CHAPTER 3B:

EMISSIONS AND SOURCE ATTRIBUTION

Chapter 3b: Emissions and Source Attribution

Introduction

Chapter 3B Highlights

1. Information about the sources of air pollution in this community is presented in a "source attribution" analysis
2. Diesel particulate matter is currently the main air toxic pollutant in this community, and it comes mostly from on-road and off-road mobile sources
3. Other key air toxic pollutants in this community are 1,3-butadiene and benzene
4. In future years, diesel emissions will decrease substantially due to ongoing and newly proposed regulations, but these emissions continue to be the main driver of air toxics cancer risk in this community

The Community Emission Reduction Plan (CERP) identifies air quality priorities based on community input and evaluation of technical data on emission sources in the community. The CERP defines actions and strategies to reduce the emissions and exposure burden from sources of criteria air pollutants and toxic air contaminants. To accurately determine emission reductions from these actions and strategies, a baseline reference needs to be established. The baseline reference can be achieved through an emissions inventory that includes an accounting of sources and their resulting emissions. This rigorous accounting of sources, their emissions and their contribution to cumulative exposure burden is what the CARB guidelines identify as a source attribution analysis. Per the direction of CARB guidelines, source attribution is required to meet the following AB 617 statutory requirements:

California Health and Safety Code § 44391.2 (b) (2) directs CARB to provide "[a] methodology for assessing and identifying the contributing sources or categories of sources, including, but not limited to, stationary and mobile sources, and an estimate of their relative contribution to elevated exposure to air pollution in impacted communities…"

The emissions inventory presented here is consistent with CARB recommendations for conducting a source attribution analysis. This approach is considered best for the South Los Angeles (SLA) community based on the availability of data and resources. Also, it includes an emphasis on identifying sources within the community. More information on source attribution methods is included in the Source Attribution Methodology report.[1] The most recent comprehensive air quality and toxics modeling analysis in the region was conducted as part of

[1] Methodology for Source Attribution Analyses for the first year AB 617 Communities in the South Coast Air Basin (Technical Report), 2019, http://www.aqmd.gov/docs/default-source/ab-617-ab-134/technical-advisory-group/source-attribution-methodology.pdf

the fifth Multiple Air Toxics Exposure Study (MATES V)[2] released in August 2021. This study showed Diesel Particulate Matter (DPM) was the air pollutant that contributed most to air toxics cancer risks in the South Coast AQMD. There are areas within SLA community with significantly higher air toxics cancer risks compared to the average of the Basin. Air toxics cancer risks in SLA range from about 435 per million to about 700 per million, while the average across the Basin is about 455 per million.

The SLA community contains many known sources of air pollution, including the I-10, I-110, I-105 and I-710 freeways and the Alameda Corridor rail line. The community also includes a wide range of industrial facilities, including those that conduct metal processing, surface coatings, auto body shops, and warehousing that attracts heavy-duty truck traffic. The source attribution analysis (discussed in the next section) highlights that in the year 2019, DPM had the highest contribution to the community's overall air toxics inventory. On-road and off-road mobile sources were the predominant sources of DPM, with the major contributors being off-road diesel equipment, heavy duty trucks, and trains. In this community, 1,3-butadiene is the second largest contributor, which is largely emitted from gasoline-powered mobile sources and from the chemical and plastics industry. Projected emissions in future years show decreases in DPM emissions, although DPM continues to be the main contributor to the cancer risk. The following sections provide more details on the main sources of criteria pollutants and air toxics in the community.

Base Year Emissions Inventory and Source Attribution

A variety of sources contribute to the emissions of criteria pollutants in the SLA community (**Figure 3b-1**, **Figure 3b-2**, **Figure 3b-3**). Emissions of nitrogen oxides (NOx) are related to combustion sources and are an important contributor to the regional formation of ozone and particulate matter with a diameter of 2.5 micrometers or smaller (PM2.5). In this community, on-road mobile sources are the largest emitters of NOx, with heavy-duty trucks being the largest contributor. Off-road mobile sources are the second largest contributor to NOx and include off-road equipment and trains. Stationary sources of NOx are mainly from fuel combustion in industrial activities and for space and water heating at commercial businesses and homes.

