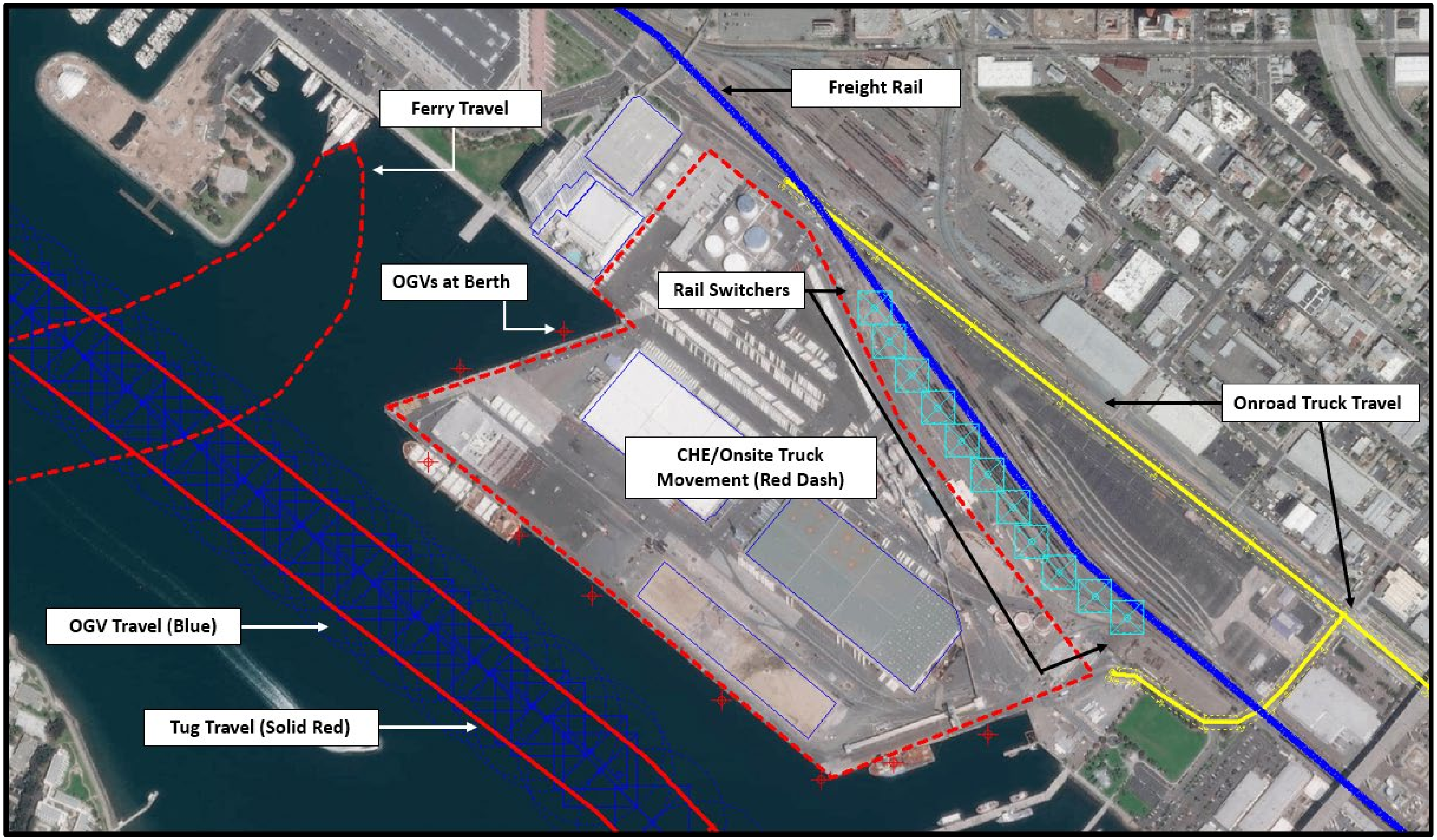


**Figure A-7: AERMOD Setup at NCMT**

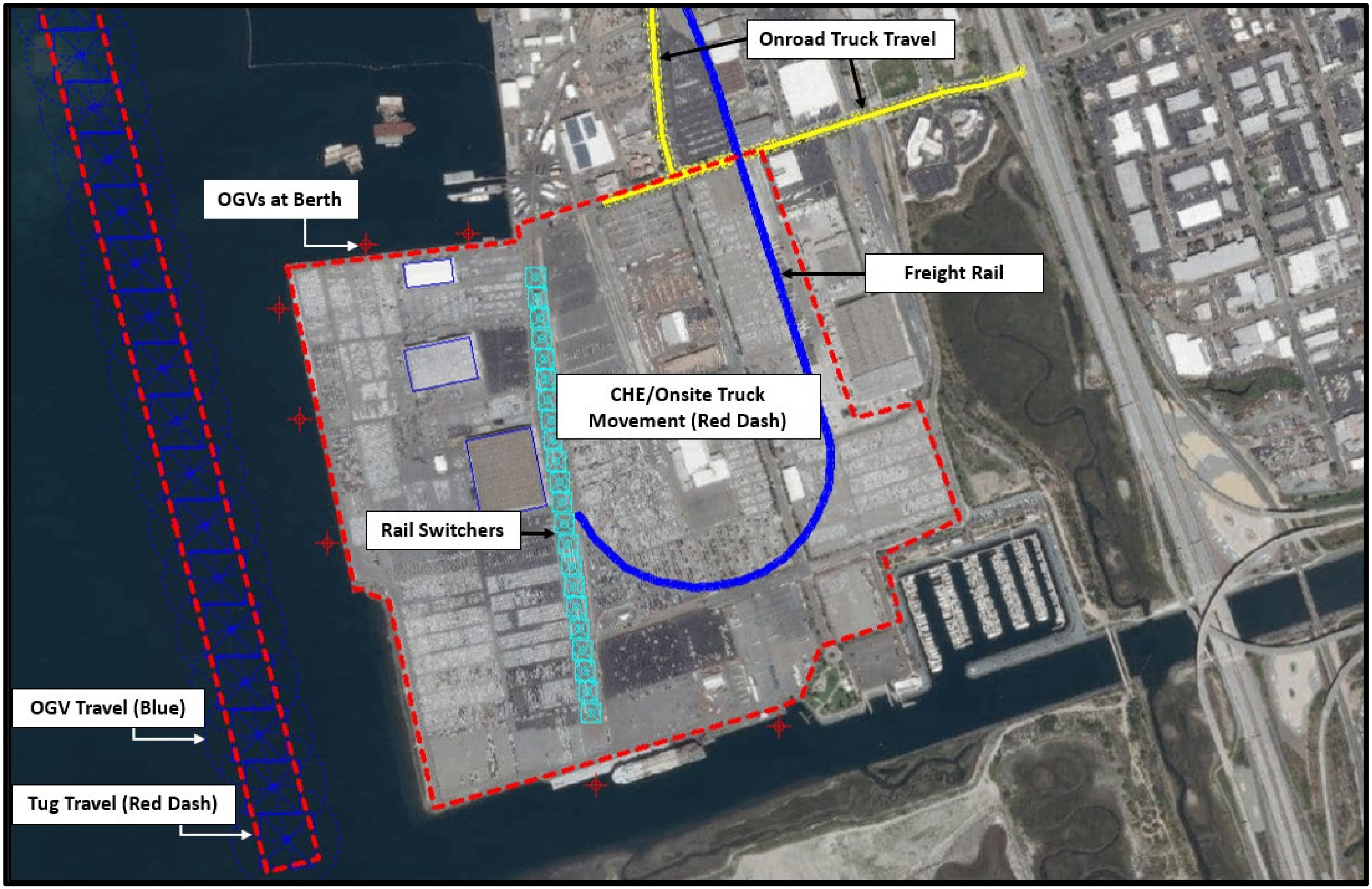


**Figure A-8: AERMOD Setup Downtown**

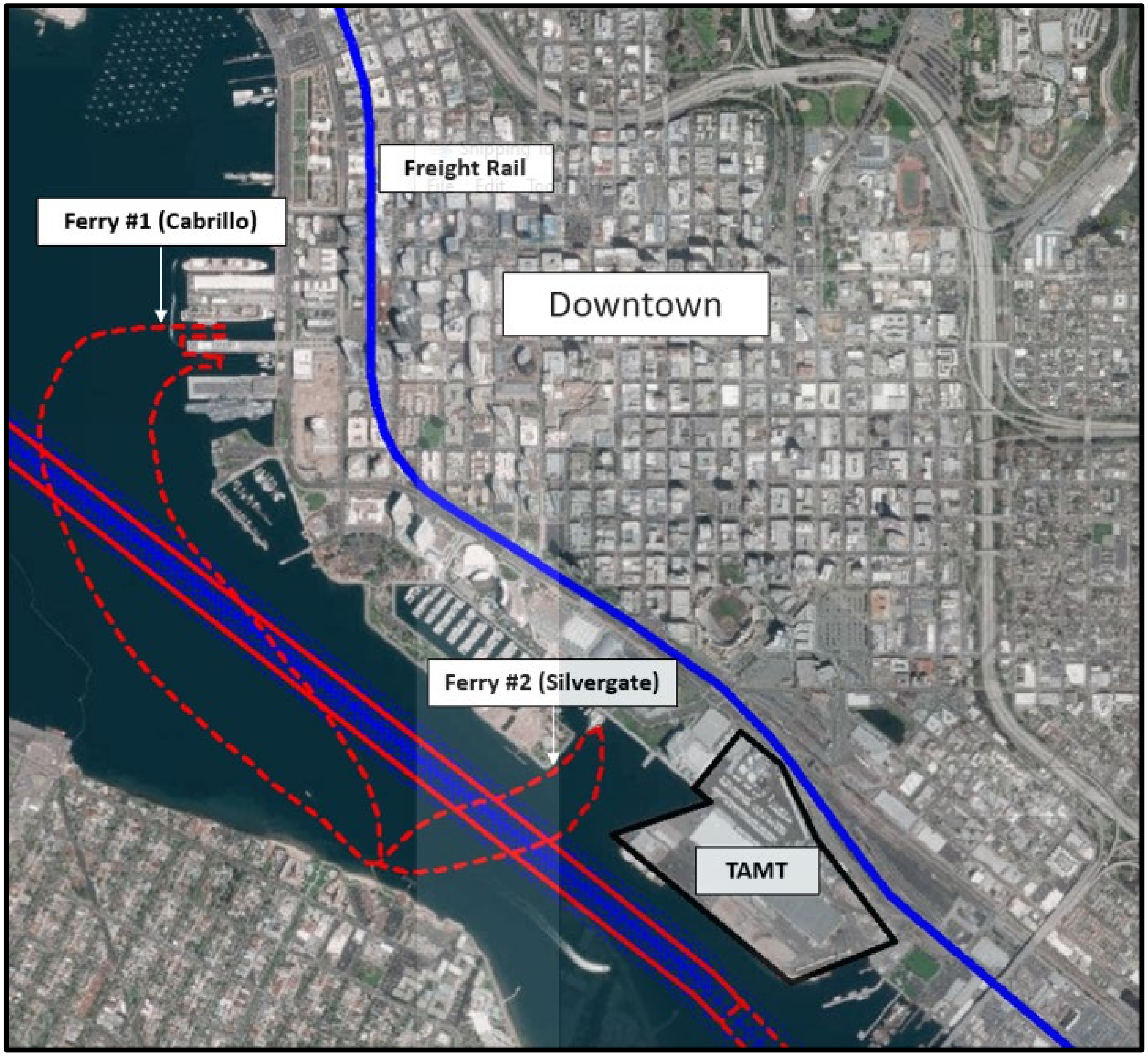


**Figure A-9: AERMOD Setup for Ferries**

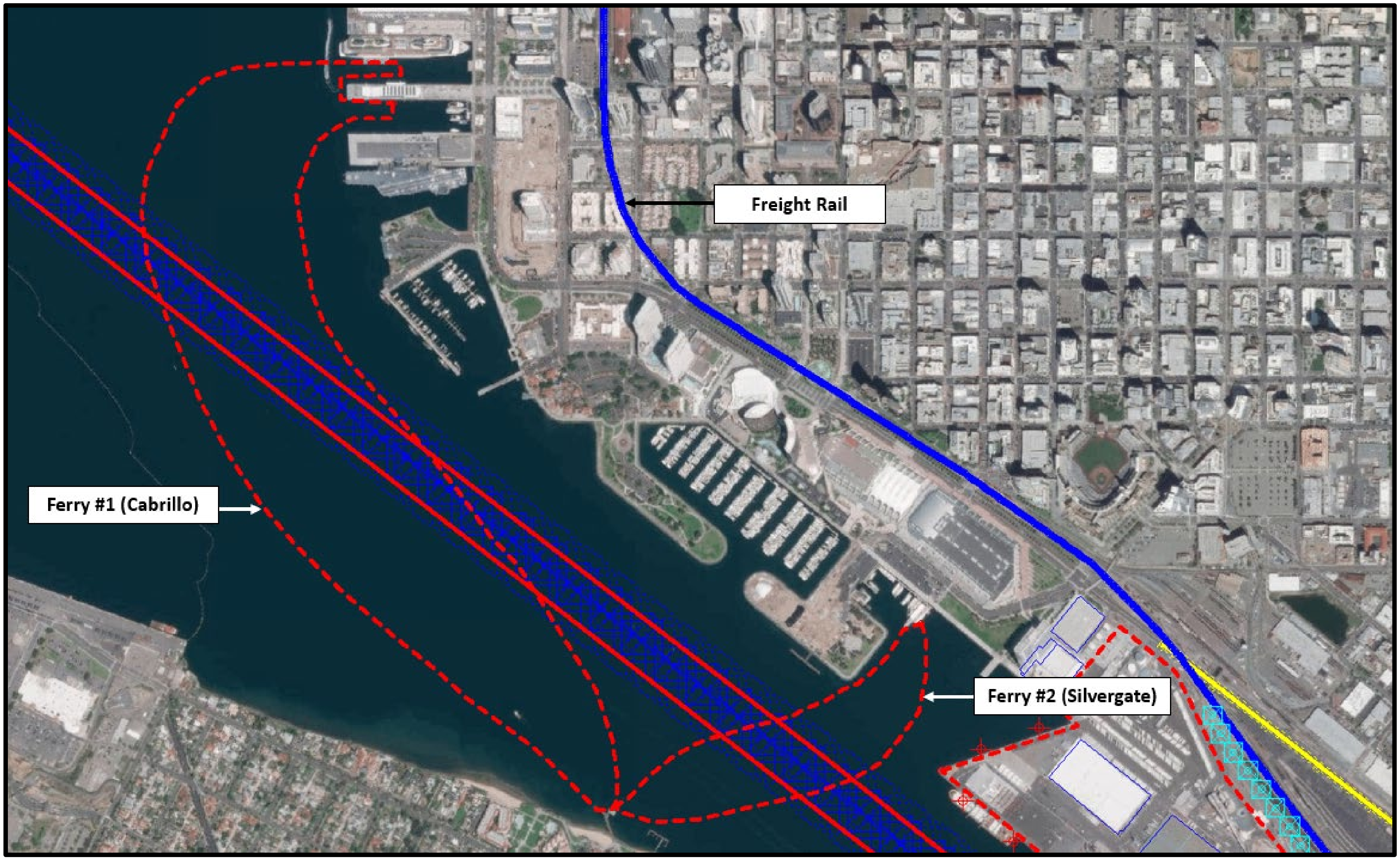


**Figure A-10: Residential Receptor Grid**

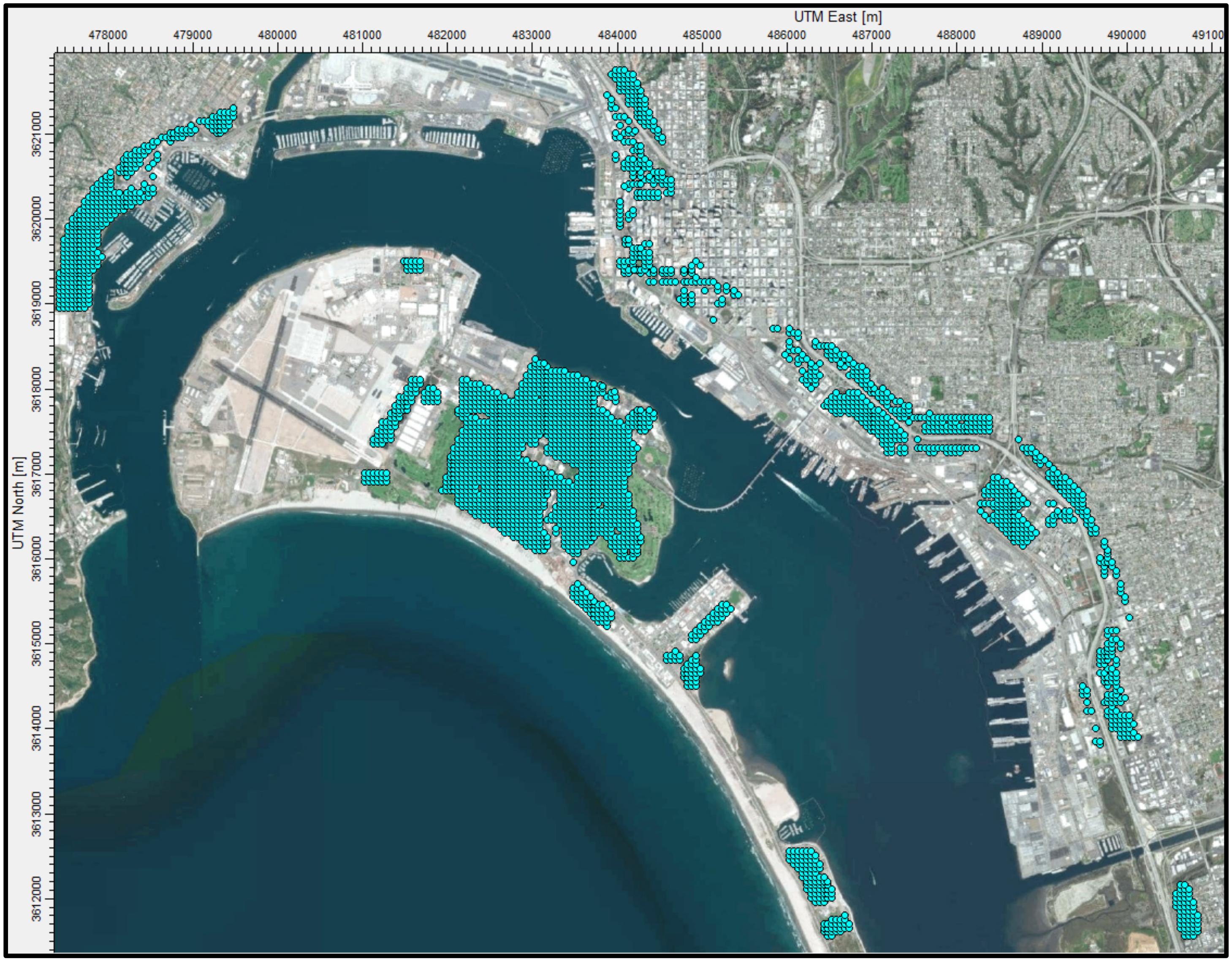


**Figure A-11: School Receptor Grid**

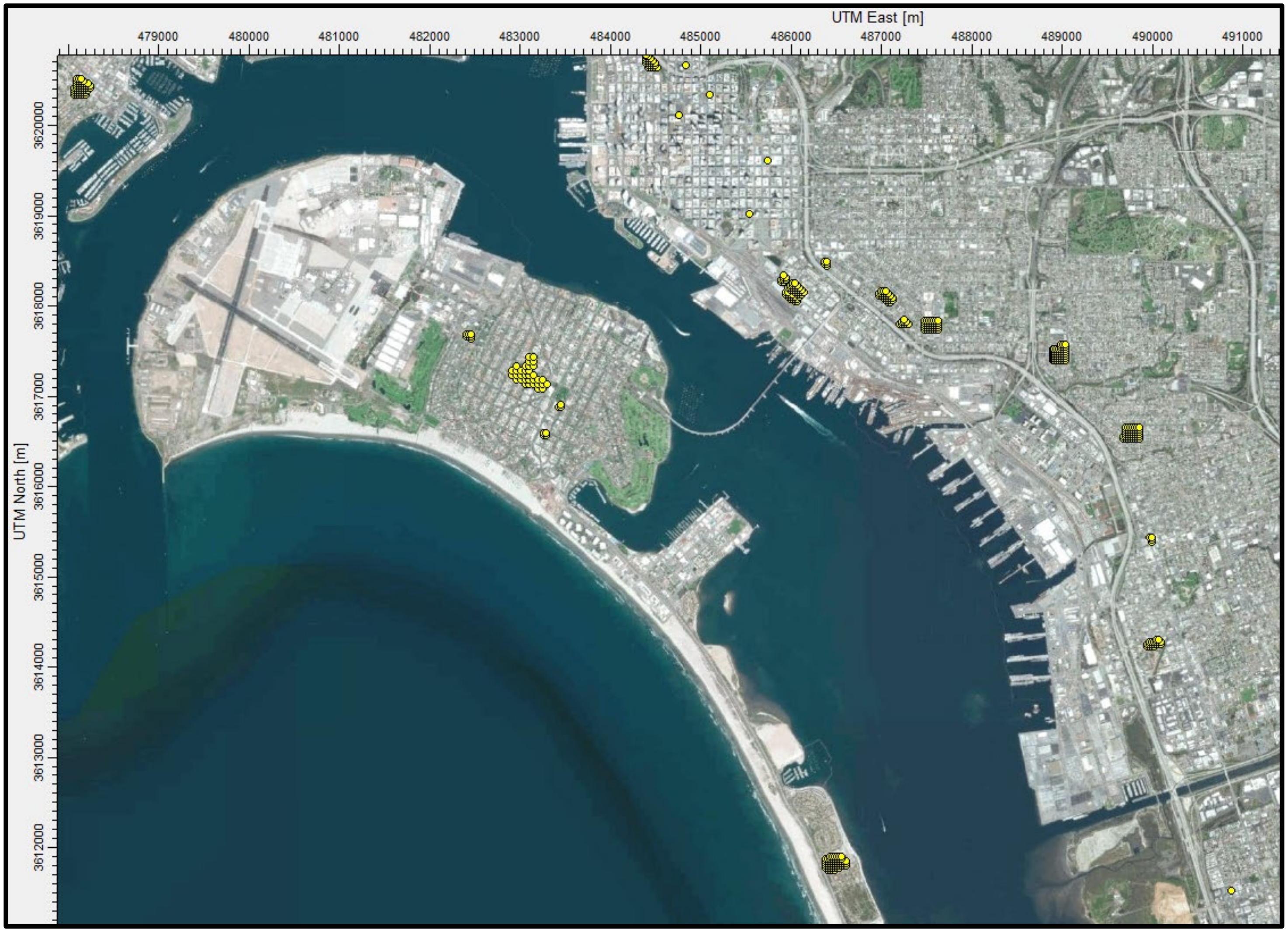


**Figure A-12: Park Receptor Grid**

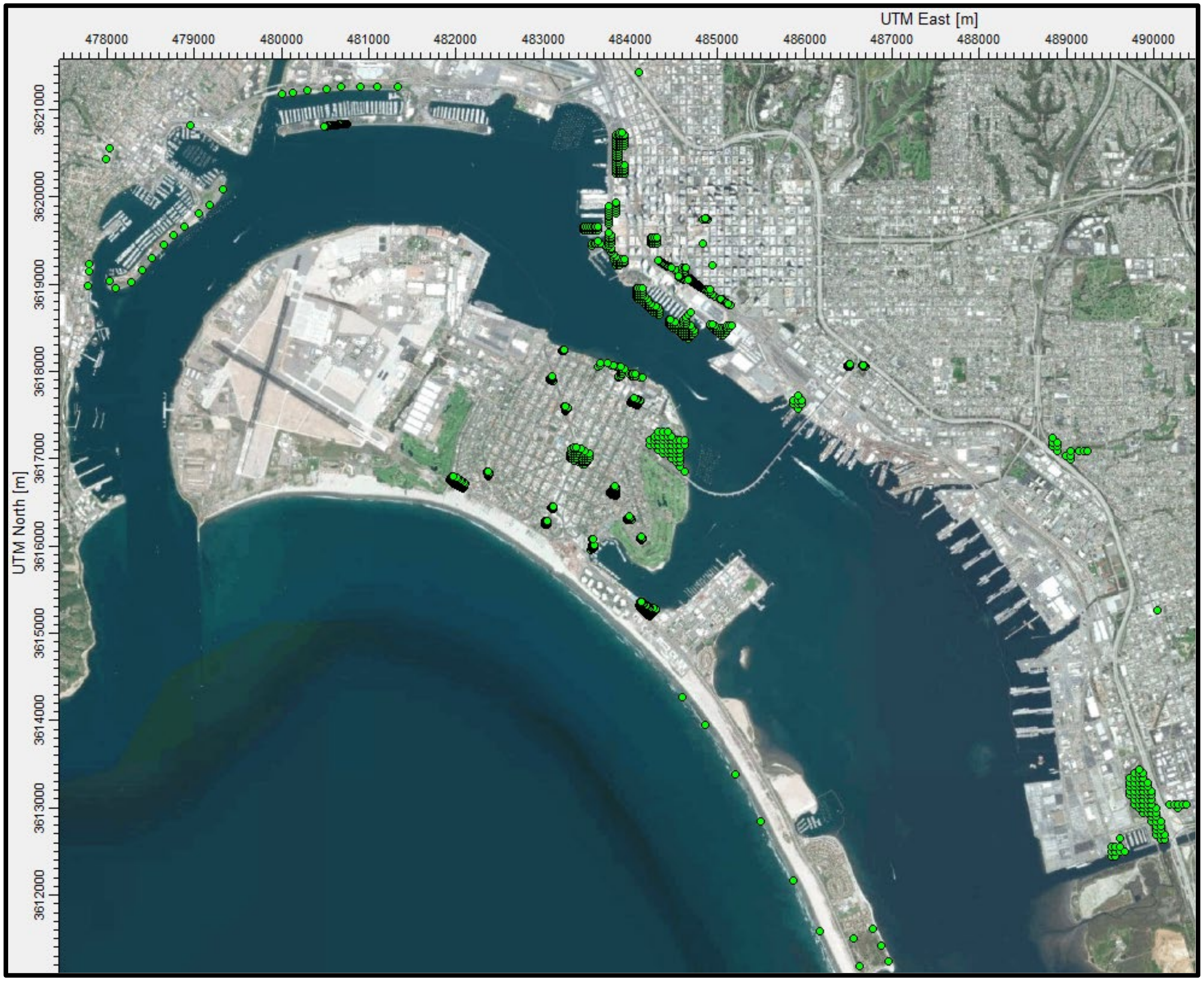
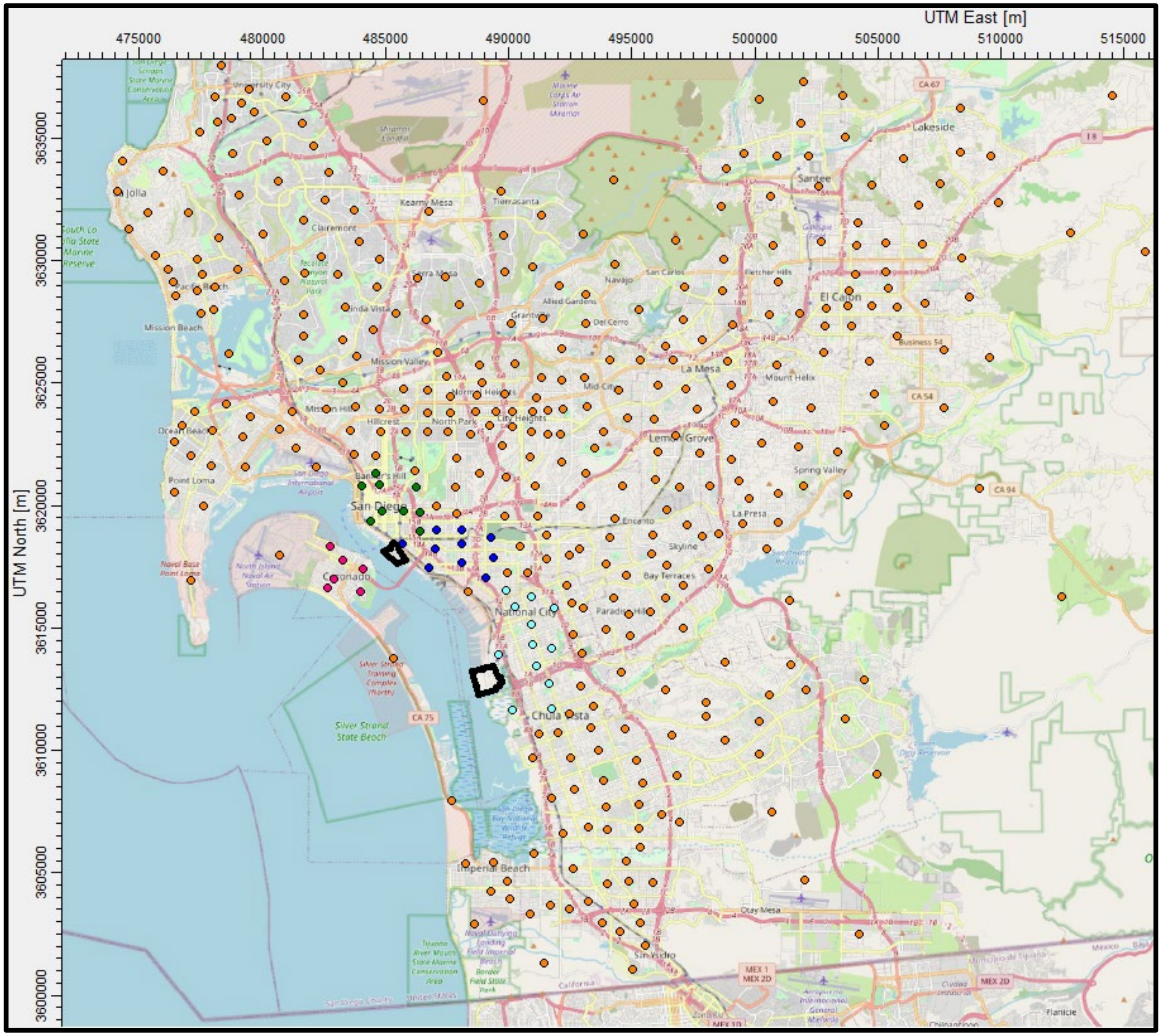


