Portside EJ Neighborhoods
Data Analysis and Interpretation

Diesel Particulate Matter & Volatile Organic Compounds

Yanju Chen, Eugene Kim, Annemarie Flores, Allison Cook

Air Quality Planning and Science Division

January 2024

Air Pollutants We Are Focusing On

- **Diesel Particulate Matter (DPM)**
  - Potential sources: diesel exhaust from on-road heavy-duty trucks, off-road mobile equipment, truck refrigeration units, construction equipment, and stationary sources
  - **Estimated by the black carbon** concentrations measured by the district
  - 5 community sites (all in Portside Community)

- **Volatile organic compounds**
  - Potential sources: port businesses, vehicle exhaust, industrial activities
  - Measured at regional toxics monitoring sites
  - 4 regional sites (one in Portside Community)
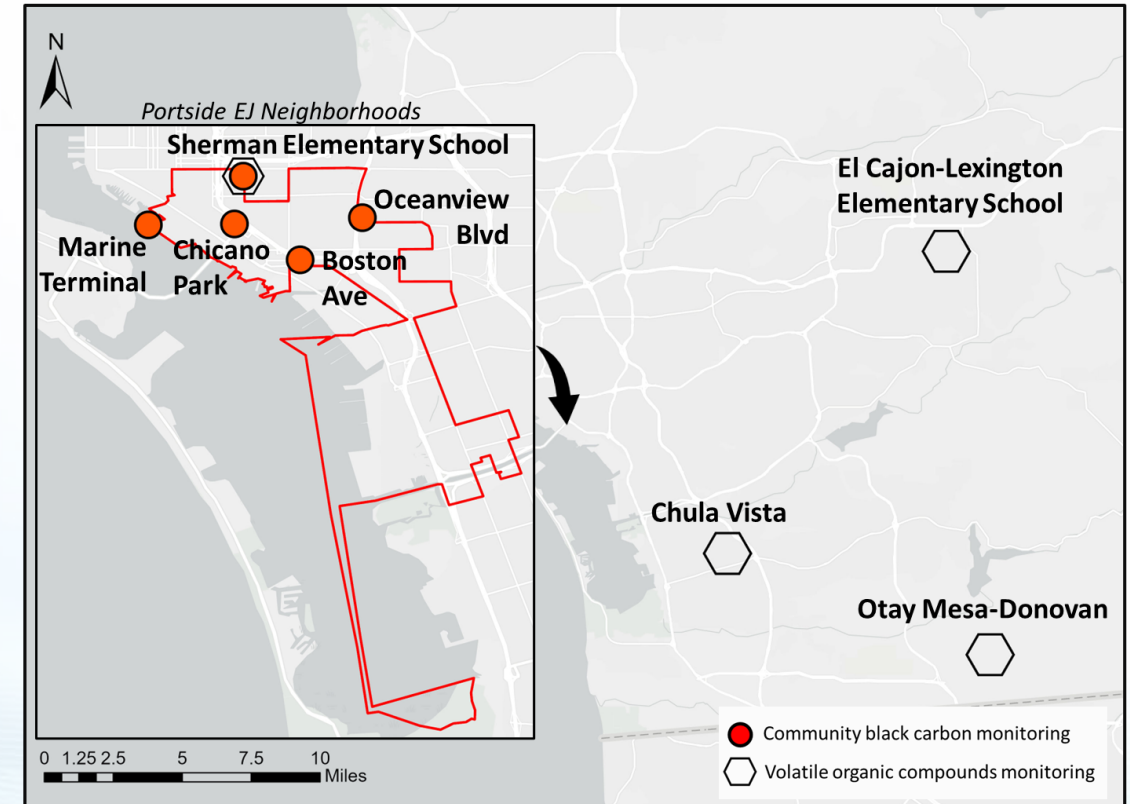
* Red line indicates Portside EJ Neighborhoods boundary