Area sources[3] contribute to two thirds of volatile organic compound (VOC) emissions. VOCs include a broad array of different pollutants, some of which are toxic, but also broadly contribute to regional ozone and PM2.5 formation. Solvent evaporation (mostly from consumer products and architectural coatings), and emissions from processes related to cleaning and surface coatings are the largest contributors in the SLA community. Mobile sources contribute to the remaining third of the VOC emissions, with light-duty vehicle exhaust and evaporative emissions being the largest contributor. Area and stationary point sources are also the largest contributors

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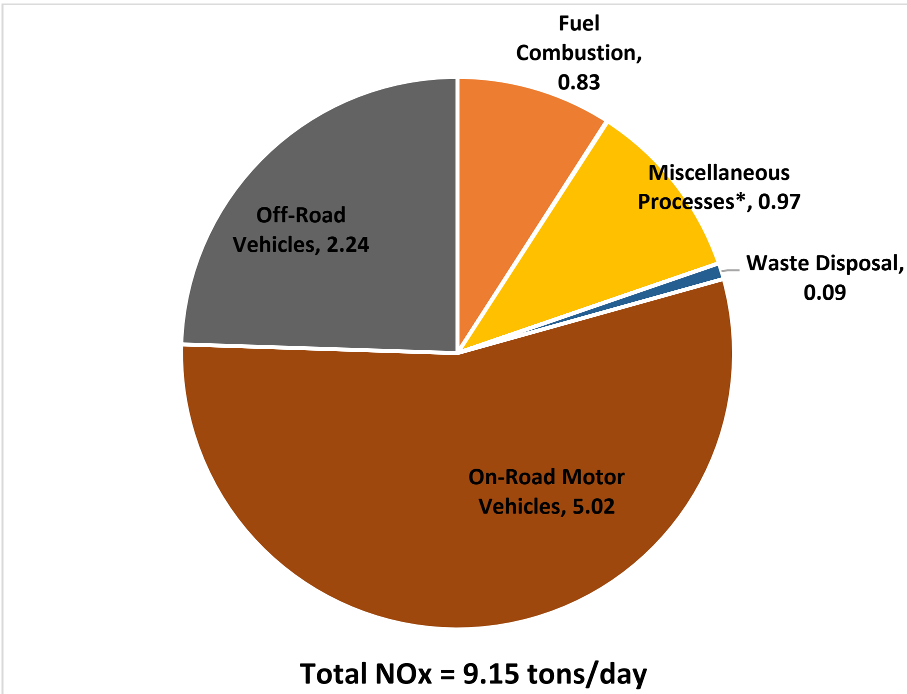
[2] The Multiple Air Toxics Exposure Study V (MATES V), August 2019, http://www.aqmd.gov/home/air-quality/air-quality-studies/health-studies/mates-v

[3] Area sources includes emission sources used in many unspecified locations across a community, like residential fuel combustion (like natural gas-fired water heaters, stoves, or gas-power lawn and garden equipment, etc.) and consumer products (for example personal care products like hairspray), etc.

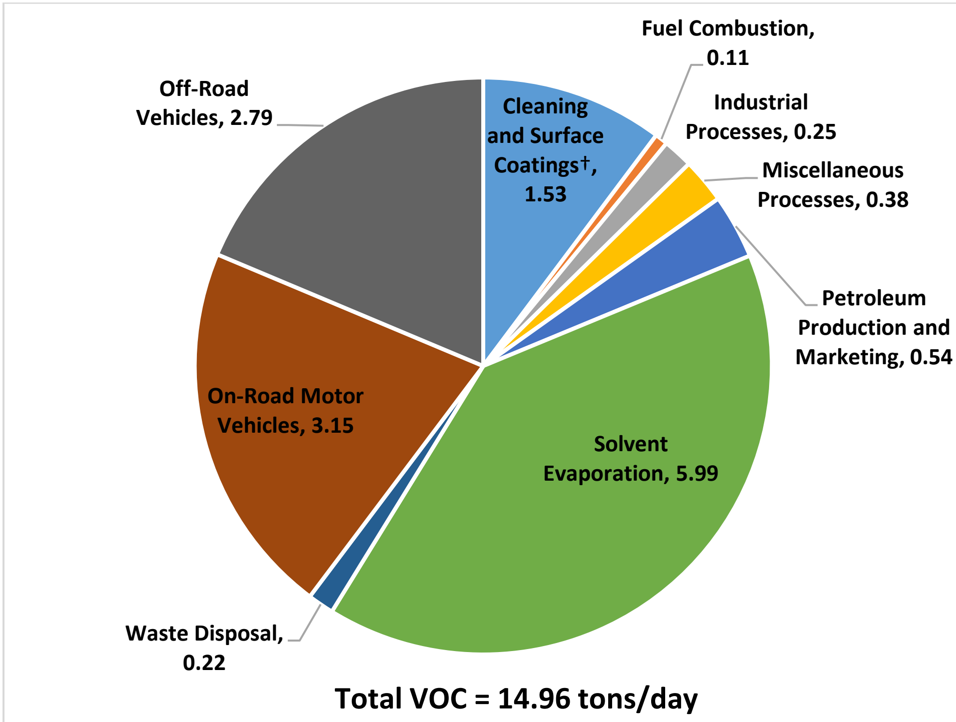
to PM2.5 emissions. Commercial cooking, fuel combustion in residential, commercial and industrial sectors, and manufacturing are the major stationary sources. PM2.5 is also emitted from vehicle exhaust and tire and brake wear. Paved road dust is also related to vehicles traveling on roads but is considered as a stationary area source and included in the "Miscellaneous" category.

