Air Toxics Modeling and Risk Assessment for the Portside Community in San Diego, California

Executive Summary

In response to Assembly Bill (AB) 617 (C. Garcia, Chapter 136, Statutes of 2017), the San Diego County Air Pollution Control District (District) worked with the Portside communities to develop a Community Emissions Reduction Plan (CERP), which specifies strategies with an aim to reduce both air pollution emissions and community exposure to air pollution. The Portside Community Steering Committee (CSC) has engaged in the development and implementation of the CERP through an extensive public process, including outreach and a number of public workshops. The CSC has proposed a series of actions to reduce air pollution in the community, with each action to be carried out based on a set of specific strategies, goals, and timelines. Among those goals listed in the actions, Goals #5 and #6 are aligned with the California Air Resources Board (CARB) air toxics modeling efforts, and are described as follows:

> *Goal #5: By December 2021, APCD to present the cumulative cancer risk for Portside Communities from Health Risk Assessments and modeling of cumulative risk (including freeways, rail, vessels, stationary sources, etc.) to inform Goal #6. APCD can achieve this modeling goal with CARB assistance and input from the Portside Community Steering Committee including methodology and input data.*
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> *Goal #6: By February 2022, establish an estimated cancer risk reduction goal based on the modeling that is done in Goal #5. Estimated cancer risk at all census tracts in Portside Community from locally generated emissions, including both stationary and mobile sources, to meet goals of ___/ million by 2026 and ___ /million by 2031.*

CARB's statewide regional[1] air toxics risk modeling was leveraged to help the CSC address CERB Goals #5 and #6. Specifically, the objectives of the CSC's health risk model are to: 1) assess cumulative population exposure and health risk from toxic pollutants; 2) quantify the relative contribution of different emission sources or categories, including those located outside of the Portside Community; 3) identify geographic areas with higher pollution burden; 4) inform strategies for reducing exposure and

[1] The regional scale modeling is typically referred to a geographically-defined region, like county, air basin, and the statewide; while microscale modeling is referred to a geographically-defined small region, like a small city or a suburban.

health risk from sources causing the greatest risk; 5) help prioritize health risks and resources; 7) complement data from monitoring network; and 7) further inform cancer risk reduction goals.

The risk estimates from this regional modeling analysis were developed based on population-weighted averages over all census blocks in the community to better identify the sources of highest impact to the community as a whole (a census block is defined as an area with an average of about 52 residents in California, ranging from 0 to 7,900, by the Census Bureau). Individual local risks within a census block may vary significantly from average risk within the census due to differences in proximity to sources and how pollutants are emitted from a source (e.g., near surface or aloft). For example, if a census block covers a city block, residents within that census block that live immediately next to a source having ground-level emissions may be exposed to significantly higher concentrations than the concentrations averaged over the entire census block.

The primary findings from the regional modeling analysis are summarized as follows:

- For the 2017 regional emissions analysis[2], Diesel Particulate Matter (DPM) was the main contributing pollutant to total average risk within the community and accounted for 85% of the total risk. The overall population-weighted cancer risk from all toxic air contaminants (TACs) was estimated to be about 950 cases per million. Among all DPM sources in 2017, on-road mobile sources were the top contributor (~42% of total DPM risk).
- For the 2017 local emissions analysis[3], DPM was still the main driver of overall risk in the community and accounted for about 76% of the overall risk. The overall population-weighted cancer risk from local emissions was estimated to be about 320 cases per million. Among DPM emission sources located within the Portside boundary, on-road mobile sources were also the top contributor (collectively ~56% of total DPM risk). Meanwhile, areawide (e.g., construction) and aggregated area-point sources (e.g., gasoline stations and dry cleaners) were the main contributors to VOC cancer risks, while stationary sources, such as industrial facilities or power plants, were the main contributors to risks from heavy metals.
- Overall, around 33% of total potential population-weighted cancer risk in the Portside community resulted from local sources (i.e., emissions within the community boundary).
- In the future, the risk associated with on-road DPM emissions would be significantly reduced from both local and regional sources. This reduction is attributed to DPM emission reductions primarily from the On-road Truck and Bus rule. Programs designed to reduce emissions from ocean going vessels (OGV), commercial harbor craft (CHC), cargo handling equipment (CHE), transport refrigeration units (TRU) and other sources have also been and/or will be

[2] For the regional analysis, the geographical modeling domain covers the whole County of San Diego and a portion of Mexico near the border of CA and Mexico, and the emissions included those sources from both inside and outside of the Portside community.

[3] For the local analysis, the geographical domain of interest is the Portside community, and the emissions included those sources from within the community only.

implemented, but the relative contributions from these sources (compared to on-road mobile) are still projected to increase with time, even though absolute risks would be decreasing.

Recommended use of the findings for CERP Goals 5 and 6:

- The modeling results are best used in a qualitative manner to inform which source categories and pollutants are contributing most to the overall risk within the community, which can then be used to inform and prioritize emission reduction strategies that target the sources most likely to lead to additional reductions in risk over time.
- Future-year risk estimates are best used to help focus on those sources that are not already projected to decrease significantly due to existing regulations, so as to achieve the greatest overall reduction in risk over time.

The remainder of this document is structured in the form of a Q&A to summarize the findings of the regional modeling analysis, describe how this risk assessment is different from a traditional Health Risk Assessment (HRA) based on microscale modeling analyses/tools, and provide additional details and recommendations on how the modeling analysis should be used to inform CERP Goals #5 and #6.

Q1. What is a regional/local risk assessment and how is it different from an HRA?