**Figure A-13: Census Tract Receptor Grid**



# 3. Health Risk Calculations

The health risk calculations were conducted in accordance with guidance from SDAPCD's Supplemental Guidelines for Submission of Air Toxics "Hot Spots" Program Health Risk Assessments (SDAPCD 2019) and OEHHA's Air Toxics Hot Spots Program Guidance Manual for the Preparation of Risk Assessments (OEHHA Guidelines) (SDAPCD 2019, OEHHA 2015). The OEHHA Guidelines were revised in 2015 to incorporate age sensitivity factors, which account for increased sensitivity to carcinogens during early-in-life exposure. Health risks were estimated using tools from CARB's Hotspots Analysis and Reporting Program (HARP2). Specifically, HARP2's Air Dispersion Modeling and Risk Tool (ADMRT) (Version 21081) was used to estimate health risks. The ADMRT incorporates OEHHA's revised guidelines for age sensitivity factors. Estimating health risk has three components: 1) Exposure Assessment, 2) Dose-Response Assessment, and 3) Risk Characterization. Each of these components is described in further detail below.

The approach used here is a standard Tier 1 point estimate that uses the recommended exposure variate (e.g., breathing rates) to determine risk. More refined analyses, such as the Tier 2 analysis approach, can be performed, which allows the use of justifiable site-specific exposure variates (e.g., breathing rates). Tier 3 and 4 analyses use a stochastic approach using distributions for the exposure pathways showing a distribution of potential cancer risk rather than a point estimate. These higher-level Tiered analyses provide a more realistic estimate of risk.

## Exposure Assessment

### Unitized Emission Rate

As discussed above, air dispersion modeling was performed using EPA's AERMOD dispersion model, 21112. For evaluating cancer risk, the PERIOD averaging time was used to estimate annual average ground level concentrations at sensitive receptors.