Figure 3b-1: Contribution of Major Source Categories to Nitrogen Oxides (NOx) Emissions in the SLA Community in 2019 (tons/day)



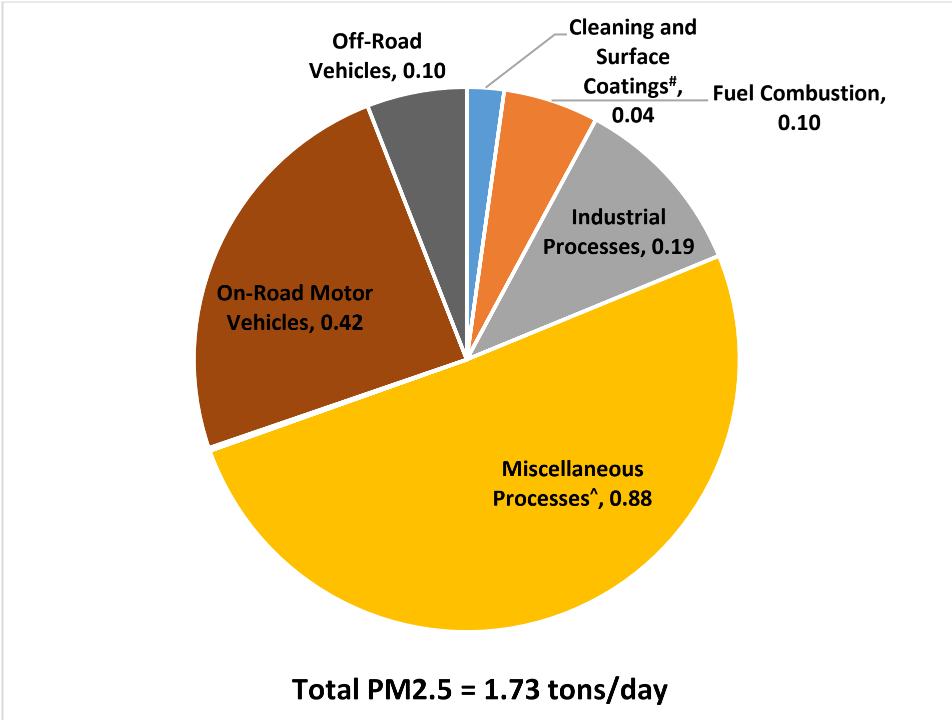
*Miscellaneous Processes include non-combustion sources (e.g., road and construction dust)

Figure 3b-2: Contribution of Major Source Categories to Volatile Organic Compound (VOC) Emissions in the SLA Community in 2019 (tons/day)



†Cleaning and surface coatings includes laundering, degreasing, coatings and related process solvents, and adhesives and sealants. Solvent evaporation is about 95% consumer products, and the rest is architectural coatings and other smaller sources.

Figure 3b-3: Contribution of Major Source Categories to Particulate Matter 2.5 (PM2.5) Emissions in the SLA Community in 2019 (tons/day)



#PM2.5 from cleaning and surface coatings include auto body shop type of sources (e.g., auto refinishing and metal coatings).
^Miscellaneous processes include non-combustion sources like road and construction dust.