CARB staff conducted a regional air toxics modeling analysis and associated health assessment for the County of San Diego (County) for 2017. Regional modeling analyses are designed to account for hundreds to hundred-thousands of emission sources and account for complexities like 3-dimensional meteorology and chemistry that occurs in the air. In this study, annual average concentrations of individual toxic species (7 reactive VOCs, 5 toxic metals and DPM)[4] were simulated using the USEPA's advanced air quality models and the associated toxic health risks assessed. This regional analysis provides a broad picture on how toxic pollutants affect public health, spatial distribution of the impact, and source apportionment of the overall impact by individual emission categories/sources for different toxic pollutants emitted within the entire County. Note that this regional study is part of an ongoing comprehensive statewide air toxic risk modeling effort at CARB, which aims to provide a statewide estimate of cumulative exposure and associated cancer risk at the census block and tract levels, and through regular updated modeling, track their trends over time based on on-going and future emission reduction plans and strategies.

In response to AB617 requirements, the San Diego County Air Pollution Control District (District) developed the CERP which specifies strategies with an aim to reduce both air pollution emissions and

[4] There are more toxics species being identified as toxic air contaminants (TACs). These 13 species were considered because they can account for over 95% of the total health risk in this state based on their emissions and associated toxicity values. Note that each species has a different toxicity value.

community exposure to air pollution in the Portside community. CARB's regional air toxics risk modeling was leveraged to help assess cumulative cancer risk within the Portside from all sources inside and outside of the community to address CERP goal #5 and separately to assess toxic health impacts from emission sources only located within the community to inform CERP goal #6.

It is worth mentioning that this study differs largely from a standard health risk assessment (HRA) under the AB2588 Air Toxic "Hot Spots" program that looks at acute (non-cancer health impacts for short-term exposure) and chronic health impact (non-cancer health impacts for long-term exposure) as well as cancer risk (health risk associated with long-term exposures) to single or multiple potential facilities' emissions. Instead, we aim to estimate the potential cumulative cancer risks associated with all toxic emission sources on the regional, community, census block and tract levels. In addition, an HRA under the hot spot program requires reporting acute and chronic health impacts as well as cancer risks at the point of maximum impact (PMI), maximally exposed individual resident (MEIR), and maximally exposed individual worker (MEIW). While this study only assesses potential cumulative health cancer risks at individual census blocks and population-weighted census tracts.

Q2. How can the results from this study be used by the Portside Community?

There are two major objectives for conducting this study: 1) assess cumulative potential cancer risk in the County and the Portside community from all emission sources, which can help inform goal #6 of the CERP, and 2) estimate the relative contributions of locally generated sources within the Portside community, and identify which sources are impacting the community the most, helping inform goal #6 of the CERP. In addition to the objectives listed above, we expect this study can be used to 1) identify geographic areas with higher pollution burden and emission sources or toxic species responsible for the greatest health risks; 2) help identify strategies for reducing exposure and health risk from those sources identified as causing the greatest risk; 3) establish a baseline health risk for further informing health risk reduction goals and tracking progress in reducing risk over time in the Portside community; and 4) complement data from the monitoring network and local air toxics measurements. Measurements are generally limited due to resources and cost, while modeling can be used to help fill in data gaps in the monitoring.

Since this study is different from an HRA under the "hot spots" program, we don't expect this study's results to be used: 1) as a definitive means to pinpoint specific risk values at a specific location; 2) as part of a hot spot program or an HRA or as a permitting application; and 3) as a sole basis for policy decisions.

Q3. What are exposure and risk?

Exposure represents the extent of public exposure to a TAC[5]. An exposure assessment can involve quantification of emissions from emission sources, modeling of environmental transport and fate, and estimation of exposure levels over a certain period of time. In this study, the modeled annual average concentrations of TACs are used to represent exposure. Exposure to TACs can occur through multiple pathways, including inhalation and non- inhalation pathways (e.g., soil ingestion, ingestion of mother's milk, etc.). The South Coast Air Quality Management District' MATES-V study[6] showed that including risk from multiple pathways increased overall risk by approximately 7.3% compared to the inhalation-only risk. CARB staff has conducted sensitivity analyses on risk associated with various exposure pathways and found that the inhalation pathway can account for over 95% of the total exposure, which is consistent with MATES-V findings. Thus, only inhalation exposure was considered in this study.

Cancer risk represents the probability of a person developing cancer if exposed continuously to a TAC over their lifetime (70 years, in units of cases per million people)[7], but it does not necessarily mean that individuals will develop cancer due to TACs. In other words, the risk number does not reflect actual cancer cases. Cancer risk calculations in this study are for TACs only and does not include other risk factors for developing cancer, such as aging, genetics, etc. Cancer risk calculations account for daily inhalation rates, age, the frequency of time spent at home (for residents only), the duration of exposure, and cancer potency of the TAC to yield the excess cancer risk. For residential inhalation exposure, the excess potential cancer risk is calculated separately by age group and then summed to yield an overall cancer risk at the receptor locations. Cancer risk due to all TACs is the sum of potential cancer risk for all individual TACs. Note that an exposure duration of 30 years with the Risk Management Policy (RMP) method (95th/80th percentile daily breathing rate (DBR)) was used for assessing potential cancer risk (inhalation only) in this study.

Q4. What are the toxic emissions within the Portside Community?

Air toxics considered in this study include DPM, seven (7) VOCs (acrolein, benzene, 1,3 butadiene, formaldehyde, acetaldehyde, perchlorobenzene, and p-Dichloroethylene), and five (5) heavy metals (lead, hexavalent chromium, arsenic, cadmium, and nickel). All emission sources were included and

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[5] According to section 39655 of the California Health and Safety Code, a toxic air contaminant (TAC) is "an air pollutant 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".

[6] *http://www.aqmd.gov/docs/default-source/planning/mates-v/appendixix_final.pdf?sfvrsn=4*, see Table IX-7-11.