### Exposure Pathways

Exposure to TACs can occur through various exposure pathways, which include inhalation and non-inhalation pathways (e.g., soil ingestion, mother's milk ingestion, homegrown produce ingestion. OEHHA has developed a cancer potency factor for DPM via the inhalation pathway only. Based on this, only the inhalation pathway was evaluated for sensitive receptor exposure.

### Exposure Scenarios

Health risk impacts were evaluated for a variety of sensitive receptor types and exposure durations. Sensitive receptor locations include residences, students at schools, and children at parks within a quarter of a mile of the Port's emissions sources.

In accordance with OEHHA Guidelines, residential cancer risk was based on a 30-year exposure duration. For students at schools, an exposure duration of 12 years was assumed and for children at parks an exposure duration of 9 years was assumed. Additionally, a 70-year exposure duration was used to evaluate cancer burden. **Table A-15** summarizes the exposure scenarios for this HRA.

**Table A-15: Exposure Durations by Receptor Type**

| Receptor Type | Exposure Duration (years) |
|---|---|
| Resident | 30 |
| Students at Schools[a] | 12 |
| Children at Parks | 9 |
| Cancer Burden | 70 |
| [a] Student exposure duration based on children attending Pre-Kindergarten from Age 2 to Grade 8 at Age 13. | |

# Dose-Response Assessment

Dose-response assessment is the process of characterizing the relationship between exposure to an agent (i.e., DPM) and incidence of an adverse health effect in exposed populations (OEHHA 2015). When evaluating cancer risk, the dose-response relationship is expressed using a potency slope and can be referred to as a cancer potency factor (CPF). CPFs are used to assess the probability of risk of cancer associated with exposure to a carcinogen. CPFs represent the 95th percent upper confidence limit of the dose-response curve and are expressed as inverse dose in units of milligram per kilogram-body weight per day $[mg/kg/day]^{-1}$). According to the OEHHA Guidelines, "cancer risk is proportional to dose and there is no threshold for carcinogenesis", meaning there is no safe level of exposure to carcinogens, there is some increment in risk even at very low exposures. CARB and OEHHA have established a CPF for DPM which accounts for the individual TACs contained in diesel exhaust. The CPF for DPM is 1.1 $(mg/kg/day)^{-1}$.

# Risk Characterization

## Cancer Risk

Excess lifetime cancer risks are conservatively estimated as the upper-bound incremental probability that an individual will develop cancer over a lifetime as a result of exposure to potential human carcinogens. The estimated cancer risk is expressed as a unitless probability but can be contextualized as the estimated probability an individual has of developing cancer per one million people exposed. Further, the risk estimates generated by the analysis should not be interpreted as the expected rate of cancer in the exposed population, but rather as estimates of potential for cancer, based on current knowledge and assumptions.

As discussed previously, cancer risk estimates were based solely on exposure to DPM emissions through the inhalation pathway. Based on this, the Risk Management Policy (RMP) approach in ADMRT was used to evaluate cancer risk. The RMP approach conservatively uses the 95th percentile (high-end) breathing rates for the 3rd trimester and 0 to 2 age groups, and the 80th percentile breathing rates for all other age groups.

Cancer risk attributed to DPM is calculated by multiplying the chemical dose at the inhalation boundary (e.g., lungs) by the CPF. For cancer risk, the risk for each age group is calculated using the appropriate daily breathing rates, age sensitivity factors, and exposure duration. The cancer risks calculated for individual age groups are summed to estimate the cancer risk for each receptor.

Exposure parameters for cancer risk by receptor type are provided in **Table A-16** and **Table A-17**. Additionally, the equations below outline the methods used to estimate cancer risk.

**Table A-16: Residential Exposure Factors by Age Group**

| | | Age Group | | | |
|---|---|---|---|---|---|
| **Parameter** | **Abbr.** | **3rd Tri** | **0<2** | **2<16** | **16<30** |
| Daily Breathing Rate (mg/kg/day)[a] | DBR | 361 | 1,090 | 572 | 261 |
| Inhalation Absorption Factor (unitless) | A | 1.0 | 1.0 | 1.0 | 1.0 |
| Exposure Frequency (unitless)[b] | EF | 0.96 | 0.96 | 0.96 | 0.96 |
| Conversion Factor (µg to mg, L to $m^3$) | CF | 1.00E-06 | 1.00E-06 | 1.00E-06 | 1.00E-06 |
| Age Sensitivity Factor (unitless)[c] | ASF | 10 | 10 | 3 | 1 |
| Exposure Duration (years) | ED | 0.25 | 2 | 14 | 14 |
| Averaging Time for Lifetime (years)[d] | AT | 70 | 70 | 70 | 70 |
| Fraction of Time at Home (unitless)[e] | FAH | 1 | 1 | 1 | 0.73 |
| Adjustment Factor (unitless) | AF | n/a | n/a | n/a | n/a |
| Cancer Conversion Factor (unitless)[f] | CCF | 1.00E+06 | 1.00E+06 | 1.00E+06 | 1.00E+06 |
| Cancer Potency Factor $(mg/kg/day)^{-1}$ | CPF[g] | 1.1 | 1.1 | 1.1 | 1.1 |

Source: OEEHA 2015.
Notes:
[a] OEHHA Table 5.7, 95th percentile for 3rd Tri and 0<2, 80th percentile all other age groups.
[b] Based on 350 days per year.
[c] OEHHA 2015, Table 8.3.
[d] Averaging time is always 70 years.
[e] Assumed 1.0 for 3rd Trimester to 2<16 since schools are within 1 in a million isopleth.
[f] Conversion factor used to convert cancer risk to chances per million.
[g] OEHHA 2015, Table 7.1.
1.00E-6 = 0.000001
1.00E+6 = 1,000,000

**Table A-17: Schools and Park Exposure Factors by Age Group**

| | | School Receptors | | Park Receptors | |
|---|---|---|---|---|---|
| | | Age Group | | | |
| **Parameter** | **Abbr.** | **2<9** | **2<16** | **0<2** | **2<9** |
| Daily Breathing Rate (mg/kg/day)[a] | DBR | 640 | 520 | 1,200 | 640 |
| Inhalation Absorption Factor (unitless) | A | 1 | 1 | 1.0 | 1.0 |
| Exposure Frequency (unitless)[b] | EF | 0.16 | 0.16 | 0.08 | 0.08 |
| Conversion Factor (μg to mg, L to $m^3$) | CF | 1.00E-06 | 1.00E-06 | 1.00E-06 | 1.00E-06 |
| Age Sensitivity Factor (unitless)[c] | ASF | 3 | 3 | 10 | 3 |
| Exposure Duration (years) | ED | 8 | 4 | 2 | 7 |
| Averaging Time for Lifetime (years)[d] | AT | 70 | 70 | 70 | 70 |
| Fraction of Time at Home (unitless)[e] | FAH | 1.0 | 1.0 | 1.0 | 1.0 |
| Adjustment Factor (unitless)[f] | AF | n/a | n/a | n/a | n/a |
| Cancer Conversion Factor (unitless)[g] | CCF | 1.00E+06 | 1.00E+06 | 1.00E+06 | 1.00E+06 |
| Cancer Potency Factor $(mg/kg/day)^{-1}$ | CPF[h] | 1.1 | 1.1 | 1.1 | 1.1 |

Source: OEEHA 2015.
Notes:
[a] OEHHA Table 5.8, 95th percentile, moderate activity for 0<2, 2<9, and 2<16.
[b] School exposure duration based on 180 days per year and 8 hours per day. Park exposure duration based on 350 days per year and 2 hours per day. These receptor types used the same approach as the residential analysis, but adjustments to the exposure duration for each were necessary since residential analysis is based on daily exposure of 24 hours.
[c] OEHHA 2015, Table 8.3.
[d] Averaging time is always 70 years.
[e] School and park analysis used the same approach as the residential analysis. Although "Fraction of Time at Home" does not necessarily apply to schools and parks, a value of 1.0 is used to ensure the receptors were at their respective locations for the full daily exposure of 8 hours for students at schools and 2 hours for children at parks.
[f] Adjustment factor not included for school and park receptors since the Port sources would operate continuously.
[g] Conversion factor used to convert cancer risk to chances per million.
[h] OEHHA 2015, Table 7.1.
1.00E-6 = 0.000001
1.00E+6 = 1,000,000