* Data analyzed are from existing monitoring efforts. There is no additional monitoring conducted by CARB for this presentation.
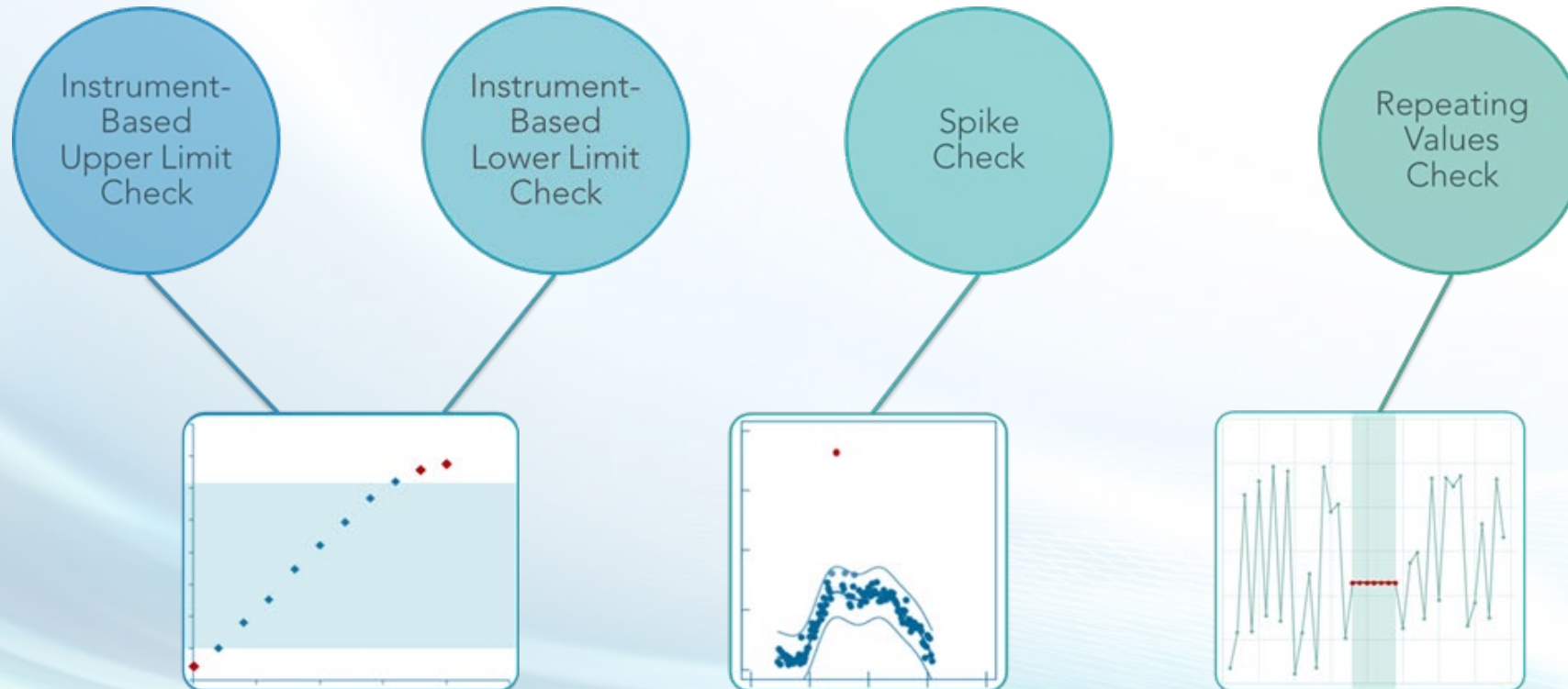
CARB

Information We Can Provide

- Where are the areas with high air pollution levels?
    - How do concentrations measured at different sites compare?

- Can we identify/quantify potential risks associated with air pollution?
    - What are the risks associated with diesel particulate matter, as well as some volatile organic compounds, based on the monitoring data?

* Information presented here is consistent with the information that SDAPCD monitoring staff has been sharing. CARB's analysis and results are focusing on a longer period of time, while the SDAPCD has been presenting quarterly updates.

CARB

Diesel Particulate Matter
Quality Assessment of Black Carbon Monitoring Data

- **More than 99.6% of the black carbon data are of good quality** based on AQview quality control checks