[7] Often, scientific notation is used and you may see it expressed as 1×10^{-5} or 10^{-5}. Therefore, if you see a potential cancer risk of 10 cases in per million, that means if one million people were exposed to a certain level of a TAC there is a chance that 10 of them may develop cancer over their 70-year lifetime. This would be 10 new/excess cases of cancer above the expected rate (background) of cancer in the population.

categorized into four main groups: on-road mobile, off-road mobile, areawide, and stationary sources. On-road mobile sources include all motor vehicles on major and minor roadways, such as passenger cars, trucks, and motorcycles, and were modeled as line sources following the road network. Off-road mobile sources include off-road engines such as cargo handling equipment (CHE), commercial harbor crafts (CHC), locomotives, ocean-going vessels (OGV), transport refrigeration units (TRU), etc. Area sources are those spread out over wide geographic areas, such as agriculture equipment, construction, and stationary-area sources without precise locations. Area sources, small point sources (such as gasoline stations, dry cleaners, etc.) and some off-road sources (such as transiting OGVs, locomotives, CHC, CHE, TRU, etc.) were modeled as 1km x 1km area average emissions. Transiting OGV's and maneuvering in and near ports and aircraft (three-dimensional) were modeled as line sources. Stationary sources are those at known fixed locations such as power plants and industrial facilities, as well as at-berth OGV emissions, were modeled as point sources.

Emissions within and outside of the Portside community were modeled separately to isolate the impact of sources within the community. Sources within the community were defined using the official Portside Environmental Justice Neighborhoods AB617 boundary, so that "locally generated emissions" were defined as emissions that fall strictly within the community boundary. The 2017 annual DPM emissions total within the community was estimated as 11.7 TPY, in which on-road, off-road, area and point sources accounted for 32%, 37%, 28% and 3%, respectively. Metals and VOCs emissions were weighted to DPM potency equivalent emissions based on their inhalation cancer potency values. The total TACs emissions amount to an estimated 16.3 TPY (DPM potency equivalent) within Portside. Figure ES-1 shows the distribution of annual total emissions by each TAC. DPM accounted for about 72% of the total TACs emissions. The other significant TAC species (i.e., contribution >1%) were hexavalent chromium (8.8%), benzene (6.2%), arsenic (4.6%), 1,3-butadiene (2.9%), cadmium (2.5%), and formaldehyde (1.3%).

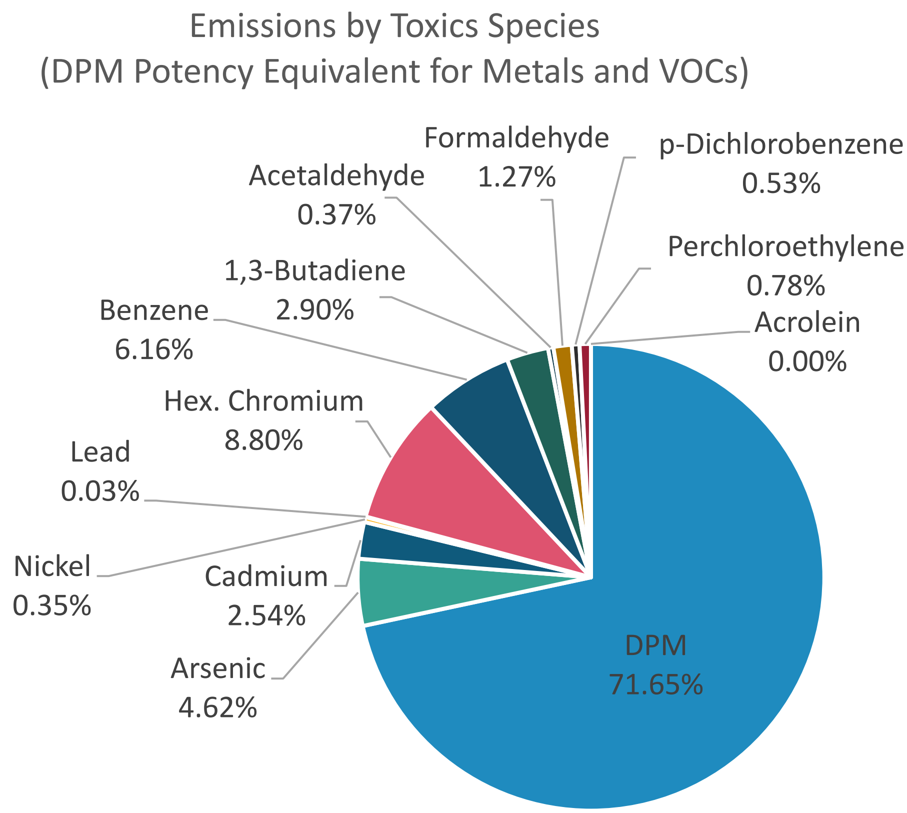

Figure ES-1. Distribution of Annual Total Emissions by TAC Species for 2017 (emissions of VOCs and metals are expressed in DPM potency equivalent values).

Q5. How are the concentrations of air toxics estimated in the Portside Community?

The emissions within and outside of the Portside community were modeled separately. For the regional emission modeling, i.e., looking at the impact from all emissions within the San Diego modeling domain on the community, this study combines results from two models: CALPUFF, which is a puff-based dispersion model that allows for highly detailed source-to-receptor relationships (e.g., near source impacts), but lacks complex chemistry, was used for the more inert species such as DPM and heavy metals, while the Community Multiscale Air Quality (CMAQ) model, which accounts for complex chemistry but lacks information on detailed source-to-receptor relationships, was used for the more chemically reactive toxic VOCs. Concentrations of DPM and heavy metals were estimated at the center of census blocks in the community, while concentrations of VOCs were estimated at the center of 2km x 2km grid cells, which were then projected into census tracts in the community. For the local emission modeling, i.e., looking at the impact from locally generated emissions, CALPUFF was used to simulate concentrations of each pollutant at the center of each census block in the community.

Q6. How are potential cancer risks estimated in the Portside Community?

