



West Oakland
Environmental
Indicators
Project

WOCAP steering committee working session: Air monitoring update + Road dust

November 5, 2025

Content

- 1 Steering Committee Welcome
- 2 October Recap
- 3 WOAQ monitoring
- 4 Street Sweeping
- 5 Open forum



October - Clean Ports Program

Port of Oakland's Zero Emissions Project

- \$322 million, community-led initiative
- support over 660 pieces of zero-emissions equipment, including 475 drayage trucks
- Working with CBOs: WOCAN, Black Cultural Zone, Rose Foundation and WOEIP
- creating clean energy career pathways and **measurable** improvements in local air quality



WOCAP Strategies (2025 Focus)

- Optimizing the Port's appointment system (Strategy #FSM-6)
- The Port of Oakland studies the effects on truck flow, congestion and related potential health impacts due to increasing visits from larger container ships
- (Strategy #43)
- Continue the work of “greening” the shipping industry (Strategy #63)



Evaluation Process

Present the plan to the Community Steering Committees of:

- West Oakland
- Shafter
- Calexico / El Centro / Heber
- East LA / Boyle Heights / West Commerce
- Portside Environmental Justice Communities (San Diego)

Receive feedback on their priorities for this evaluation and potential interviewees.



Background Research:

What We *Think* We Know About West Oakland

Process - Strengths

- Seen as model in terms of process .
- Co-created with BAAQMD and WOEIP
- Extensive Subcommittees
- Third-party facilitator
- Consensus based decision-making

Process - Shortcomings

- Limited resident participation
- Maybe too many indicators
- Youth participation was limited
- Unclear if model is replicable due to time and resource intensiveness

Outcome - Strengths

- Alignment across policy levels
- Established targeted equity-based pollution reduction
- 114 project funded

Outcome - Shortcomings

- Did not achieve equity-based targets for pollution reduction
- PM 2.5 reductions did not meet target





**West Oakland
Environmental
Indicators
Project**

Analysis Update: West Oakland Air Quality Monitoring Network Results

Sonoma Technology

Steve Brown, Olivia Ryder, Lindsay Nash, Paul Moon

Agenda

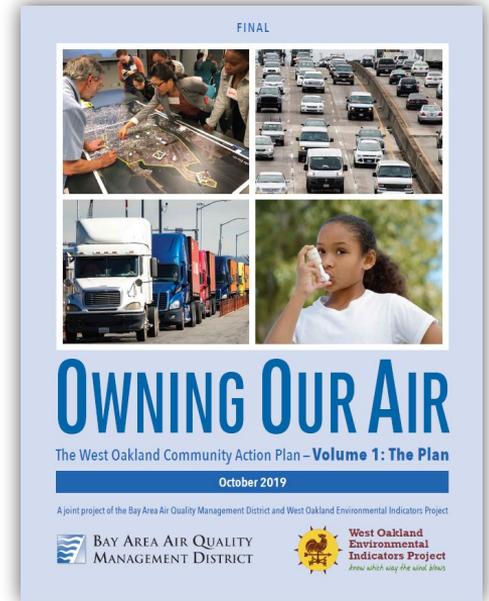
- Review of project scope and background
- Review of air monitoring goals

Air Quality Results

- Toxic metals
- Road dust
 - Concentrations in the air
 - Road silt before and after street sweeping

Review of West Oakland Air Quality (WOAQ) Monitoring Network

1. Goals: Measure air pollution in West Oakland with regard to WOCAP strategies and goals
2. Air monitoring
 - Community locations – what is the air quality in the community? Are pollution levels approaching WOCAP goals?
 - Street sweeping – does street sweeping change the amount of dust on the road and in the local air?