## Cancer Risk

Equation 1: Dose (mg/kg/day) = $C_{AIR}$ × DBR × A × EF × CF where:

- **$C_{AIR}$** = concentration in air (μg/$m^3$)
- **DBR** = daily breathing rate normalized to body weight (L/kg body weight-day)
- **A** = inhalation absorption factor (1 for DPM, unitless)
- **EF** = exposure frequency (unitless) (350 days/365 days)
- **CF** = $10^{-6}$, correction factor, micrograms to milligrams conversion, liters to cubic meters conversion

Equation 2: $Risk_{INH\text{-}RESIDENT}$ (chances per million) = $Dose_{AIR}$ × CPF × ASF × ED/AT × FAH × CCF where:

- **$Dose_{AIR}$** = daily inhalation dose (mg/kg/day)
- **CPF** = cancer potency factor $(mg/kg\text{-}day)^{-1}$
- **ASF** = age sensitivity factor (unitless)
- **ED** = exposure duration (years)
- **AT** = averaging time for lifetime cancer risk (years)
- **FAH** = fraction of time spent at home (unitless)
- **CCF** = $10^6$, cancer conversion factor to represent risk in chances per million

## Student Cancer Risk

Equation 3: $Dose_{STUDENT}$ (mg/kg/day) = $C_{AIR}$ × DBR × A × EF × CF where:

- $C_{AIR}$= concentration in air ($\mu g/m^3$)
- DBR= daily breathing rate normalized to body weight (L/kg body weight-day)
- A= inhalation absorption factor (1 for DPM, unitless)
- EF= exposure frequency (unitless)= 0.16 (180 days/365 days and 8 hours/24 hours).
- CF= $10^{-6}$, correction factor, micrograms to milligrams conversion, liters to cubic meters conversion

Equation 4: $Risk_{\text{-}STUDENT}$ (in one million) = $Dose_{AIR}$ × CPF × ASF × ED/AT × CCF where:

- **$Dose_{AIR}$** = daily inhalation dose (mg/kg/day)
- **CPF** = cancer potency factor $(mg/kg\text{-}day)^{-1}$
- **ASF** = age sensitivity factor (unitless)
- **ED** = exposure duration (years)
- **AT** = averaging time for lifetime cancer risk (years)
- **FAH** = fraction of time spent at home (unitless)
- **CCF** = $10^6$, cancer conversion factor to represent risk in chances per million

## Children at Park Cancer Risk

Equation 5: $Dose_{PARK}$ (mg/kg/day) = $C_{AIR}$ × DBR × A × EF × CF where:

- **$C_{AIR}$** = concentration in air ($\mu g/m^3$)
- **DBR** = daily breathing rate normalized to body weight (L/kg body weight-day)
- **A** = inhalation absorption factor (1 for DPM, unitless)
- **EF** = exposure frequency (unitless) = 0.08 (350 days/365 days and 2 hours/24 hours)
- **CF** = $10^{-6}$, correction factor, micrograms to milligrams conversion, liters to cubic meters conversion

Equation 6: $Risk_{INH\text{-}PARK}$ (chances per million) = $Dose_{AIR}$ × CPF × ASF × ED/AT × FAH × CCF where:

- **$Dose_{AIR}$** = daily inhalation dose (mg/kg/day)
- **CPF** = cancer potency factor $(mg/kg\text{-}day)^{-1}$
- **ASF** = age sensitivity factor (unitless)
- **ED** = exposure duration (years)
- **AT** = averaging time for lifetime cancer risk (years)
- **FAH** = fraction of time spent at home (unitless)
- **CCF** = $10^6$, cancer conversion factor to represent risk in chances per million

## Cancer Burden

The OEHHA Guidelines recommends facilities with large emissions footprints such as ports, provide information on population-wide health based impacts since a large number of people may be exposed to the facility's emissions. Population-wide risk is independent of individual risk, and assumes that a population (not necessarily the same individuals) will live in the impacted zone over a 70-year period (OEHHA 2015). To estimate population-wide health impacts, the cancer burden approach was used and required a 70-year exposure duration. Cancer risk for each census tract was based on residential exposure parameters and estimation methods as shown in **Table A-18**.

Cancer burden was estimated by multiplying the 70-year cancer risk at a census tract by the number of people who live within the census tract, and then summing the total number of potential cases across the zone of impact (ZOI). Census tract receptors were generated by GIS and based on the 2010 U.S Census. The ZOI was defined as the geographic area surrounding the Port's sources where the 70-year cancer risk is greater than $1 \times 10^{-6}$ (1 in 1,000,000) (OEHHA 2015). A contour map would be generated to show where cancer risk is greater than $1 \times 10^{-6}$ to define the ZOI. Once the ZOI is defined, the cancer risk values for all census tracks within the ZOI were summed to provide the cancer burden. **Figure A-14** shows the zone of impact for the cancer burden analysis under baseline (2019) conditions, and **Figure A-15** shows the zone of impact for the cancer burden analysis after implementation of MCAS measures.

**Table A-18: Cancer Burden Exposure Factors by Age Group**

| | | Age Group | | | |
|---|---|---|---|---|---|
| **Parameter** | **Abbr.** | **3rd Tri** | **0<2** | **2<16** | **16<70** |
| Daily Breathing Rate (mg/kg/day)[a] | DBR | 361 | 1,090 | 572 | 233 |
| Inhalation Absorption Factor (unitless) | A | 1.0 | 1.0 | 1.0 | 1.0 |
| Exposure Frequency (unitless)[b] | EF | 0.96 | 0.96 | 0.96 | 0.96 |
| Conversion Factor (μg to mg, L to $m^3$) | CF | 1.00E-06 | 1.00E-06 | 1.00E-06 | 1.00E-06 |
| Age Sensitivity Factor (unitless)[c] | ASF | 10 | 10 | 3 | 1 |
| Exposure Duration (years) | ED | 0.25 | 2 | 14 | 54 |
| Averaging Time for Lifetime (years)[d] | AT | 70 | 70 | 70 | 70 |
| Fraction of Time at Home (unitless)[e] | FAH | 1 | 1 | 1 | 0.73 |
| Adjustment Factor (unitless) | AF | n/a | n/a | n/a | n/a |
| Cancer Conversion Factor (unitless)[f] | CCF | 1.00E+06 | 1.00E+06 | 1.00E+06 | 1.00E+06 |
| Cancer Potency Factor $(mg/kg/day)^{-1}$ | CPF[g] | 1.1 | 1.1 | 1.1 | 1.1 |

Source: OEEHA 2015.
Notes:
[a] OEHHA Table 5.7, 95th percentile for 3rd Tri and 0<2, 80th percentile all other age groups.
[b] Based on 350 days per year.
[c] OEHHA 2015, Table 8.3.
[d] Averaging Time always 70 years.
[e] Conservatively assumed 1.0 for all age bins.
[f] Conversion factor used to convert cancer risk to chances per million.
[g] OEHHA 2015, Table 7.1.
1.00E-6 = 0.000001
1.00E+6 = 1,000,000

## Cancer Risk

Equation 1: $Dose_{RESIDENT}$ (mg/kg/day) = $C_{AIR}$ × DBR × A × EF × CF where:

- **$C_{AIR}$** = concentration in air (μg/m$^3$)
- **DBR** = daily breathing rate normalized to body weight (L/kg body weight-day)
- **A** = inhalation absorption factor (1 for DPM, unitless)
- **EF** = exposure frequency (unitless) (350 days/365 days)
- **CF** = $10^{-6}$, correction factor, micrograms to milligrams conversion, liters to cubic meters conversion