A health risk assessment evaluates the potential health impacts (long-term cancer and non-cancer) from exposures to toxic substances found in the air. In this study, cumulative cancer risks were estimated using the methodology consistent with the procedures recommended in the 2015 California Office of Environmental Health Hazard Assessment's (OEHHA) "Air Toxics Hot Spots Program Guidance Manual for Preparation of Health Risk Assessments" (Guidance)[8]. As discussed in the Guidance, the risk assessment process generally consists of four steps: hazard identification (determining whether the substance of concern is a potential human carcinogen and/or other types of adverse health effects in humans), exposure assessment (estimating/modeling the extent of public exposure to toxic substances), dose response assessment (characterizing the relationship between exposure to a substance and the incidence of an adverse health effect in an exposed population), and risk characterization (estimating potential cancer risk by multiplying estimated/modeled annual average concentration of a substance by the cancer potency factor). The total cancer risks from all regional emission sources and all TACs are the summation of results from both CALPUFF (DPM and metals) and CMAQ (VOCs) modeling. Note that this study is different from hot spot health risk assessment (HRA) studies which look at peak health impacts very close to a particular source. The purpose of the results presented here is not to show what a single person may experience at a specific location (for example what a person standing a few meters away from a chrome plating facility may experience). Rather, it estimates the cumulative risk from all surrounding emission sources at the census block level.

Q7. What is the overall potential cancer risk within the Portside Community and how do different regional emission sources contribute to the overall risk?

The potential cancer risk in the community from regional emission sources is the total cumulative cancer risk from ALL emission sources, inside and outside of the community boundaries, including OGV emissions over the ocean, and emissions from Mexico near the US-Mexico border. Figure ES-2 shows the total DPM risk distribution over census blocks within the Portside community. For DPM, the source specific contribution to the overall risk was on-road mobile sources (42%), CHC (19%), aggregated areawide sources or "Others" (15%), Mexico on-road mobile sources (9%), TRU (6%), locomotives (3%), and OGV (3%), which is shown in Figure ES-3. The "Others" category includes off-road equipment such as commercial and industrial forklifts and generators, and stationary area-sources such as auto-body

[8] : https://oehha.ca.gov/media/downloads/crnr/2015gmappendiceslm.pdf

shops and gas stations. These are smaller sources that are difficult to assign specific locations to and therefore are modeled as aggregated area sources. When all regional emission sources and all TACs are considered, DPM accounted for 85% of the total cancer risk in the community, while VOCs accounted for about 14% of the total risk (mainly from Benzene (5%), 1,3-Butadiene (5%) and Formaldehyde (3%)), and heavy metals accounted for the remaining 1% (Figure ES-4).

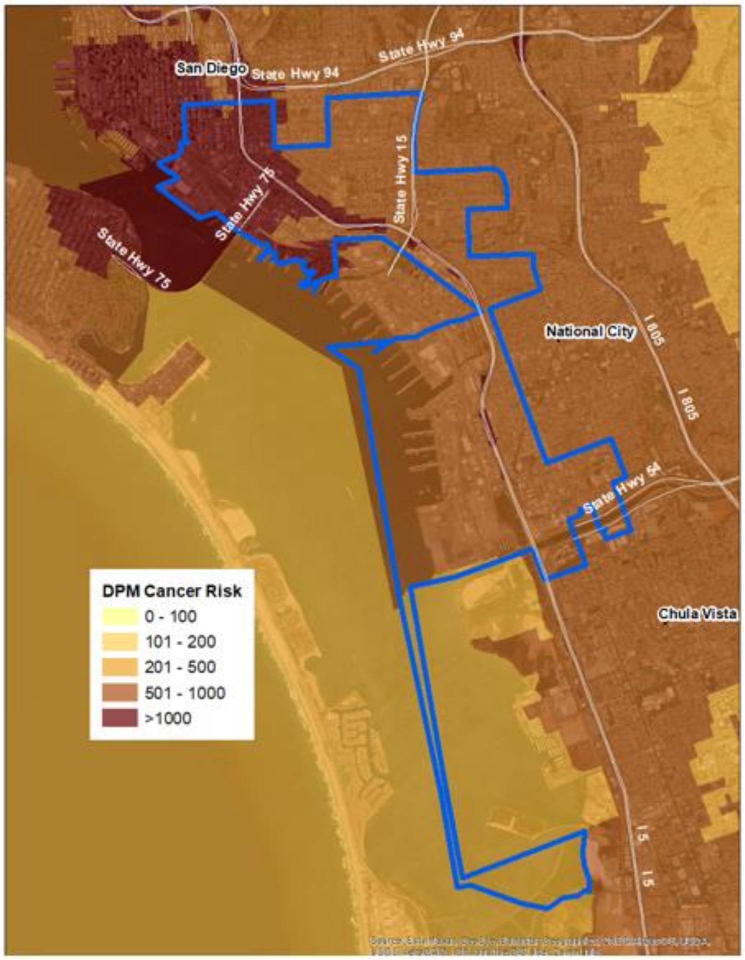

Figure ES-2: Total DPM risk distribution in the Portside community census blocks (2017 regional emissions).