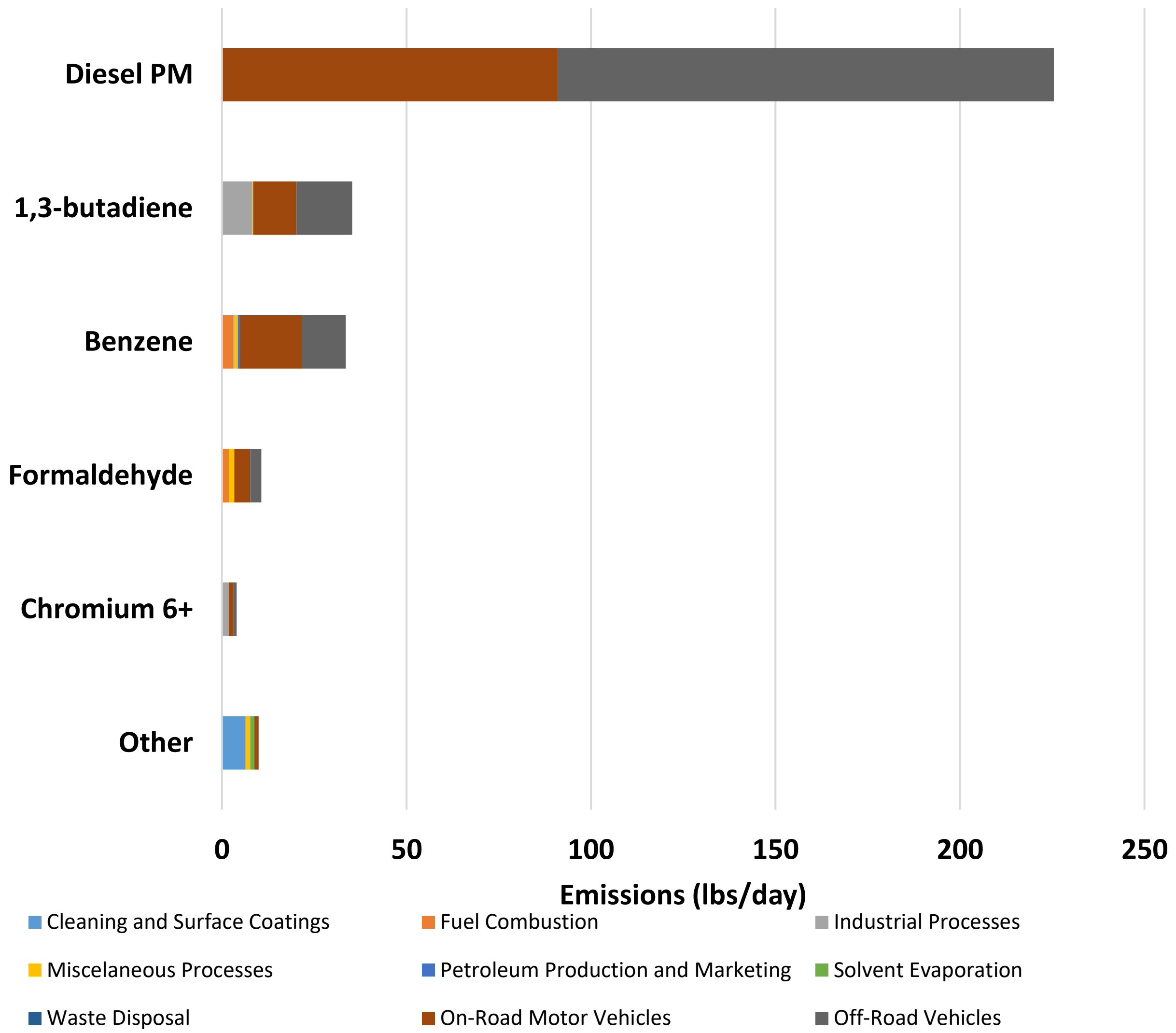
Toxic air contaminant emissions from the largest point sources in the community were compiled from the emissions reported by facilities to South Coast AQMD's Annual Emissions Reporting program. Toxic air contaminant emissions from all other stationary, area, on-road, and off-road sources were calculated using chemical speciation profiles applied to Total Suspended Particulate matter (TSP) and Total Organic Gas (TOG) emissions. Details on the chemical speciation profiles are described in the Source Attribution Methodology report[4]. In total, 21 toxic air contaminants were analyzed and included in this report. This list of toxic air contaminants is consistent with the list of toxic air contaminants that facilities are required to report under the South Coast AQMD Annual Emissions Reporting (AER) and AB2588 Air Toxics Hot Spots programs, except chlorofluorocarbons and ammonia. Chlorofluorocarbons are not considered to have toxic effects on human health, whereas ammonia is included in the criteria air pollutant inventory due to its importance as a PM precursor.