Diesel Particulate Matter
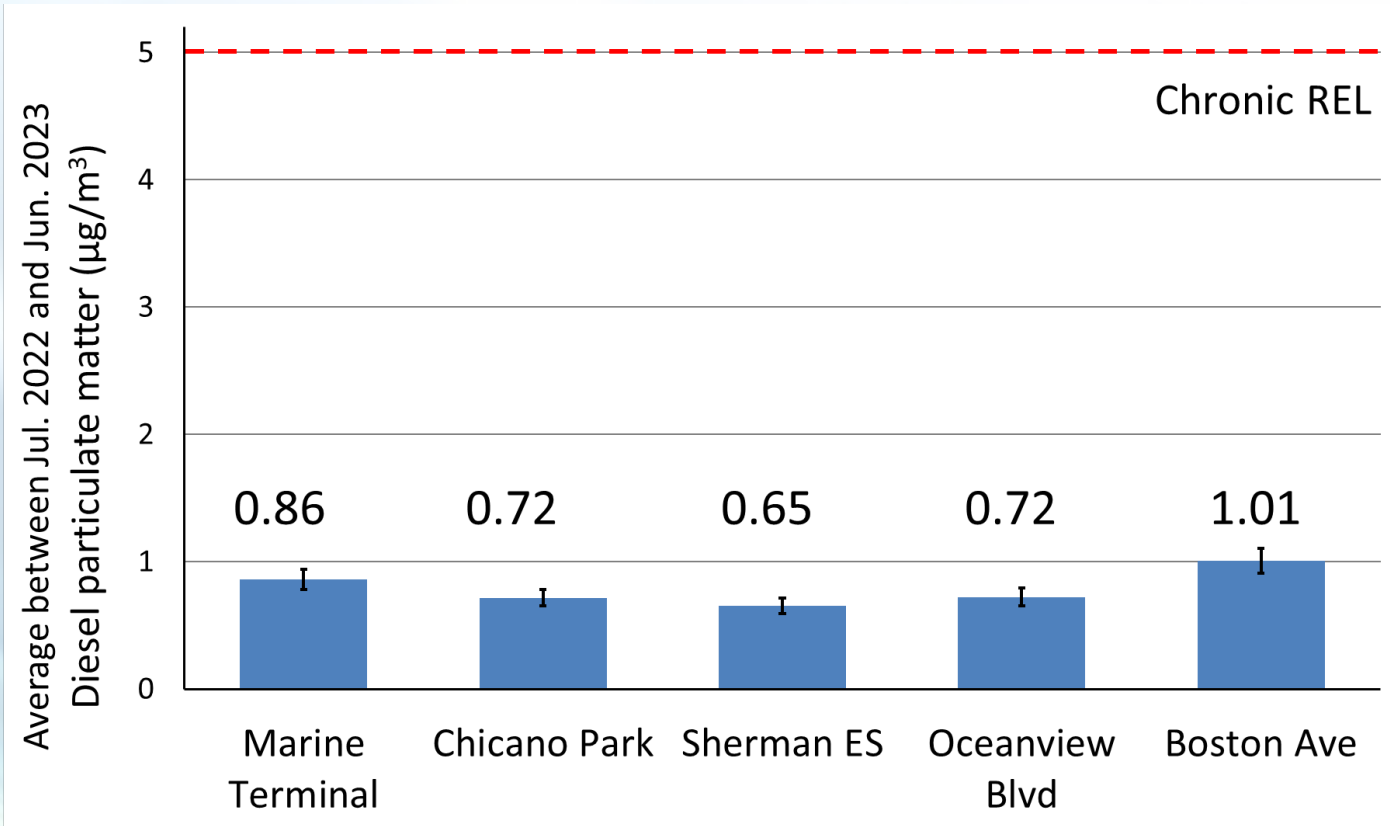## Estimation from Black Carbon Concentrations Data

- Diesel Particulate Matter cannot be measured directly, so we use black carbon as "surrogate" to estimate concentrations

> **1 gram Black Carbon ≈ 1.3 grams Diesel Particulate Matter**

- This is a conversion factor recommended by Office of Environmental Health Hazard Assessment (presentation to CSC on January 19, 2021)

- It provides a rough estimation based on two major assumptions:
  - 75% of diesel particulate matter is black carbon (The fraction is known to vary in different studies. This number is from Long et al., Environmental Pollution, 2013)
  - All black carbon particles in the ambient air are from diesel emissions (This assumption is not entirely true, but it provides a worst-case scenario)

- We can use this estimate to understand non-cancer health impact and cancer risk caused by diesel particulate matter

CARB

Diesel Particulate Matter
## Yearly Averaged Concentrations

Average between Jul. 2022 and Jun. 2023 Diesel particulate matter (µg/m³)

Chronic REL

Marine Terminal	Chicano Park	Sherman ES	Oceanview Blvd	Boston Ave
0.86	0.72	0.65	0.72	1.01

- Estimated 1-Year average concentrations ranged **from 0.65-1.01 ug/m³**

- Estimated concentrations at all sites is **below 5 ug/m³**, the Chronic Reference Exposure Level (REL)
  - Represents **non-cancer impacts**
  - These concentration levels **can still have significant cancer risk**
    → Will discuss cancer risk later in presentation

* Reference Exposure Levels are the airborne concentrations of a chemical below which are not anticipated to result in adverse non-cancer health effects in the general population, including sensitive groups. Chronic Reference Exposure Levels are designed to address continuous exposures for up to a lifetime: the exposure metric used is the annual average exposure.