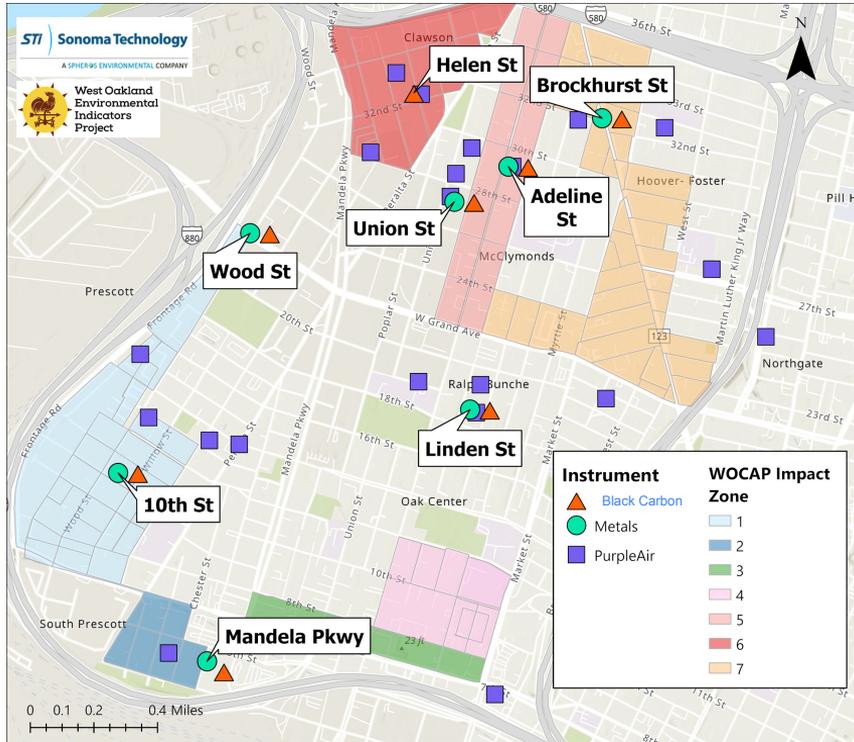
Air Monitoring Goals

1. Quantify road dust, diesel PM, and toxic metals in multiple community locations

- Assess variation in neighborhoods and compare to prior air monitoring, BAAD modeling, and WOCAP goals



West Oakland Air Quality Monitoring Network



- Speciated $PM_{2.5}$ (metals, dust) network
- Black carbon (diesel PM) network
- Hourly metals and dust measurements at 2 locations
- PurpleAir for PM mass

Targeted pollutants



$PM_{2.5}$



Black Carbon



Metals and hazardous air particulate pollutants

Air Monitoring Goals

1. Quantify **road dust, diesel PM, and toxic metals** in multiple community locations

- Assess variation in neighborhoods and compare to prior air monitoring, BAAD modeling, and WOCAP goals



2. Measure impact of **street sweeping** on road dust

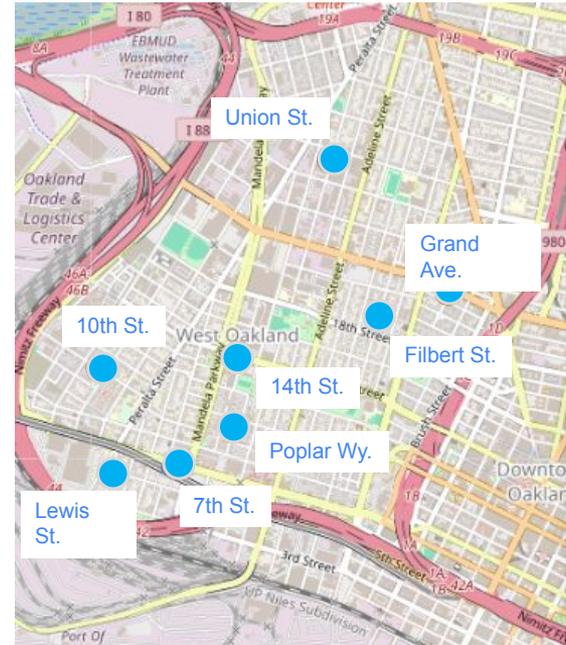
- Assess amount of dust on road removed, and whether there is a difference in ambient dust, after sweeping
- Assess amount of ambient dust compared to modeled, and whether dust concentrations are lower on days after sweeping



West Oakland Road Dust Evaluation

- In WOCAP, over one-third of local fine particulate matter modeled impacts ($PM_{2.5}$) was attributed to road dust
- Road dust emissions are anticipated to increase as traffic volumes increase over time.
- WOCAP Strategy #59: "City of Oakland increases the frequency of street sweeping to decrease road dust..."

Targeted pollutants	Instruments
Road Dust	<ul style="list-style-type: none">• Road silt sampling before and after street sweeping• Ambient dust on days before and after street sweeping



Blue circles are where we did road silt sampling

Toxic Metals

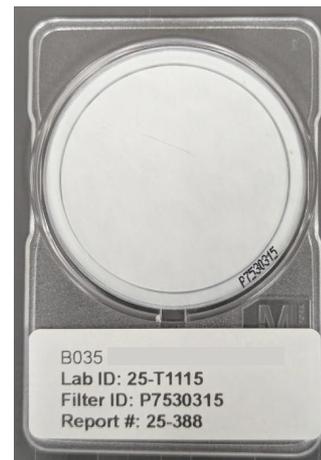
In WOCAP, non-diesel toxics such as metals are part of the overall risk in the community. Measurements can help identify sources and where concentrations are highest .