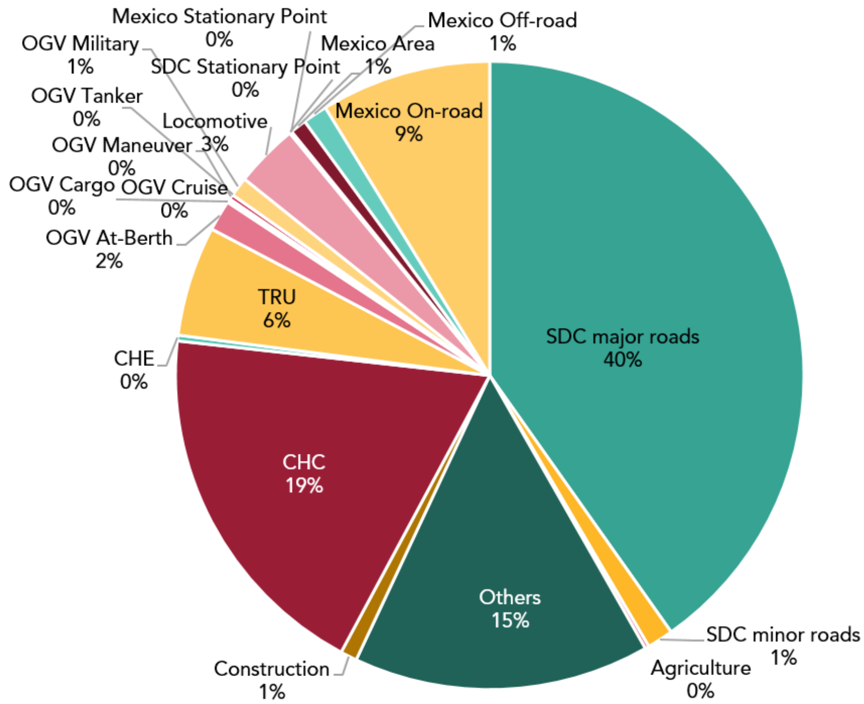

Figure ES-3: Relative contributions to total DPM risk by emission sources within the Portside community (2017 regional emissions).

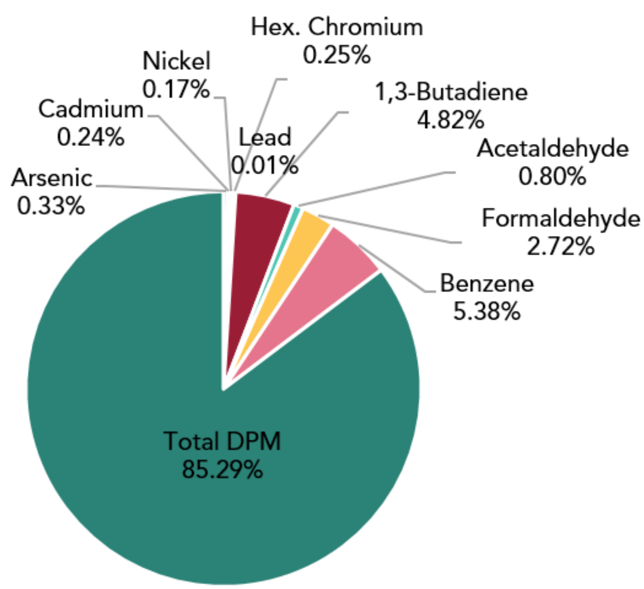

Figure ES-4: Relative contributions to total risk by toxic species within the Portside community (2017 regional emissions).

These estimates were made based on population-weighted averages over all census blocks in the community. We present these average values with the goal of helping the community identify the sources of highest impact to the community as a whole. It is worth mentioning here that local risks and source apportionment may vary significantly across specific locations depending on their nearby emission sources.

Q8. How do local emission sources within the Portside Community contribute to the overall cancer risk estimates?

The potential cancer risk in the community from local emissions is the cumulative cancer risk that results from emission sources located within the community boundaries only. Overall risk distribution in census blocks within the Portside community is presented in Figure ES-5. When only local emission sources are considered, DPM accounted for 76% of the cancer risk within the community, while VOCs accounted for about 23% and heavy metals for the remaining 1% (Figure ES-6). The main sources of DPM were on-road mobile sources (56%), with 32% from Interstate-5 that runs through the community, aggregated area sources ("Others", 26%), TRU (7%), locomotives (5%), and OGV (5%) (Figure ES-7). Although overall risk numbers are shown in Figure ES-5, risk calculations are highly dependent on the scale and proximity of receptors to emission sources, so it is recommended to focus more on the sources and species contributing to the overall risk as opposed to focusing on the absolute risk values.

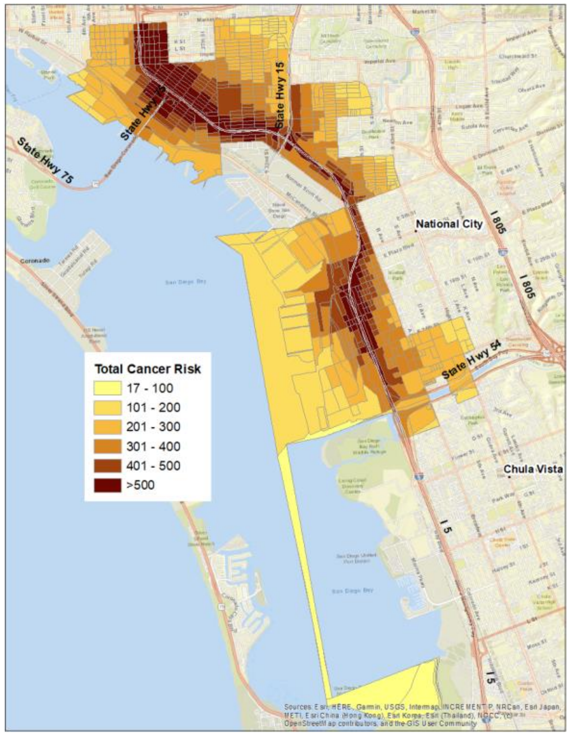

Figure ES-5: Overall risk distribution in the Portside community (2017 local community emissions only).