CARB

Diesel Particulate Matter
## Variation in Space
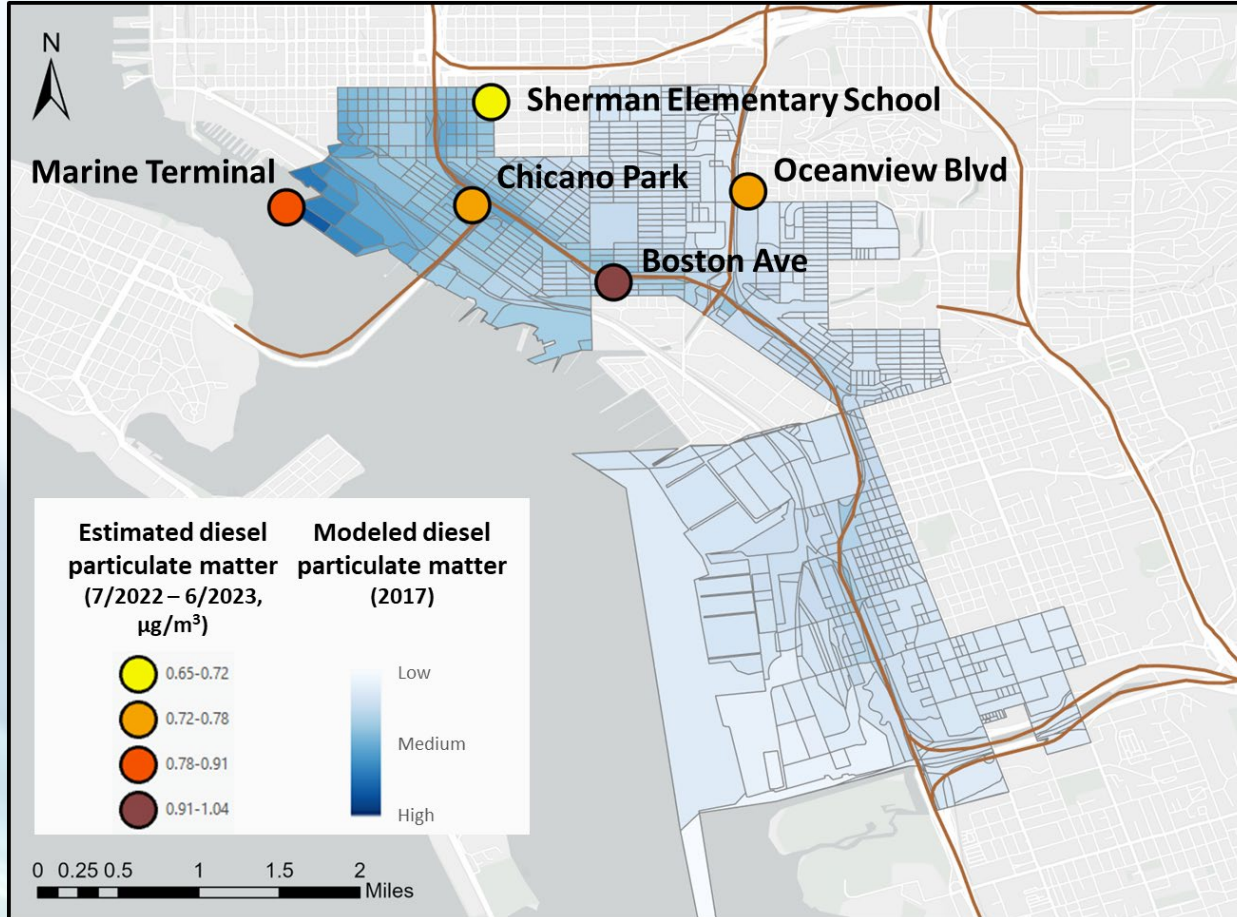
- Map shows data from this project (7/2022 – 6/2023) and the data from CARB's risk modeling project (2017 emission, presented in May 2022)

- Both estimated and modeled concentrations of diesel particulate matter showed similar variations in space: **higher levels near the coast** and lower levels inland

- **Important to note differences** in the two projects:
  - **Years** that the data represented
  - **Estimation methods** applied

Volatile Organic Compounds
Overview

Site Name	Time Period [1]	Data Completeness (%) [4]	Sampling Duration
Sherman Elementary School	Oct. 2019 – Oct. 2021[2]	81.7	24 hours (1-in-6 days)
Chula Vista	Jan. 2019 – Dec. 2021[3]	67.0	24 hours (1-in-12 days)