Key Questions:

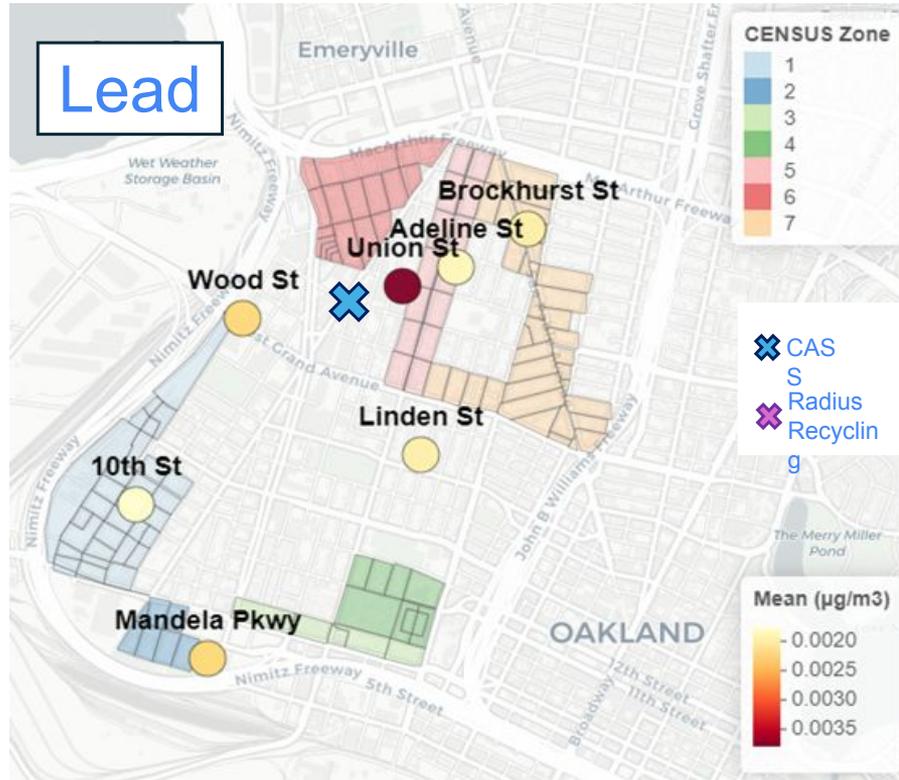
1. How do the toxic metals concentrations vary by location?
2. What are the possible sources and local impacts?

Metals: Background

- Metals are prevalent in the environment,
 - Some are toxic (arsenic, lead, nickel); these are predominantly from industrial sources
 - Others are non-hazardous, like those that make up soil (calcium, silicon, aluminum, etc.), though they make up total PM2.5 mass which can have health impacts.
- Collect onto a filter over 24-hour period; analyzed at lab by XRF for over 30 metals.
- Samples were collected at 7 locations across West Oakland for > 1 year.



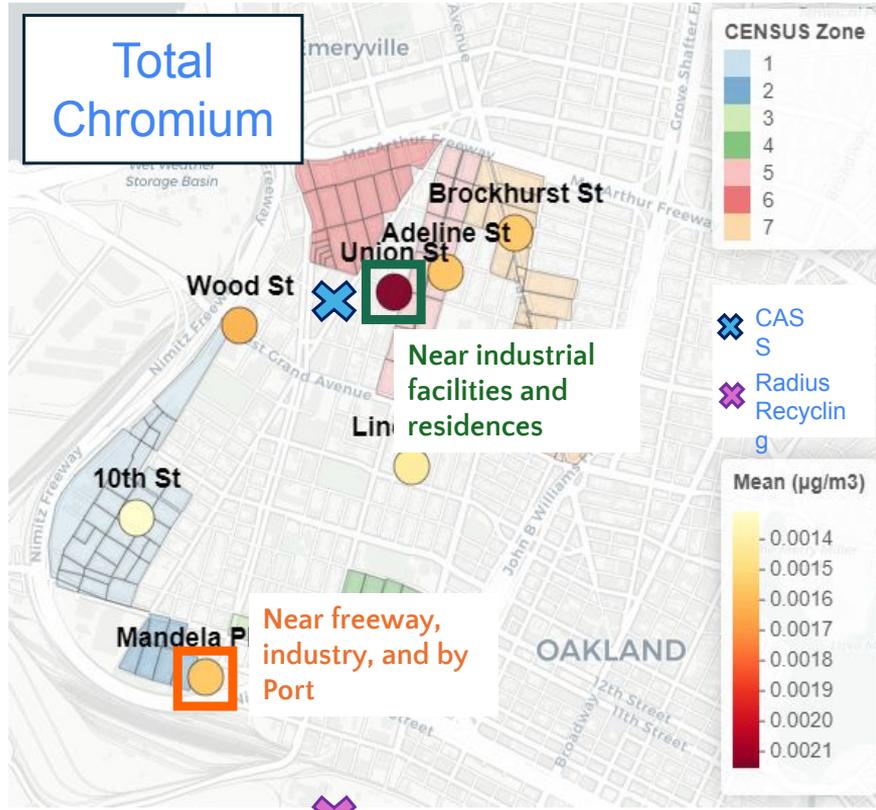
How Do Toxic Metals Vary By Location?



- Lead is released from production of lead compounds and alloys, and from coal and oil burning.
- Lead was found to be highest at **Union Street**.
- Concentrations of lead were **lower** than the OEHHA Cancer Risk threshold, (no increased cancer risk)



How Do Toxic Metals Vary By Location?