The contribution from major emission categories to toxic air contaminant emissions in the SLA community are presented in **Figure 3b-4**. Note that the emissions in the figure are weighted

[4] Methodology for Source Attribution Analyses for the first year AB 617 Communities in the South Coast Air Basin. Available at: http://www.aqmd.gov/docs/default-source/ab-617-ab-134/technical-advisory-group/source-attribution-methodology.pdf

based on the inhalation toxicity of each toxic air contaminant relative to diesel PM (DPM), following the methodology described in the Source Attribution Methodology report.[4] For example, the cancer potency of hexavalent chromium is approximately 464 times higher than the cancer potency of DPM per unit of mass. Thus, hexavalent chromium emissions are multiplied by 464 to estimate the cancer potency-weighted emissions of hexavalent chromium. The units in the toxicity-weighted DPM-equivalent emissions are expressed in pounds per day (lbs/day). This weighting approach enables a comparison of the contribution of each toxic air contaminant to overall toxicity using a consistent scale. **Figure 3b-4** indicates that DPM is the largest contributor to the overall air toxics cancer risk in the community, followed by 1,3-butadiene, benzene, formaldehyde and hexavalent chromium. **Figure 3b-4** also indicates the major source categories from which the five toxic air contaminants originate. Most of the DPM is emitted from mobile sources (on-road and off-road vehicles). Also, mobile sources are the major contributor to all the other major toxic air contaminants: 1,3 butadiene, benzene, formaldehyde and hexavalent chromium. Plastic production in the chemical industry is another major contributor to 1,3-butadiene, whereas fuel combustion in industrial, commercial, and residential sectors contribute to benzene and formaldehyde emissions. Industrial activities related to laundering, degreasing and coatings contribute to emissions of methylene chloride, perchloroethylene and cadmium, represented in the 'Other' category in **Figure 3b-4**. A detailed emission inventory by major source category is provided in the Appendix 3b: Source Attribution Analysis.

Figure 3b-4: South Los Angeles Community Toxic Air Contaminants Emissions (toxicity-weighted diesel equivalent) in 2019



Future Year Emissions Inventory and Source Attribution

Future emissions of criteria pollutants and toxic air contaminants in the SLA community are projected using the best available information for population growth, economic growth and emission adjustments that reflect the ongoing implementation of existing regulations. The estimates shown here do not reflect the potential impact of any new programs or measures not yet approved, and/or included in the CERP for SLA. The community includes a variety of facilities subject to rules targeting toxic emissions. Furthermore, on-road DPM emissions from heavy-duty diesel vehicles in this community are subject to California Air Resources Board's Truck and Bus Regulation.[5] Off-road diesel equipment is also subject to state regulations that will reduce DPM and NOx emissions and the South Coast AQMD has also developed and implemented various regulations and programs to reduce NOx and VOC emissions from stationary and mobile sources. A detailed emission inventory by major source category for future years is provided in the Appendix 3b.

Figure 3b-5 presents the projected trend in major criteria air pollutant emissions (NOx, VOC and PM2.5) in the SLA community from 2019 to the two milestone years, 2026 and 2031. NOx emissions in the community are expected to decrease substantially between 2019 and 2031, due to the existing regulations and programs for mobile and stationary sources. The emission reduction commitments under the South Coast AQMD RECLAIM program that covers the largest stationary NOx sources are expected to bring a significant amount of NOx reductions as well. VOC emissions are also expected to decrease between the years 2019 and 2031, mostly due to cleaner vehicle emissions. Unlike NOx and VOC emissions, PM2.5 emissions remain virtually unchanged during the period from 2019 to 2031, reflecting that growth in population and economic activities offsets the reductions in on-road and off-road mobile sources due to regulations.

Trends for toxic air contaminant emissions are shown in **Figure 3b-6**. Diesel PM continues to dominate the toxic air contaminants emission inventory in future years, despite a significant reduction in DPM from heavy-duty trucks. DPM is expected to decrease by 61% from 2019 through 2031. The second largest contributor to air toxics is 1,3-butadiene, with emissions anticipated to decrease due to reductions from vehicles. Benzene and formaldehyde emissions are also expected to decrease throughout the 12-year period due to overall emission reductions from vehicles, whereas hexavalent chromium emissions decreases from 2019 to 2031 are expected due to a decrease in vehicle emissions that is partially offset by a slight increase in industrial emissions. Emissions of perchloroethylene, methylene chloride and cadmium are not expected to change much.