[1] Monitoring and data analyses are ongoing. This presentation provides the results for a snapshot of the data during the above-mentioned time period
[2] Data from Apr. 2020 to May 2020 are not available because of COVID Stay-At-Home Order. Data are also missing for Nov. 2021 to Dec. 2021
[3] Data from Apr. 2020 to Mar. 2021 are not available because of COVID Stay-At-Home Order
[4] Due to factors like the COVID Stay-at-Home Order, there were many missing samples which contributed to lower percentages of valid data points


CARB
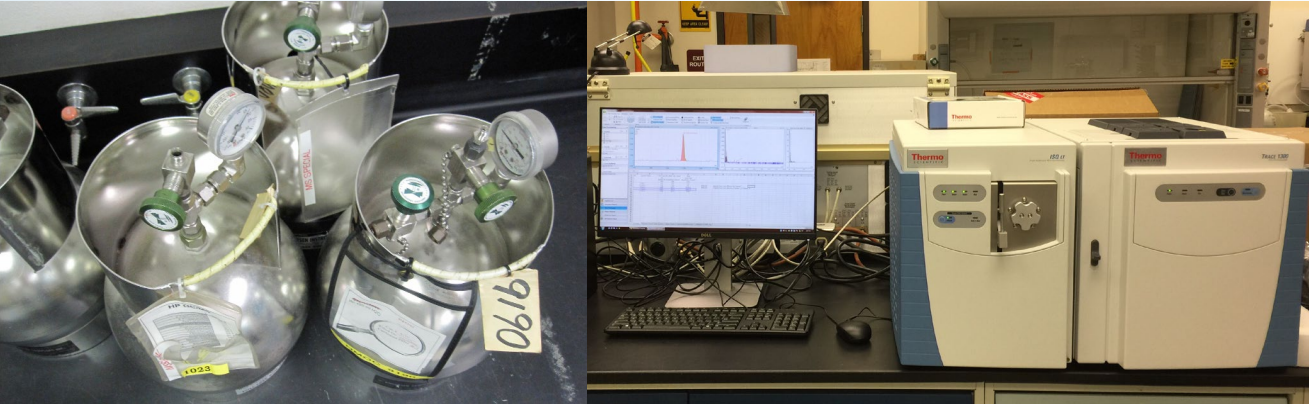
Volatile Organic Compounds
Benzene, Toluene, Ethylbenzene, and Xylene (BTEX) at Sherman Elementary School and Chula Vista
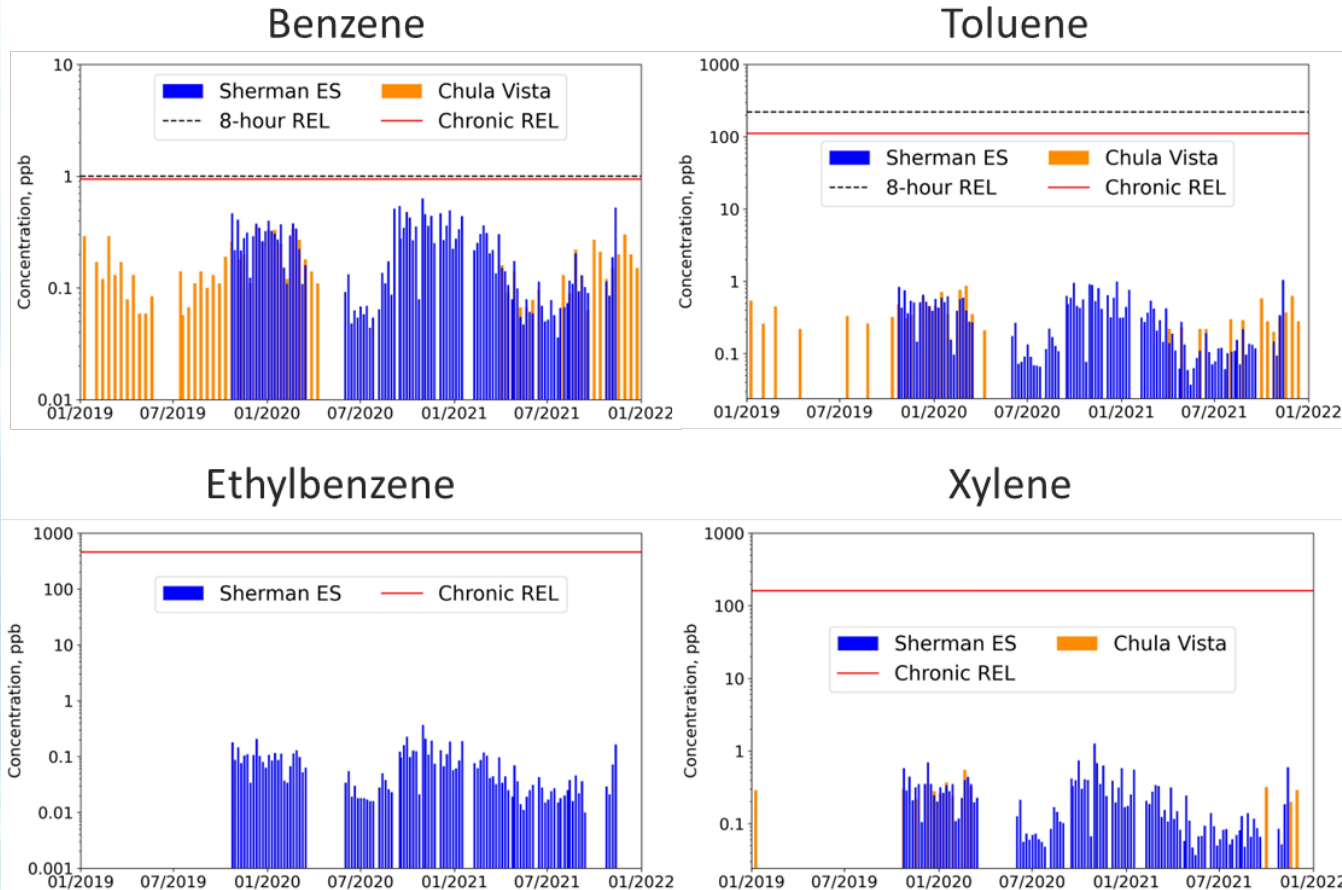
- Non-cancer health impact: BTEX concentrations were **below** the available Reference Exposure Levels (RELs)