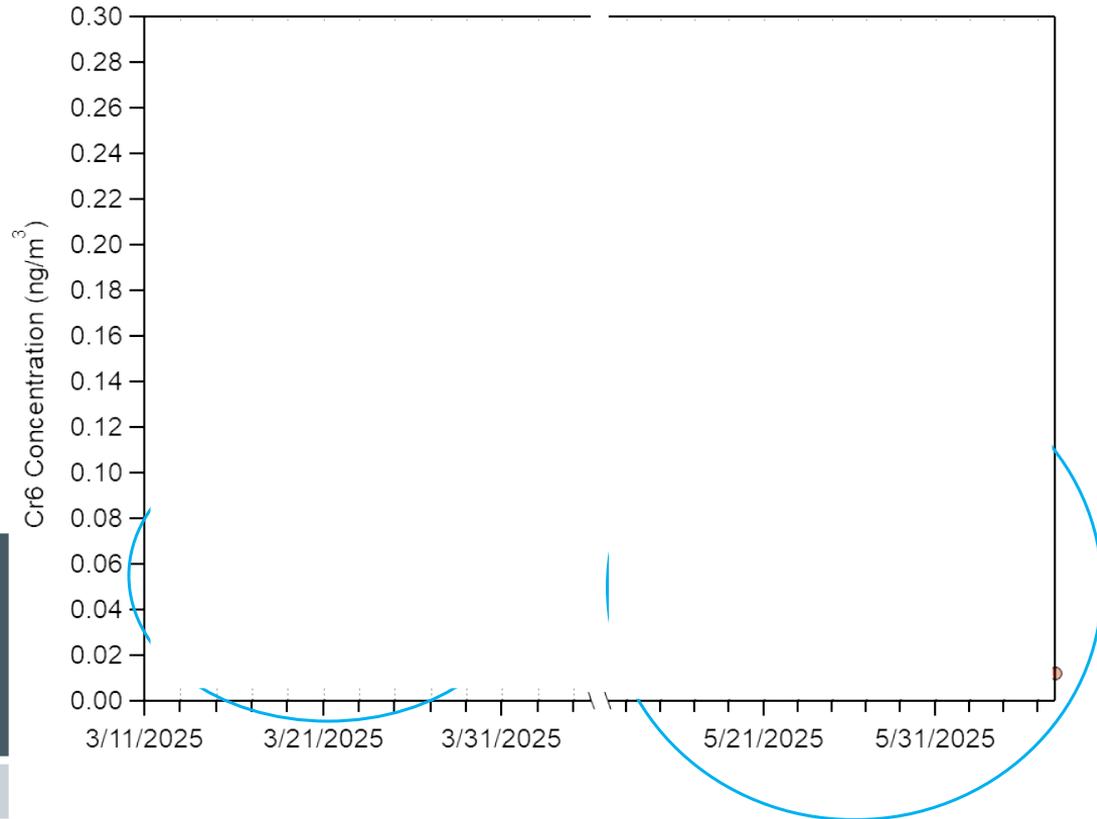
- **Total Chromium** was also highest at **Union Street**.
- Chromium is produced during a variety of industrial activities

- **Chrome-6** (Cr-6, hexavalent chromium) is a form of chromium that increases the risk of cancer in humans
- Due to its carcinogenic nature, we performed Cr-6 specific monitoring at two sites in March–April 2025, and continued at Union St in May

Cr-6 Results

- Results represent a snapshot of Cr-6 concentrations only on the days when sampling occurred.
- Cr-6 concentrations at the two sites are similar until April 2, when Union Street increases to 14 x higher levels.
- May-June 2025 Union Street concentrations spiked on May 16, but not to April 2 levels.
- Elevated concentrations likely due to

Site	Average concentration (ng/m ³)	If for a full year, Lifetime Cancer Risk (per million people)
WOEIP	0.049	7
Union St.	0.065	10



Cr-6 Results

- Results represent a snapshot of Cr-6 concentrations only on the days when sampling occurred.
- Cr-6 concentrations are similar to background levels, but increase during the May-July period.
- May-July concentrations are not reaching the level of concern.

- Cr-6 was highest at Union St.
- While concentrations are not always elevated, they do spike, especially at Union St.
- These spikes contribute to an increased health risk to nearby residents.



Site	concentration (ng/m3)	Cancer Risk (per million people)
Union St.	0.065	7.29
WOEIP	0.049	9.81

Metals Summary

How do the toxic metals concentrations vary by location? What are the possible sources and local impacts?

- Highest concentrations of arsenic, lead, and total chromium were detected at Union Street, showing the impact of local sources.
- Metals concentrations at Union St were highest with winds from the west, while at WOEIP with winds from the south.
- Cr-6 sampling at Union Street and WOEIP revealed elevated concentrations at both locations, likely due to nearby industrial facilities.

What Next

- Metal concentrations are variable across the community, meaning that nearby, local sources are generally the most important for any given neighborhood
- Chromium-6 may be a significant concern for residents near these types of sources
- Emissions from the metal recycler south of the freeway can impact the community when winds are from the south; there is ongoing work regarding these sources.