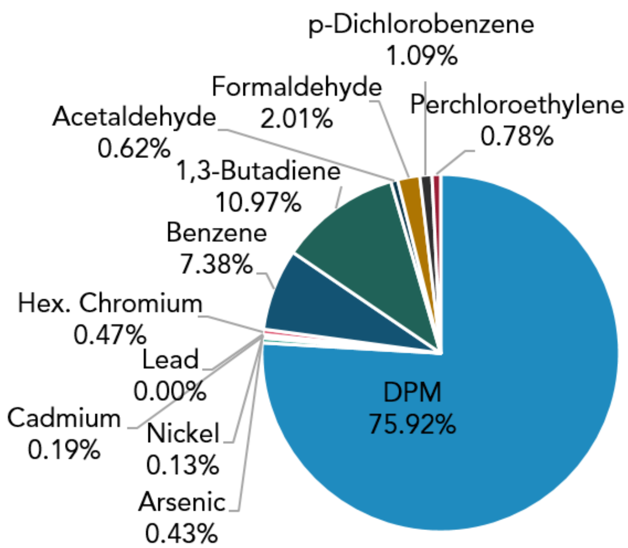

Figure ES-6: Relative contributions to the overall risk by toxic species within the Portside community (2017 local community emissions only).

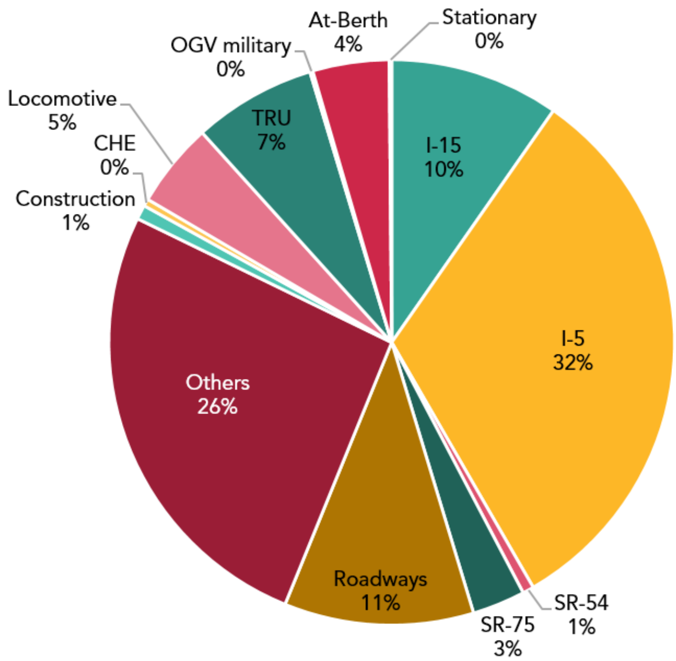

Figure ES-7: Relative contributions to total DPM risk by emission sources (2017 local emissions only).

Q9. What are the key findings of the study?

For the 2017 regional emissions analysis, DPM was the main contributing pollutant to total average risk within the community and accounted for 85% of the total risk. The overall population-weighted cancer risk from all TACs was estimated to be about 950 cases per million. Among all DPM sources in 2017, on-road mobile sources were the top contributor (~42% of total DPM risk).

For the 2017 local emissions analysis, DPM was still the main driver of overall risk in the community and accounted for about 76% of the overall risk. The overall population-weighted cancer risk from local emissions was estimated to be about 320 cases per million. Among DPM emission sources located within the Portside boundary, on-road mobile sources were also the top contributor (collectively ~56% of total DPM risk). Meanwhile, areawide and aggregated area-point sources were the main contributors to VOC cancer risks, while stationary sources were the main contributors to risks from heavy metals.

Overall, around 33% of total potential population-weighted cancer risk in the Portside community resulted from local sources, i.e., emissions within the community boundary (Figure ES-8).

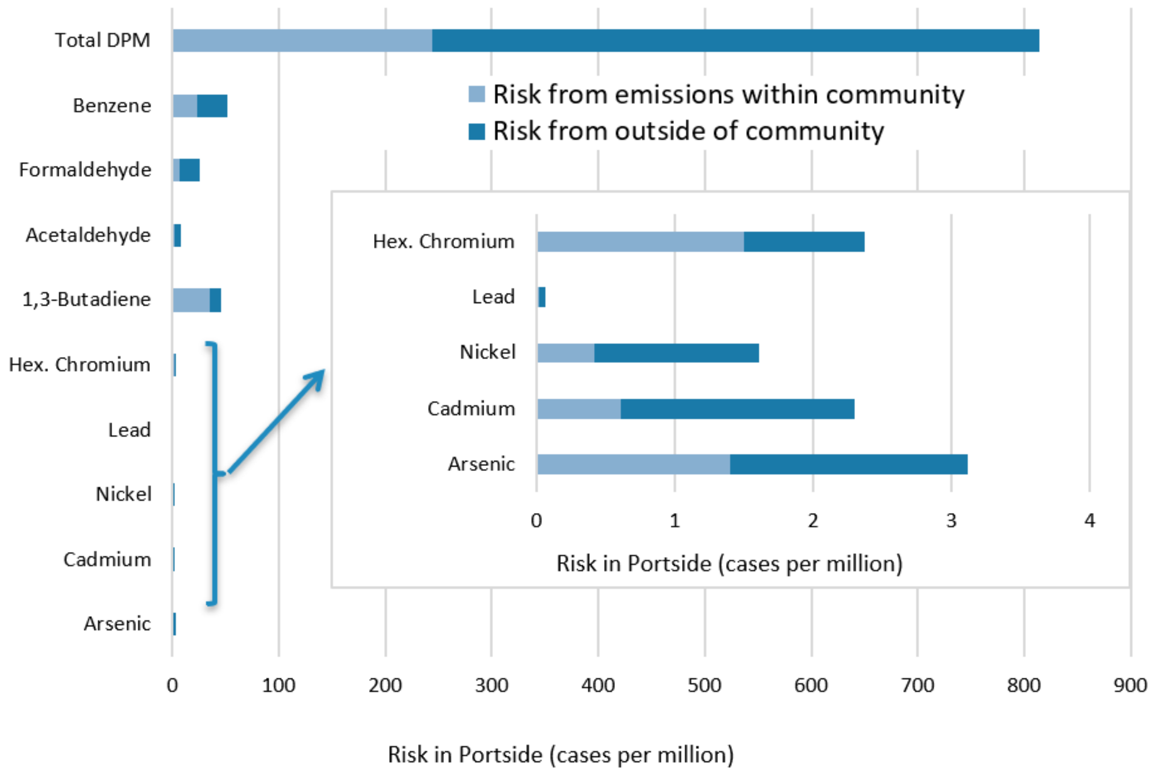

Figure ES-8: Relative contributions to overall risk of each pollutant by regional versus local emissions in the Portside community (2017 base year).