- Benzene and ethylbenzene may cause cancer and their cancer risks are discussed later in the presentation

- Ethylbenzene concentrations at Chula Vista were all below the detection limit

- In general, BTEX concentrations showed **winter-high** seasonal patterns

* Reference Exposure Levels are the airborne concentrations of a chemical below which are not anticipated to result in adverse non–cancer health effects in the general population, including sensitive groups. For 8-hour RELs, the exposure averaging time is 8 hours, which may be repeated. Chronic RELs are designed to address continuous exposures for up to a lifetime; the exposure metric used is the annual average exposure.

Volatile Organic Compounds
Other Toxic Compounds
at Sherman Elementary School and Chula Vista

- Concentrations for most of the toxic compounds were below the available Reference Exposure Levels (non-cancer) except acrolein

  - Further analysis needs to be conducted to understand the cumulative impacts of all compounds
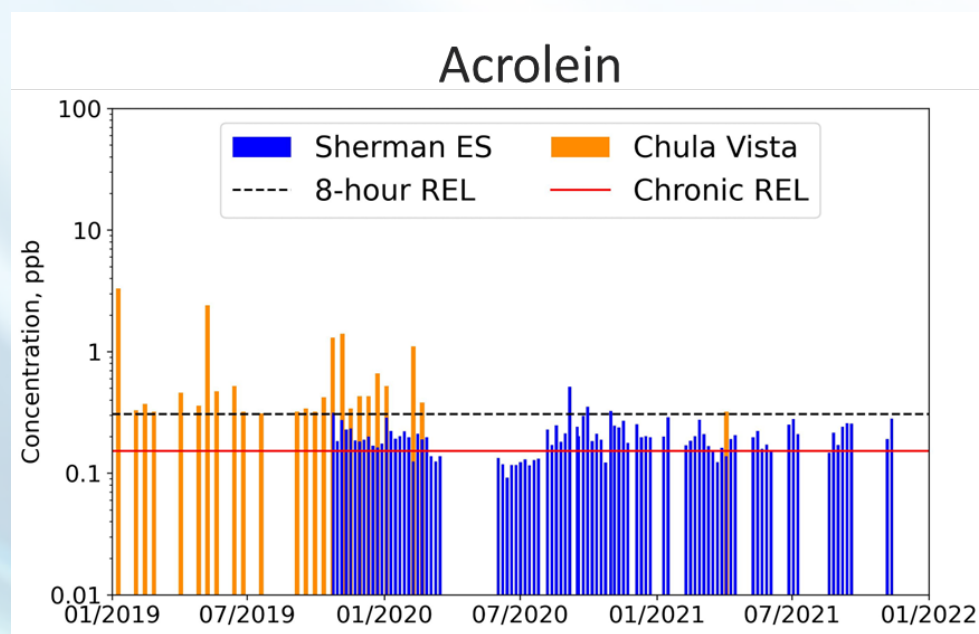
- **Acrolein** concentrations were **above** the Reference Exposure Levels (8-hour and chronic at both sites)

- Potential sources: motor vehicle exhaust, wood burning, cooking oil burning, cigarette smoke, reactions of other compounds

- Measurement challenges: acrolein in the air is very **difficult** to measure accurately. More work is needed to accurately quantify acrolein concentration

* Other major toxic volatile organic compounds from the urban area that were analyzed include 1,3-butadiene, 1,4-dichlorbenzne, acetaldehyde, ethylene dichloride, formaldehyde, MTBE, bromomethane, carbon tetrachloride, naphthalene, styrene, tetrachlorethylene, chloroform, dichloromethane, ethylene dibromide, trichloroethylene, vinyl chloride, etc.