Road Dust & Street Sweeping

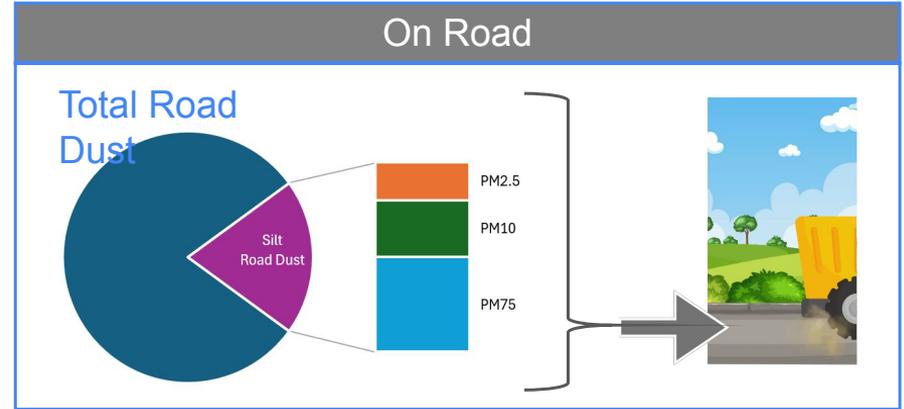
1. What is the composition of road dust, and does it vary by location?
2. How effective is street sweeping in reducing the silt on the road?
3. Are road dust concentrations lower in the air after street sweeping?

Why street sweeping??



What is Dust?

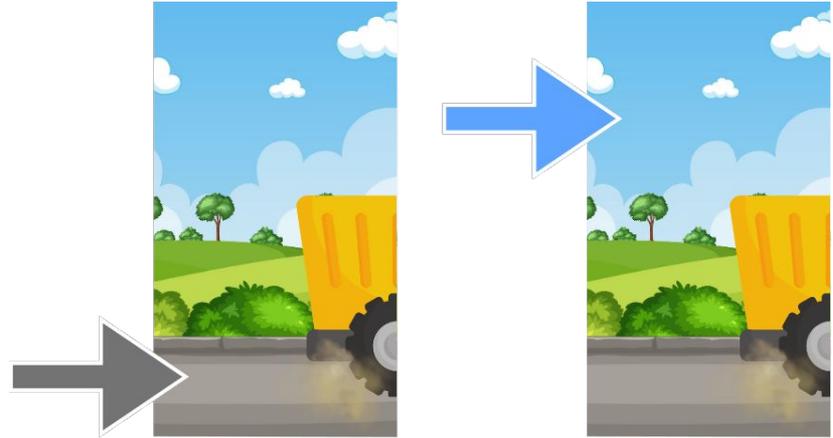
- **Road dust:** solid particles that are generated by any mechanical processing of materials, including crushing, grinding, rapid impact of materials on a roadway.¹
- **Silt** is a subset of road dust; Material equal to or less than 75 micrometers [μm] in diameter
- **Silt road dust** includes $\text{PM}_{2.5}$ and PM_{10} , which can become airborne when kicked up by tires moving or wind.



- **Airborne $\text{PM}_{2.5}$ dust** is composed of dust from road dust and wind-blow dust. Recent work by UC Riverside found that wind blown dust in urban Southern California was ~2% of $\text{PM}_{2.5}$, with most of the measured dust due to road dust (Assessment of Paved Road Dust Emissions; April 2025; Hopkins et al).

Measuring Effectiveness of Street Sweeping (Prior Studies)

- Effectiveness of street sweeping at reducing road dust PM emissions and improving air quality is not well studied compared to other pollution sources and control measures.
- Two assessment methods:
 1. Amount of silt on the road
 2. Air concentrations near the road.
- **Conflicting study results.** Most studies see no significant change or higher PM directly after sweeping; a few studies see reductions (winter, Toronto, where road salt is applied).
- **Combination of street washing** after street sweeping shows beneficial results to removal of road dust.



Road Dust Sampling and Analysis

- Road dust is collected using an adaptation of EPA Method AP-42 and Das and Wiseman et al¹
- Collection uses broom and vacuum to collect road dust
- Samples are weighed and sent to the lab
- The laboratory determines the silt fraction (portion of total mass that has size <75 μm [<200 mesh]) using sieve analysis
- The silt is then further fractionated to PM_{10} and $\text{PM}_{2.5}$ using resuspension sampling²
- Samples were collected on weeks without rain between July – Dec 2024 and April – August 2025