It is important to note that many of the South Coast AQMD regulations addressing toxic metal emissions from industrial facilities (e.g., South Coast AQMD Rule 1407.1 and Rule 1469) include requirements to reduce fugitive metal toxic particulate emissions from these facilities. Fugitive metal particulate emissions can make up the majority of the toxic metal emissions from a metal processing facility but are often difficult to quantify due to a lack of accepted emission estimation

[5] CARB Truck and Bus Regulation, https://ww2.arb.ca.gov/our-work/programs/truck-and-bus-regulation/about

methods. Therefore, while the inventories shown here may not illustrate an overall decrease in toxic metal emissions, the regulations are expected to result in overall decreased emissions due to reductions in fugitive emissions. The analysis presented in this section is a regional analysis evaluating total toxic air contaminant emissions. This analysis is different than a localized health risk assessment which takes into account specific parameters about the emission sources within a facility and the proximity and types of receptors around the facility.

Figure 3b-5: Community Total Emission Trends for NOx, VOC, and PM2.5 (tons/day) for the Year of 2019, 2026, and 2031

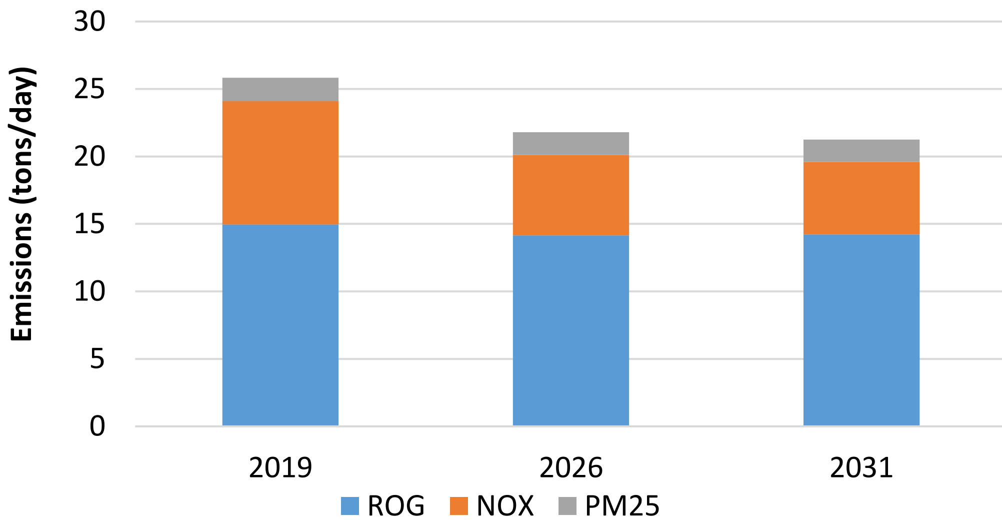


Figure 3b-6: Total Emission Trends for Toxic Air Contaminants in SLA (Cancer Potency-Weighted Diesel-Equivalent Emissions, lbs/day) for the Year of 2019, 2026, and 2031