CARB

Cancer Risk

- Definition: **Probability** of developing cancer if a person was exposed continuously to a toxic air pollutant over a **lifetime**.
    - It does not mean it will happen or indicate when a person will develop cancer
- Estimate cancer risks from **monitoring data** in the Portside community
    - Based on **annual mean concentrations** measured at **Sherman Elementary School**
        - Diesel particulate matter (converted from black carbon concentrations)
        - Volatile organic compounds
    - Results are expressed in **chance per million people**
    - Using CARB's Risk Assessment Standalone Tool
    - Following risk assessment guidance from California Office of Environmental Health Hazard Assessment
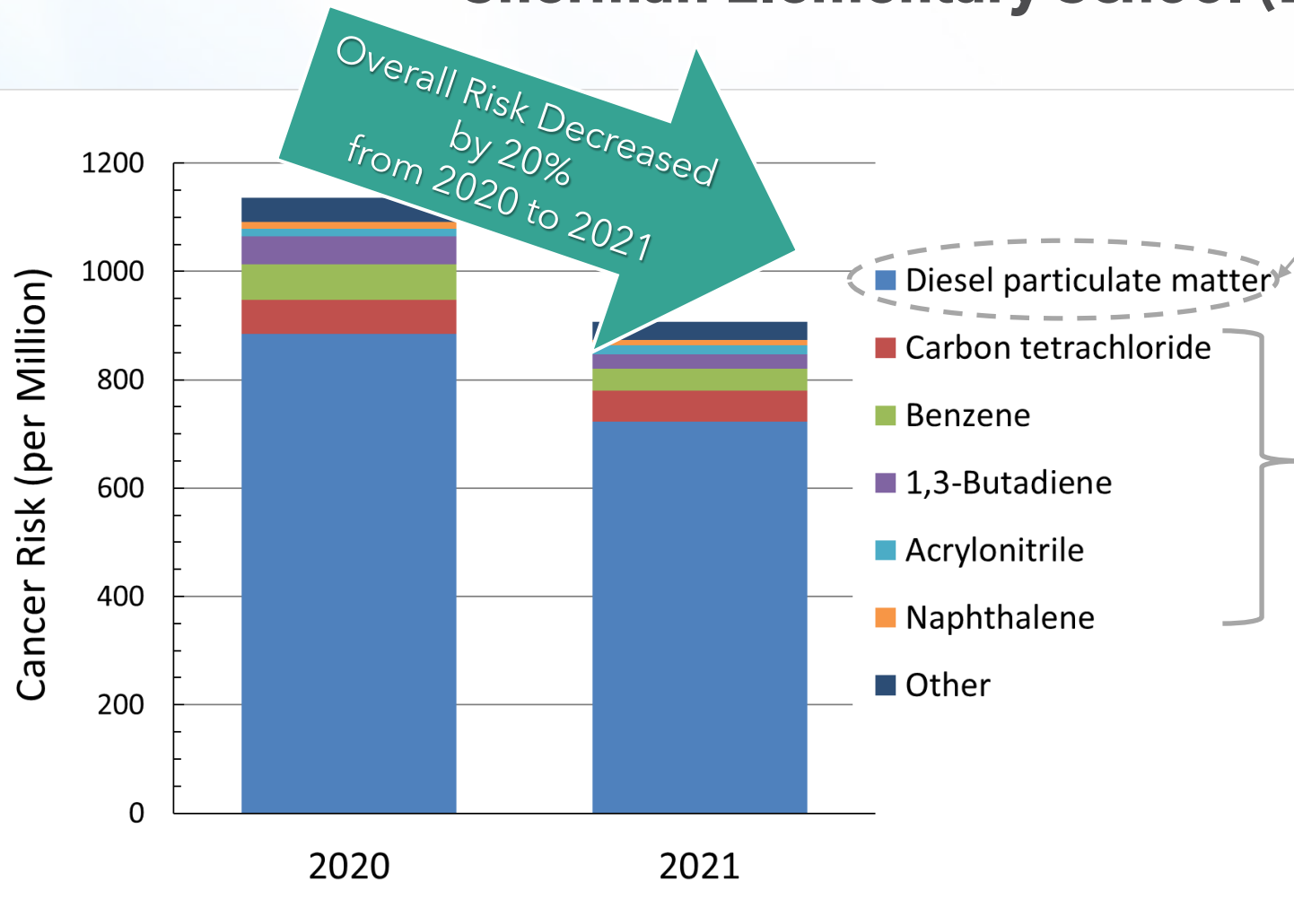
* Risk assessment guidance from California Office of Environmental Health Hazard Assessment (https://oehha.ca.gov/air/crnr/notice-adoption-air-toxics-hot-spots-program-guidance-manual-preparation-health-risk-0).