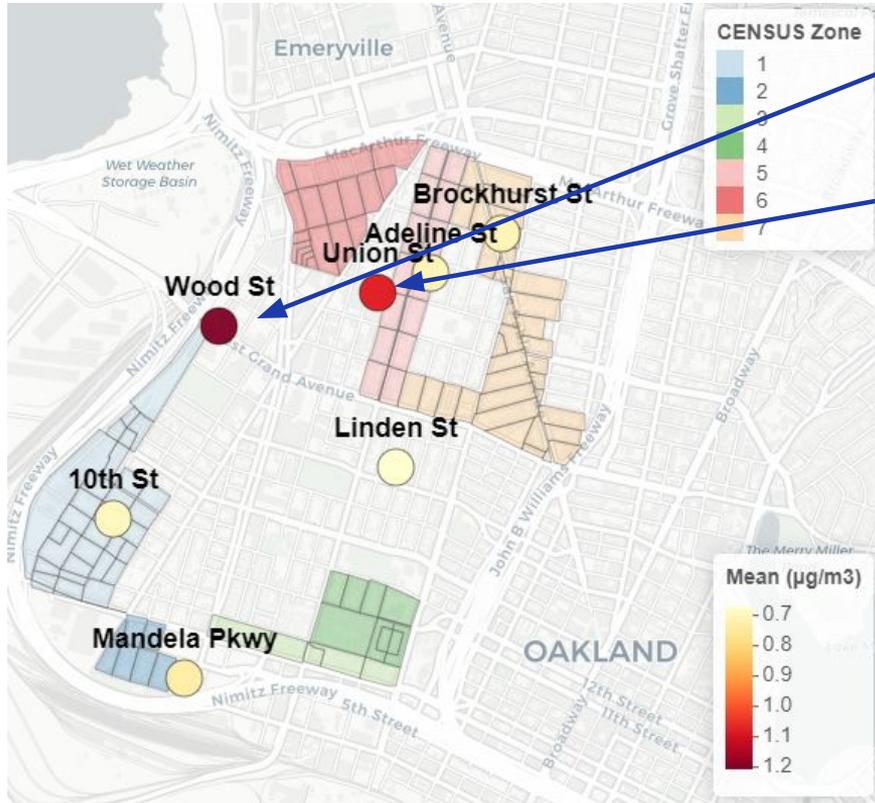
Image of sampling area in West Oakland

1. Das, Sourav, and Clare LS Wiseman. "Examining the effectiveness of municipal street sweeping in removing road-deposited particles and metal (loid) s of respiratory health concern." *Environment International* 187 (2024): 108697.
2. Sarver, R. H. (1996). Aerosolization as a means of sample preparation of geological materials for XRF analysis and its validity compared to EPA method 3050a digestion. *Journal of the Air & Waste Management Association*, 46(3), 234-240.

How Does Airborne PM_{2.5}
Dust Vary By Location ?



Airborne PM_{2.5} Dust By Location



- The highest concentration of airborne PM_{2.5} dust was at **Wood Street**. This is possibly due to the proximity to highway 880 and Grand Ave.
- **Union Street** also had relatively high ambient dust levels, which may be due to increased truck activity at nearby facilities

Site	Average Concentration (µg/m ³)
Wood St	1.20
Union St	1.07
Mandela Pkwy	0.73
Brockhurst St	0.71
Adeline St	0.71
10th St	0.70
Linden St	0.67

How Does Street Sweeping Impact Silt on Roads?



Does Street Sweeping Remove Roadway PM?



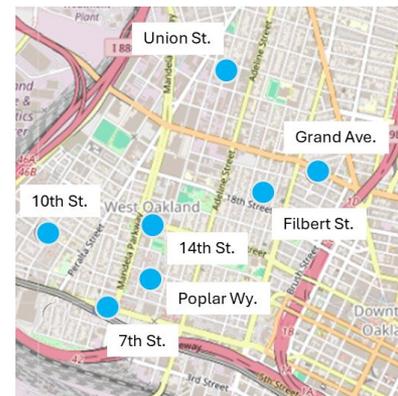
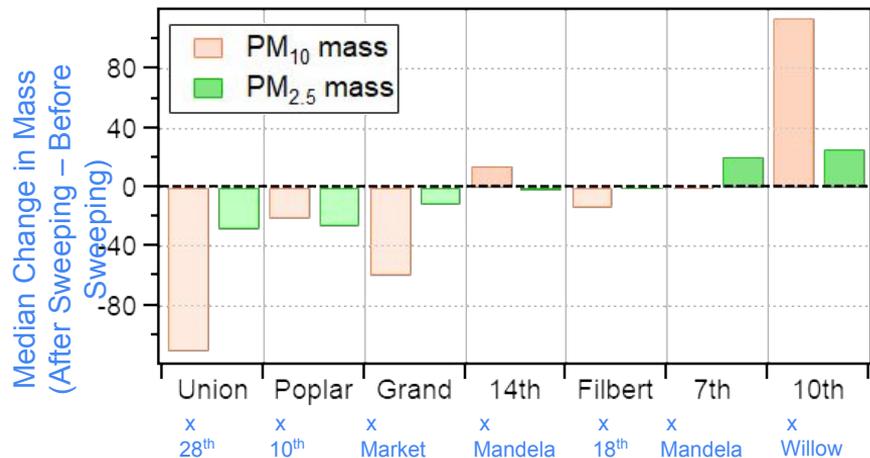
- Compared the mass of total material, silt, $PM_{2.5}$ and PM_{10} on the road before and after street sweeping.
- 6 to 20 weeks sampled per site

At most locations:

- Street sweeping often removed silt and PM from the road.
- Largest reduction in both $PM_{2.5}$ and PM_{10} at Union Street, which has the highest ambient dust and among the highest silt mass.
- There does not appear to be a correlation between PM reduction and road type.