It is important to keep in mind that individual risks at specific locations are highly dependent on their proximity to emission sources. Even though the impact from DPM sources dominates on average within the community, volatile organic compounds (VOCs) and heavy metals can generate high local risks at certain locations. Furthermore, when identifying priorities and developing strategies to reduce risk, it is important to take into consideration recent and future changes in emissions resulting from the implementation of regulations such as the state's Truck and Bus rule, and regulatory programs designed to reduce DPM emissions from off-road mobile sources such as ocean-going vessels (OGV), commercial harbor craft (CHC), cargo handling equipment (CHE) and transport refrigeration units (TRU). For future years, for example 2037, emission sectors such as OGV, TRU, area and stationary sources of VOCs and heavy metals could become as important as on-road mobile sources or exceed them in terms of risk impact on the community.

Q10. How do the modeling results compare with monitoring data?

The simulated individual TAC concentrations were compared against available observations for the purpose of validating the CALPUFF and CMAQ models. Although there were no observational datasets available within Portside in 2017, we were able to extract observational data at three monitoring stations (Lexington Elementary School in El Cajon, Chula Vista, and Donovan in Otay Mesa) in the County of San Diego from the USEPA AIR database[9]. Note that elemental carbon (EC) was used as a surrogate for evaluating DPM since DPM cannot be directly distinguished in the measurements. Results showed that the simulated EC in El Cajon and four VOCs in El Cajon and Chula Vista have a reasonable agreement with the observations. Meanwhile, the CALPUFF-simulated heavy metal concentrations at the three monitoring sites were underestimated compared to the observations, which indicates substantial uncertainty in emissions estimates for metals. Thus, cancer risks associated with toxic metals may also be underestimated.

Since October 2019, measurements of hourly black carbon (BC) within the Portside community have been available[10]. Based on those measurements, the corresponding potential cancer risks of diesel PM can be compared[11] against our 2017 modeling results at three monitoring sites and are presented in Table ES-1. Note that the risks should be higher in 2017 (our modeling year) than in 2021-2022 (the measurement years) due to emission reductions over time. To estimate 2021-2022 risk from the 2017 modeling, the 2017 results were scaled based on the rate of change in risk from 2012 to 2017, accounting for the change in DPM emissions, where 2012 was the first year modeled as part of CARB's preliminary statewide risk assessment. As can be seen, our projected modeling results are comparable with DPM estimates derived from monitoring measurements. This comparison increases our confidence for the risk estimates in this study.

	Monitoring measurements		Model values	Model projected values	
Site	**2021**	**2022**	**2017**	**2021**	**2022**
Chicano Park	664.8	615.9	1260.9	849.8	747.1

[9] https://www.epa.gov/outdoor-air-quality-data

[10] https://aqview.arb.ca.gov

[11] Assuming: 1) about 85% of ambient BC come from fossil fuel-related sources based on measurement data from the South Coast Air Quality Management District, and 2) 1 gram BC ≈ 1.3 gram DPM (https://www.sdapcd.org/content/dam/sdapcd/documents/capp/meetings/portside-csc/011921/011921-VII-Presentation-OEHHA.pdf).

Downtown Sherman Elementary	599.6	513.3	1103.0	581.7	468.2
Oceanview Blvd	654.2	540.0	809.8	507.9	447.3

Table ES-1: Comparison between modeled and observed DPM potential cancer risks at three monitoring sites in Portside.

Q11. What activities at CARB are underway to further reduce emissions and risks?

CARB's toxic air control program started in 1983 with the passage of Assembly Bill 1807, which requires CARB to identify and control toxic air pollutants. Since that time, CARB has adopted and implemented 26 mobile and stationary airborne toxic control measures (ATCMs)[12]. These ATCMs have been successful in controlling DPM from various diesel-fueled engines, benzene in gasoline, hexavalent chromium from chrome platers, and perchloroethylene from dry cleaners. As a result, ambient cancer risk in California has been reduced by about 80 percent since 1990.[13]

Nevertheless, exposure to air toxics is still a significant concern in California. CARB is working now on efforts to continue to reduce exposure to a few specific air toxics. Amendments to the chrome plating control measure and the composite wood products control measure are under development. These two control measures will help reduce exposure to toxic chemicals in environmental justice communities as well as throughout the state. However, DPM is still the main driver for toxic exposure and risk in the state. CARB has recently passed two amended ATCMs for OGV at-Berth and CHC and is working on other amended ATCM for CHE and TRUs. These amended ATCMs will help further reduce DPM emissions and exposure statewide, especially for those communities near ports.

[12] https://ww2.arb.ca.gov/resources/documents/airborne-toxic-control-measures
[13] https://ww2.arb.ca.gov/resources/documents/what-air-toxics-program

Q12. What are projected emissions and risks in 2037?