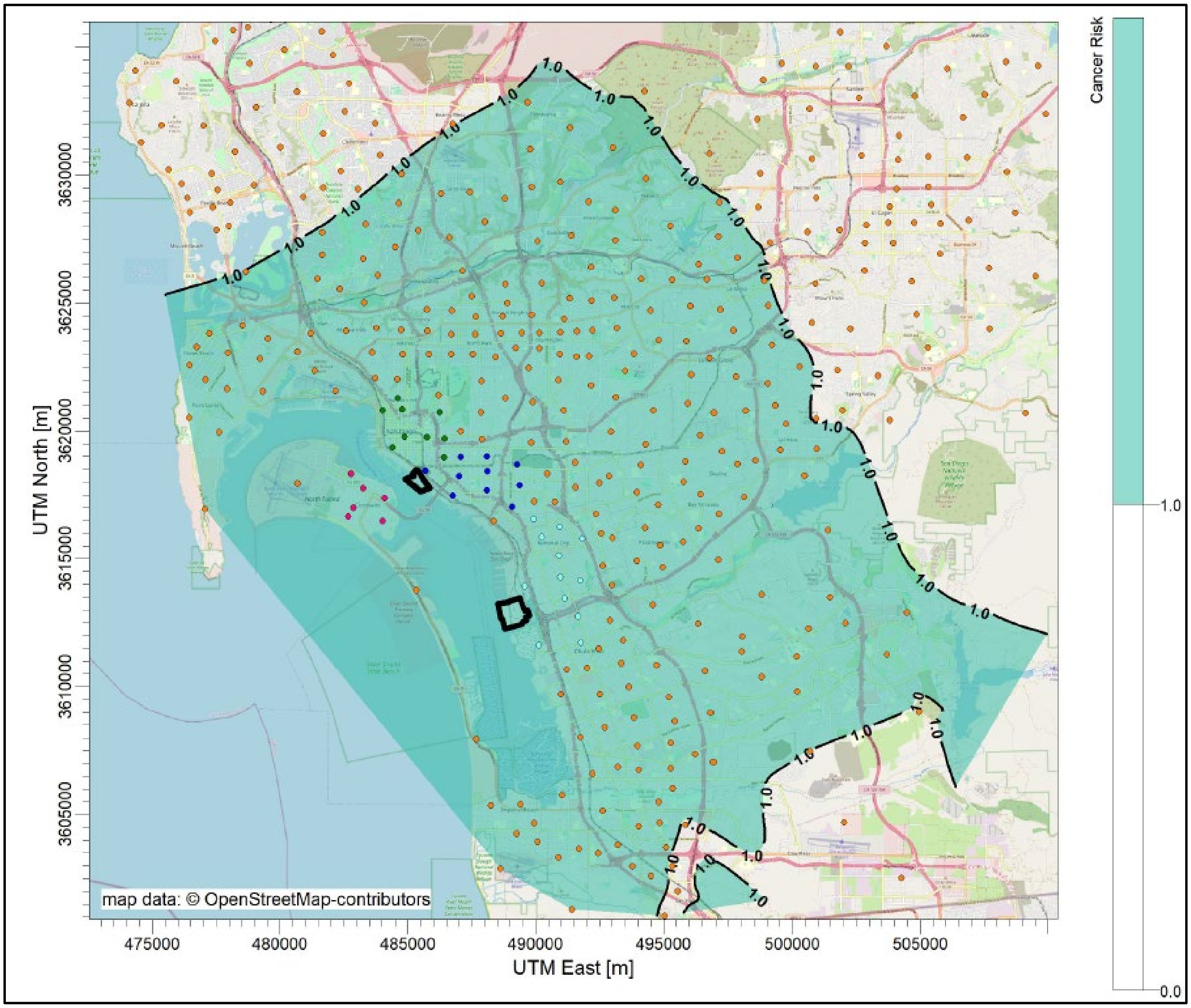
Equation 2: $Risk_{INH-RESIDENT}$ (chances per million) = $Dose_{AIR}$ × CPF × ASF × ED/AT × FAH where:

- **$Dose_{AIR}$** = daily inhalation dose (mg/kg/day)
- **CPF** = cancer potency factor (mg/kg-day)$^{-1}$
- **ASF** = age sensitivity factor (unitless)
- **ED** = exposure duration (years)
- **AT** = averaging time for lifetime cancer risk (years)
- **FAH** = fraction of time spent at home (unitless)

## Cancer Burden

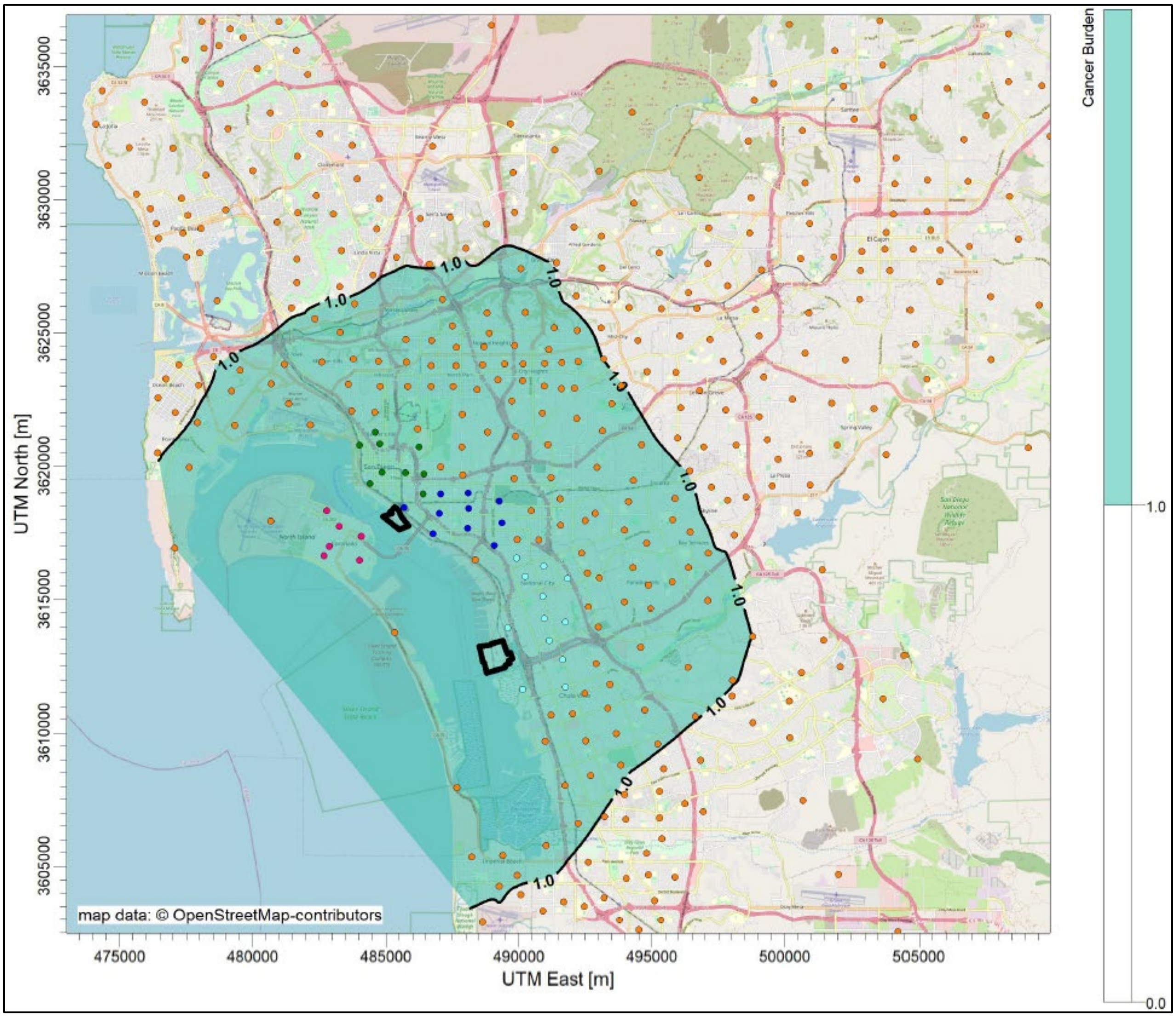
Equation 3: Cancer Burden = Sum of [(Cancer Risk per Census Tract > 1 in 1,000,000) x (Population per Census Tract)]