At 10th and 7th street

No reduction of total material, silt, or PM was observed after sweeping; high week-to-week variability; 7th swept daily.



Are $PM_{2.5}$ Road Dust
Concentrations Lower in
the Air After Street
Sweeping?



Are Airborne Road Dust Concentrations Different After Street Sweeping?



$$\% \text{ Road Dust} = \frac{\text{Road Dust}}{\text{Total PM}_{2.5}} \times 100$$

Site	Sweep Day	Change in Conc. ($\mu\text{g}/\text{m}^3$)	Change in % of Ambient PM that is Dust
Union St	Fridays	- 0.5	- 1.3
Brockhurst St	Fridays	- 0.2	- 0.7
10th St	Thursdays	-0.04	- 0.6
Linden St	Thursdays	+ 0.1	0.0
Adeline	Thursdays	+ 0.1	0.0

- Compared the difference in ambient dust amount on the day before street sweeping with the amount on the day after street sweeping.
- Results show a **decrease or no change** in the amount of PM that is dust after street sweeping.
- Saw the largest reduction in road dust concentration at Union St., which has the 2nd highest ambient dust concentrations
- Sites not listed did not have sweeping.

Summary

How Does PM_{2.5} Dust in the Air Vary By Location?

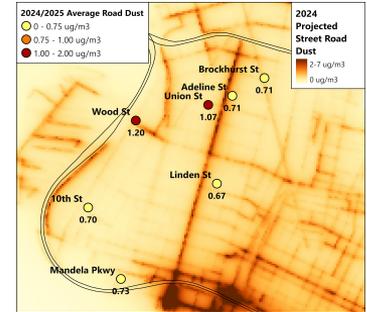
- There is a 2x difference among sites; PM_{2.5} dust was highest at Wood Street and Union Street.

How Does Street Sweeping Impact On-Ground Road Silt?

- Street sweeping generally reduced silt from the road at most locations.

Are PM_{2.5} Dust Concentrations Lower in the Air After Street Sweeping?

- The % of PM_{2.5} from dust is slightly lower or the same on the day after street sweeping.



What Next

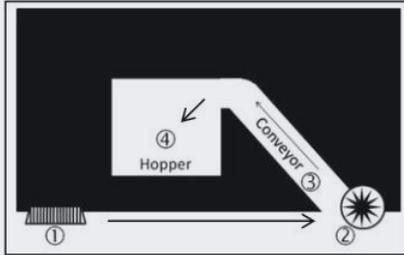
- Current street sweeping has a small impact on local airborne $PM_{2.5}$;
- *Use of more advanced sweepers could provide a larger decrease in road silt and resulting ambient $PM_{2.5}$.*
- Total airborne dust is highest at Wood St and Union St locations; this is likely a combination of higher traffic creating local dust and potentially uncovered/open lots or piles
- *Focusing more sweeping in areas with higher silt or other dust sources could help reduce local PM.*
- There are periodic high concentrations of dust from local uncovered piles that can be an intermittent nuisance to local residents;
- *Ensuring these are covered and/or watered could have an immediate impact.*

Types of Sweepers

Basic

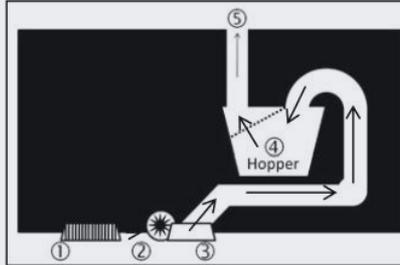
Best

Mechanical Broom



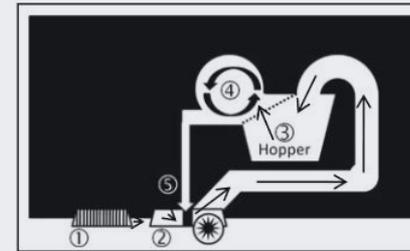
- Motorized brush sweeps debris up a conveyor belt to a storage tank
- Primarily used in Oakland

Vacuum



- Vacuum can pull more dust but exhaust to the community.
- Can be PM₁₀ certified* with appropriate filter.