CARB has implemented a variety of strategies including regulatory efforts, voluntary and incentive programs to control toxic emissions from all sources, particularly DPM sources because DPM is still the largest contributor to overall risk statewide. Figure ES-9 shows projected normalized DPM emissions by different emission sources for 2037. Figures ES-10 and ES-11 present projected DPM cancer risk reduction from regional and local emission sources in Portside, respectively. The most prominent change is the reduction of risk associated with on-road DPM emissions, which would reduce total DPM risks by more than half for both regional and local emission sources. This can be attributed to continuously phased in implementation of the On-road Truck and Bus rule. Programs designed to reduce emissions from OGV, CHC, CHE, TRU and other sources have also been implemented, but the relative contributions from these sources (compared to on-road mobile) are projected to increase with time, even though their associated absolute risks would decrease over the same time.

Figure ES-9: Projected changes in normalized DPM emissions for specific emission categories from 2017 to 2037.

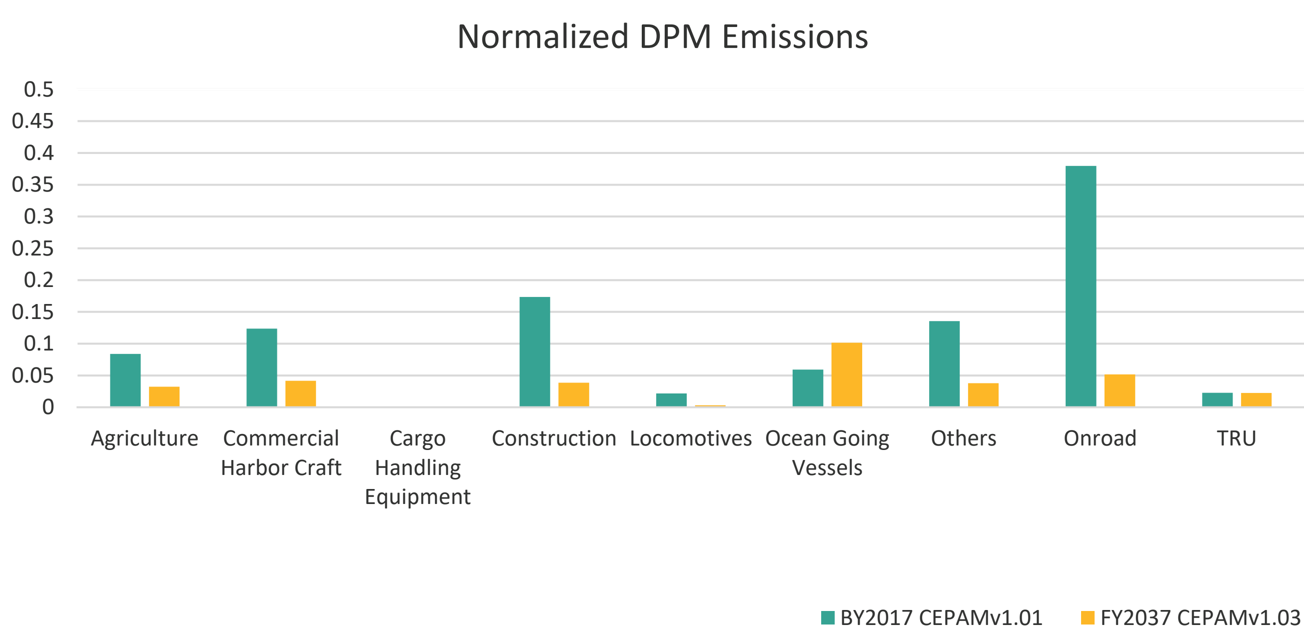

Figure ES-10: Relative contributions to total DPM risk by emission categories for the 2017 base year, and the projected risks for 2037 (relative to the 2017 base year total) for regional emissions.

Figure ES-11. Relative contributions to total DPM risk by emission categories for the 2017 base year, and the projected risks for 2037 (relative to the 2017 base year total) for local community emissions only.

Q13. What are the caveats associated with this study?

Although this study reflects the state-of-the-science in modeling techniques and analytical tools, it is important to recognize study caveats/limitations to avoid over- or under-interpretation of the modeling results. In this study, the emissions inventory was developed based on the best-established datasets and/or methods to quantify emissions from many diverse emission sources. However, there may be circumstances where emissions were under- or over-estimated. This may be because there are sources of air toxics that have not yet been identified or that are episodic and difficult to represent in the inventory. Diesel PM was the major contributor to cancer risk in this study. However, there are no existing techniques to directly measure diesel PM, so our ability to validate the diesel PM emission inventory from direct measurements is lacking. The modeling methods used in this study were designed specifically to provide the best estimates of cumulative exposures to air toxics from the multitude of emission sources and finite known air toxics. The risk estimates were developed based on population-weighted averages over the census blocks in the community. Thus, the results may not necessarily reflect near-source impacts from any particular source.

This study used the risk assessment guidance recommended by OEHHA and the annual average modeled air toxics concentration to calculate health risks. However, any toxic health risk assessment requires the use of certain assumptions, which are based on current scientific knowledge and designed to be conservative and health protective. These assumptions may simplify things to make an assessment possible, but they may also introduce uncertainties. As noted in the OEHHA risk assessment guidelines, sources of uncertainty, which may either overestimate or underestimate risk, include: (1) extrapolation of toxicity data in animals to humans; (2) uncertainty in the estimation of emissions; (3) uncertainty in the air dispersion models; and (4) uncertainty in the exposure estimates. Uncertainty may be defined as what is not currently known and may be reduced with further scientific studies. In addition to uncertainty, there is a natural range or variability in the human population for things such as height, weight, breathing rate, and susceptibility to chemical toxicants. Future air toxics risk assessments will include improvements and updates to the emission inventories, the spatial and temporal allocation of emissions data, and more robust evaluation of the modeling performance as additional toxics monitoring data becomes available.

It is important to note that while these limitations are an important consideration, the study results here do provide a best estimate of the health risk impacts for the Portside community given the current emissions inventory, OEHHA guidance, and USEPA recommended modeling systems.