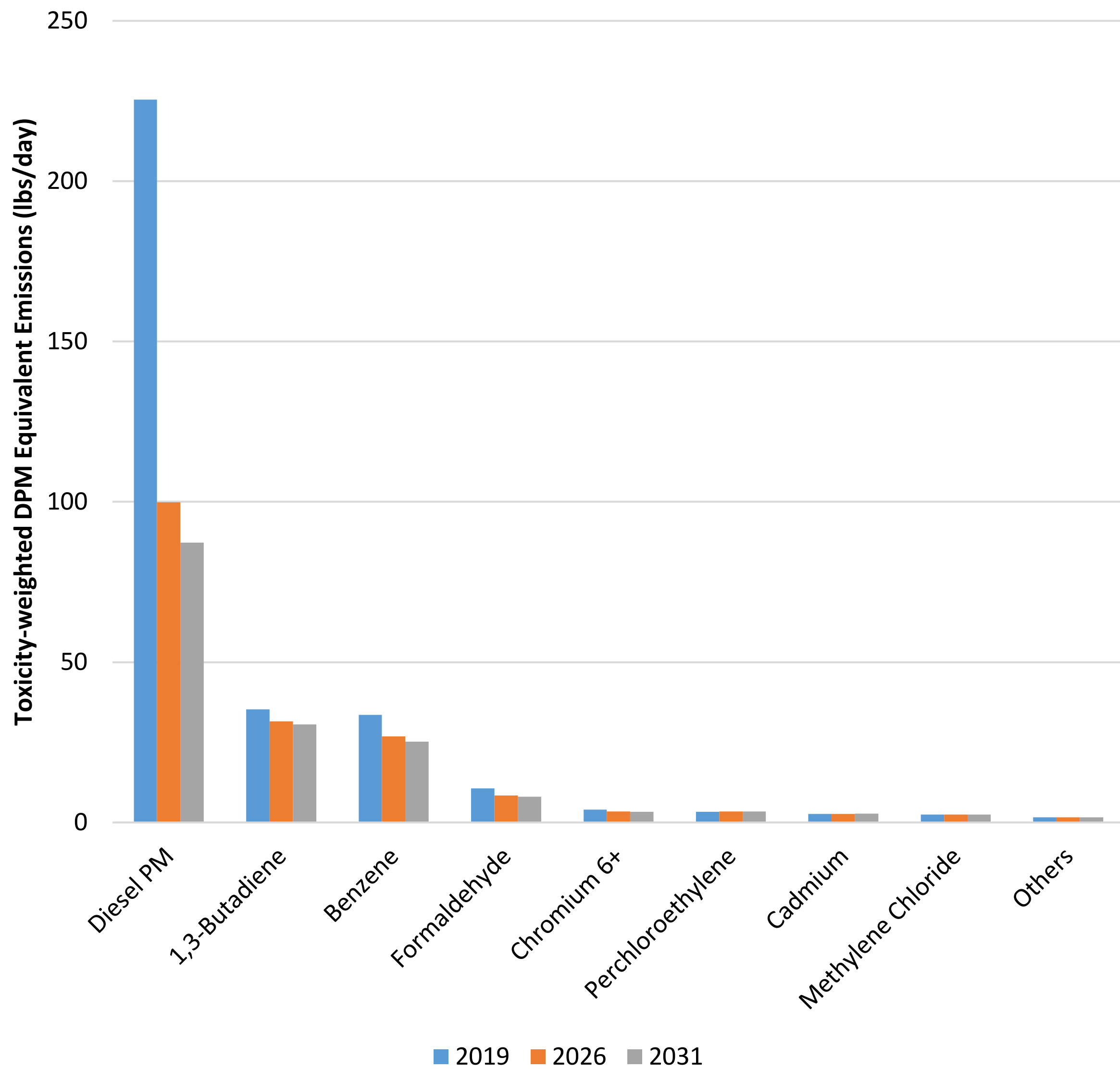
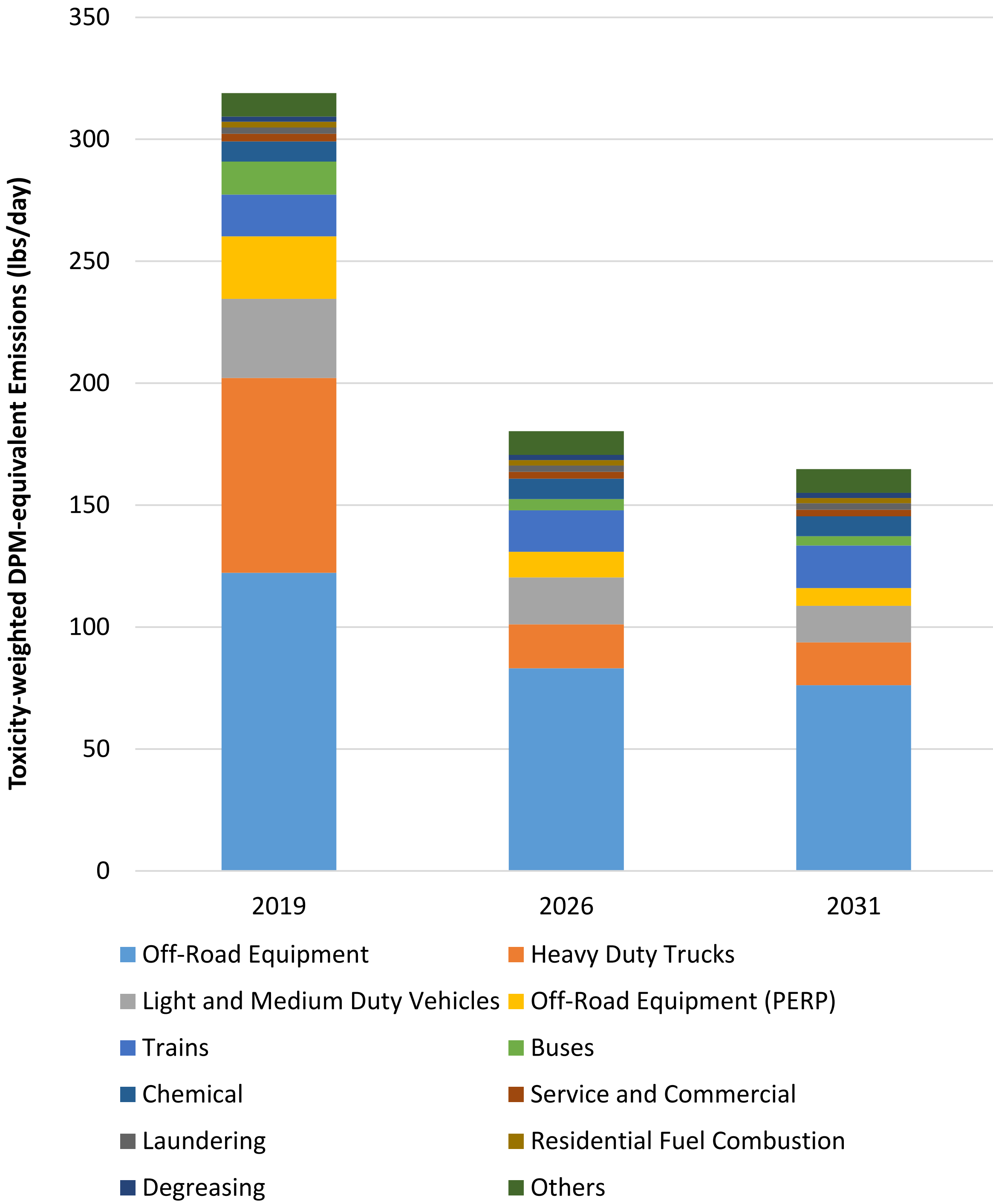