** CARB's Risk Assessment Standalone Tool: https://ww2.arb.ca.gov/resources/documents/harp-risk-assessment-standalone-tool

*** More information on health risk assessment can be found at: https://ww2.arb.ca.gov/resources/documents/health-risk-assessment

CARB

Cancer Risk
Sherman Elementary School (2020 and 2021)

Overall Risk Decreased by 20% from 2020 to 2021

Legend:
- Diesel particulate matter
- Carbon tetrachloride
- Benzene
- 1,3-Butadiene
- Acrylonitrile
- Naphthalene
- Other

Y-axis: Cancer Risk (per Million), 0 to 1200
X-axis: 2020, 2021

Diesel particulate matter is the **largest contributor**.

Pollutants (among all monitored) that have cancer risks greater than **10 per million**.

- Reduced activities during COVID pandemic may have affected 2020 and 2021 levels
- We will continue the estimation for future years as the data are available

* We will work with SDAPCD to obtain future monitoring data

CARB

Cancer Risk
Sherman Elementary School (2021 & 2020)

2021 vs. 2020

Overall Risk	- 20%
Diesel particulate matter	- 18%
Carbon tetrachloride	- 8%
Benzene	- 39%
1,3-Butadiene	- 50%
Naphthalene	- 17%
Acrylonitrile	+ 14%

Potential sources of major cancer-causing pollutants

o Diesel particulate matter: diesel exhaust from on-road heavy-duty trucks, off-road mobile equipment, truck refrigeration units, construction equipment, and stationary sources

o Benzene: motor vehicle exhaust, fuel oil leak, gasoline fumes

o 1,3-Butadiene: motor vehicle exhaust, forest fires, cigarette smoke

o Carbon tetrachloride: background level (previously used as fire extinguishers, dry cleaning solvent, refrigerant)

o Naphthalene: gasoline and oil combustion, cigarette smoke, consumer products (paints, insecticides)

o Acrylonitrile: motor vehicle exhaust, cigarette smoke

CARB

Comparison with What You See from CATA

- This is **not** a direct comparison, because the **two approaches are different**.

- Estimated cancer risks in million population for some common compounds are **qualitatively similar**.

Pollutant	Cancer risk (Chances per million people)	
	Monitoring (2020)	Modeling (2017)
Diesel Particulate Matter	900	1000
Benzene	65	50
1,3-Butadiene	50	60

CARB

Key Takeaways

- Where are the areas with high air pollution levels?
  - Diesel particulate matter concentrations are high **near the coast** (at Marine Terminal)
  - Estimated diesel particulate matter concentrations from the monitoring black carbon were also high at **Boston Ave site**.

- Can we identify/quantify potential risks associated with air pollution?
  - Major toxic volatile organic compounds except acrolein were **below existing Reference Exposure Levels**.
  - **Cancer risk** estimation showed **diesel particulate matter** to be the **greatest contributor**.
  - **Cancer risk decreased by 20%** from 2020 to 2021.

CARB

Ways to Access Data that were Analyzed

Access black carbon data via AQview:

- AQview is CARB's innovative cloud-based data system for managing community air monitoring data

- AQview provides easy access and visualization of air quality data from diverse sources in near real-time

Access volatile organic compounds data from CARB or SDAPCD:

- ADAM is CARB's data system for Toxics data (including volatile organic compounds). Data can be requested by emailing the ADAM team at adam@arb.ca.gov

- Data can also be obtained by contacting SDAPCD

https://aqview.arb.ca.gov/

Next Steps

Present data analysis and interpretation results for other pollutants	Update current analyses as new data become available	Explore potential and possibility for source attribution
• Black carbon • PM2.5 • PM10 • Metals	• Cancer risk	• PM2.5 • Volatile organic compounds

CARB

Thank you!
Questions?

CARB