**Figure A-14: Zone of Impact for Cancer Burden under Baseline**




**Note:** Colored dots represent census tract receptors.

**Figure A-15: Zone of Impact for Cancer Burden after MCAS Measures**




**Note:** Colored dots represent census tract receptors.

# Appendix B MCAS Reductions

**Table B-1: Emission Comparison Between 2019 and MCAS Scenarios (tons per year)**

| Source Category | Source Description | Annual DPM Baseline | Annual DPM With MCAS Measures by Year | | | MCAS Measure Description |
|---|---|---|---|---|---|---|
| | | | 2025 | 2026 | 2030 | |
| OGV | OGV Transit Outside Bay | 0.5426 | 0.5426 | 0.5426 | 0.5426 | 2 shore power plugs at NCMT = 88% reduction; no reduction at TAMT, starting in 2025<br><br>Vessel Speed Reduction is not quantified |
| | OGV Maneuvering Inside Bay-TAMT | 0.1022 | 0.1022 | 0.1022 | 0.1022 | |
| | OGV Maneuvering Inside Bay-NCMT | 0.4494 | 0.4494 | 0.4494 | 0.4494 | |
| | TAMT-Berth 10-1 | 0.0207 | 0.0207 | 0.0207 | 0.0207 | |
| | TAMT-Berth 10-2 | 0.0207 | 0.0207 | 0.0207 | 0.0207 | |
| | TAMT-Berth 10-3 | 0.0207 | 0.0207 | 0.0207 | 0.0207 | |
| | TAMT-Berth 10-4 | 0.0207 | 0.0207 | 0.0207 | 0.0207 | |
| | TAMT-Berth 10-5 | 0.1487 | 0.1487 | 0.1487 | 0.1487 | |
| | TAMT-Berth 10-6 | 0.1487 | 0.1487 | 0.1487 | 0.1487 | |
| | TAMT-Berth 10-7 | 0.0262 | 0.0262 | 0.0262 | 0.0262 | |
| | TAMT-Berth 10-8 | 0.0262 | 0.0262 | 0.0262 | 0.0262 | |
| | NCMT-Berth-24-1 | 0.1768 | *0.0211* | *0.0211* | *0.0211* | |
| | NCMT-Berth-24-2 | 0.1768 | *0.0211* | *0.0211* | *0.0211* | |
| | NCMT-Berth-24-3 | 0.1768 | *0.0211* | *0.0211* | *0.0211* | |
| | NCMT-Berth-24-4 | 0.1768 | *0.0211* | *0.0211* | *0.0211* | |
| | NCMT-Berth-24-5 | 0.1768 | *0.0211* | *0.0211* | *0.0211* | |
| | NCMT-Berth-24-10 | 0.1768 | *0.0211* | *0.0211* | *0.0211* | |
| | NCMT-Berth-24-11 | 0.1768 | *0.0211* | *0.0211* | *0.0211* | |
| Ferries | Broadway Ave-Coronado (Cabrillo) | 0.1711 | 0.1711 | *0.0000* | *0.0000* | 100% ZE<br>(CHC Objective 2), starting in 2026 |
| | Convention Ctr-Coronado (Silvergate) | 0.0935 | 0.0935 | *0.0000* | *0.0000* | |

| Source Category | Source Description | Annual DPM Baseline | Annual DPM With MCAS Measures by Year | | | MCAS Measure Description |
|---|---|---|---|---|---|---|
| | | | 2025 | 2026 | 2030 | |
| Tugs | Assist Tug at TAMT | 0.0902 | 0.0902 | 0.0590 | 0.0590 | 30,000 gallons saved = 35% overall reduction (CHC Objective 1), starting in 2026 |
| | Assist Tug at NCMT | 0.1494 | 0.1494 | 0.0978 | 0.0978 | |
| CHE | CHE at TAMT | 0.0963 | *0.0193* | *0.0193* | *0.0000* | 80% reduction in DPM at TAMT (CHE Objective 1) starting in 2025; 100% ZE at TAMT and NCMT starting in 2030 |
| | CHE at NCMT | 0.0305 | 0.0305 | 0.0305 | *0.0000* | |
| Rail | Switchers at TAMT-Daytime | 0.0007 | 0.0007 | 0.0007 | 0.0007 | No change |
| | Switchers at TAMT-Nighttime | 0.0007 | 0.0007 | 0.0007 | 0.0007 | |
| | Switchers at NCMT-Daytime | 0.1480 | 0.1480 | 0.1480 | 0.1480 | |
| | Switchers at NCMT-Nighttime | 0.1480 | 0.1480 | 0.1480 | 0.1480 | |
| | Line-Haul Travel-Daytime | 0.0527 | 0.0527 | 0.0527 | 0.0527 | |
| | Line-Haul Travel-Nighttime | 0.0527 | 0.0527 | 0.0527 | 0.0527 | |
| Trucks | TAMT Truck Route 1-Gates to 32nd to I-15 N | 0.0010 | 0.0010 | *0.0006* | *0.0000* | 40% ZE = 40% DPM reduction (Truck Objective 1a) starting in 2026; 100% ZE starting in 2030 |
| | TAMT Truck Route 2-Harbor to 28th to I-5 N | 0.0007 | 0.0007 | *0.0004* | *0.0000* | |
| | TAMT Truck Route 3-Harbor to Civic to I-5 S | 0.0003 | 0.0003 | *0.0002* | *0.0000* | |
| | TAMT Truck Route 4-Harbor to 32nd to Main to Yard | 0.0002 | 0.0002 | *0.0001* | *0.0000* | |
| | TAMT Truck Route 5-Harbor from TAMT to NDC | 0.0010 | 0.0010 | *0.0006* | *0.0000* | |
| | NCMT Truck Routes 6 & 7-Bay Marina | 0.0043 | 0.0043 | *0.0026* | *0.0000* | |
| | TAMT Onsite Truck Emissions | 0.0006 | 0.0006 | *0.0004* | *0.0000* | |
| | NCMT Onsite Truck Emissions | 0.0022 | 0.0022 | *0.0013* | *0.0000* | |

Values in *italics* indicate a reduction from Baseline

# Appendix C List of Preparers

## Matthew McFalls

Matthew is an experienced air quality professional with vast experience working on Port projects and performing and leading health risk assessments.  Matthew has led air quality analyses for numerous projects at the Port of San Diego, including the Port Master Plan Update Environmental Impact Report (EIR), National City Bayfront Projects EIR, Fireworks EIR, National City Tank Farm EIR, Tenth Avenue Marine Terminal Redevelopment Plan EIR, Mitsubishi Cement Corporation EIR, and the San Diego Convention Center Phase III EIR. Matthew performed all of the emissions and HRA analysis tasks on the Tenth Avenue Marine Terminal Redevelopment Plan EIR and was ICF's lead author and lead technical specialist on the Maritime Clean Air Strategy (MCAS) as well as the 2016 Maritime Air Emissions Inventory.  Matthew holds a Master of Science in Geography from the San Diego State University. Matthew was the Project Manager on this HRA.

## Blake Barroso

Blake is an experienced air quality professional with over five years of environmental consulting experience. Blake has experience conducting HRAs for a variety of projects in accordance with guidelines from the Office of Environmental Health Hazard Assessment (OEHHA). He is proficient with HRA modeling tools, which include air dispersion modeling software, AERMOD, and the suite of tools from the California Air Resources Board's (CARB) Hotspots Analysis and Reporting Program (HARP). Blake holds a Bachelor of Science degree in Environmental Science from California Lutheran University and a Master of Science degree in Civil Engineering from the University of Washington. He has also completed CARB's Intermediate training course on Health Risk Assessments. Blake was the lead analyst and modeler on this HRA.

## Edward Carr

Ed is a Technical Director of Air Quality Assessments at ICF. Ed is an expert modeler having completed multiple projects examining mobile source emissions contributions on air quality both for research studies and in regulatory support using a wide variety of emission and air quality models. During the past 15 years, Ed has conducted research and applications for project-level air quality analyses in more than a dozen cities that involved examination of a broad array of air pollutants, including particulate matter, air toxics, and diesel particulate matter. Ed performs research related to air quality modeling from mobile sources to better understand the formation of air pollutants at the micro to corridor scale and identify the sources that contribute to it.  He has supported the Federal Highway Administration (FHWA), U.S. EPA, and National Cooperative Highway Research Program (NCHRP) in more than 20 studies over the past 30 years on mobile source emissions and near road exposure. Ed also led the air quality and health risk assessment for the San Pedro Waterfront Project at the Port of Los Angeles.  Ed holds a Bachelor of Science in Meteorology from San Jose State University and a Master of Science in Atmospheric Science from the University of Washington, Seattle. Ed provided technical guidance and performed Quality Assurance/Quality Control on this HRA.