Figure 3b-7 presents the total toxic air contaminant emissions by the major emission categories for the three years of interest. The overall toxicity-weighted emissions decrease between 2019 and 2031. In particular, emissions from diesel heavy-duty trucks and off-road equipment are expected to decrease substantially over the 12-year period, reducing the overall toxic air contaminant emissions. While emissions of toxic air contaminants from mobile sources is expected to decrease over time, emissions from stationary sources in large facilities can still affect the nearby population, if these emissions are not remediated.

Figure 3b-7: Toxic Air Contaminant Emissions from All Sources in the SLA Community, Shown by Major Categories



Summary

The main sources of air pollutant emissions in the SLA community are on-road vehicles, trains, off-road equipment, and industrial activities.

NO_X emissions in this community are dominated by mobile sources – both on-road and off-road – which account for 79% of the total emissions in 2019. Heavy-duty truck traffic and off-road equipment are the largest sources for NOx. Stationary sources contribute to 21% of NOx emissions in this community, mostly from fuel combustion in the residential, commercial, and industrial sectors.

VOC emissions are dominated by area sources, with consumer products such as evaporation from solvents and cleaning supplies being the largest source. Passenger vehicles and off-road equipment such as lawn mowers and other small gasoline engines, are the largest contributors to VOC emissions from on-road and off-road sources, respectively.

Unlike NOx and VOC, sources of PM2.5 emissions span through a wide variety of activity sectors, which include commercial cooking, light- and medium-duty automobiles, fuel combustion, paved road dust, and wood and paper industries.

Toxic air contaminant emissions in the SLA community are dominated by diesel particulate matter (DPM). Major sources of DPM in this community are off-road equipment, heavy-duty trucks, trains, and buses. 1,3 butadiene is the second largest toxic air contaminant based on cancer potency-weighted emissions, and the major sources are gasoline combustion in on-road and off-road vehicles and plastic production. Other significant toxic air contaminant species includes benzene and formaldehyde, which are mostly emitted from mobile sources. Hexavalent Chromium, which is mostly emitted from metal processing facilities are identified to have the fifth highest contribution to the community's total cancer-potency weighted toxic air contaminant emissions.

Future NOx emissions in the community are expected to decrease due to the existing regulations and programs on mobile and stationary sources. VOC emissions are also expected to decline, although they will decline at a slower rate compared to NOx. The increase in the VOC emissions is driven by the growth in consumer products and small off-road equipment, both of which are tied with population growth. In particular, emissions in consumer products are expected to increase significantly. On the other side, most NOx emissions are from on-road and off-road mobile sources, which have regulations in place to reduce emissions in future years. Emissions of DPM from heavy-duty trucks are also expected to decrease due to ongoing implementation of regulations (e.g., Truck and Bus regulation, In-Use Off-Road Diesel-Fueled Fleets regulation) and incentive programs to expedite turning over to cleaner trucks. Emissions of 1,3-butadiene, benzene, formaldehyde, and hexavalent chromium are also expected to decrease due to overall reductions of vehicle emissions. Despite the projected reductions in DPM over the next decade, DPM continues to be the main contributor to air toxics cancer risk in this community.