Regenerative Air

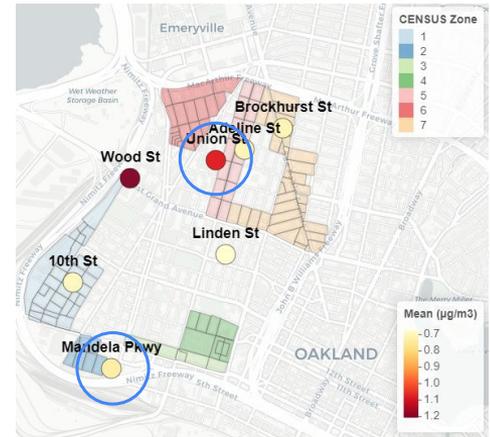
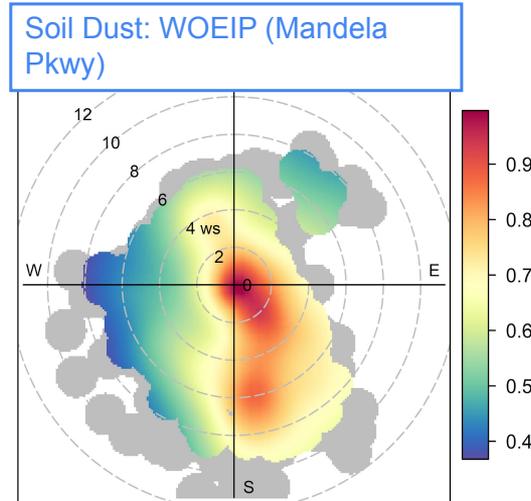
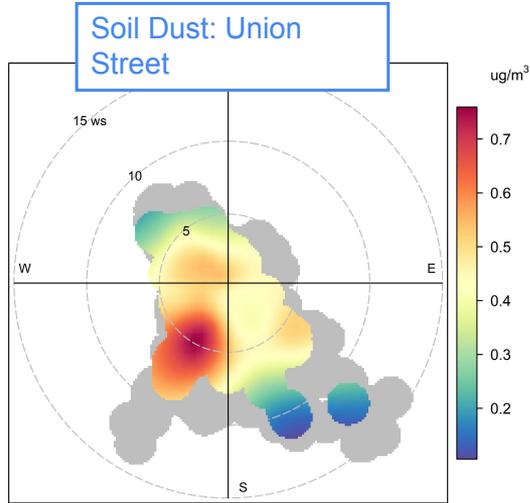


- Exhaust air is recirculated to remove more dust from road
- Challenging to use if large debris on street

*South Coast AQMD maintains list of “PM₁₀ certified” sweepers (rule 1186), which have been proven to limit the amount of PM₁₀ resuspended during sweeping.

Where Does Airborne Dust Originate?

- A continuous metals monitor was set up at WOEIP and at Union Street.
- Combined with wind data, this allows us to determine the direction where different metals are coming from.
- Here we have combined the metals that comprise soil and are showing where they are coming from using a polar plot (heat map) analysis



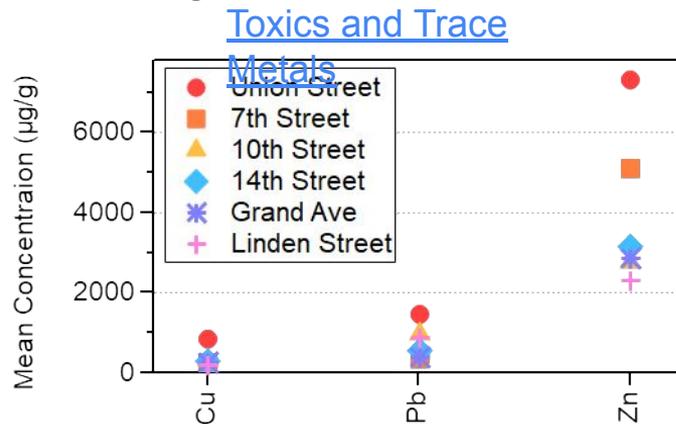
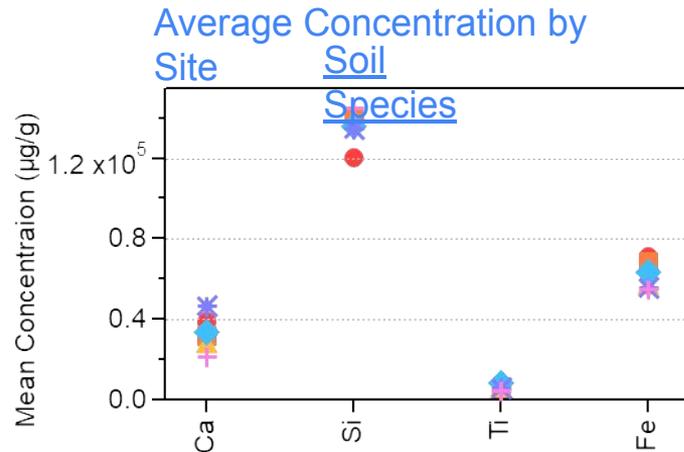
- Airborne PM_{2.5} dust at Union Street originates in the southwest, consistent with the direction of CASS, cement facilities and other industrial areas
- At WOEIP, it originates from the south and southeast, direction of freeway and industrial areas

What is the Composition of Road Dust, and How Does it Vary By Location?



How does chemical composition of road dust PM ^{2.5} vary by location?

- Generally, soil species (Silicon, Titanium, Iron, Calcium) are very similar across sites.
- Toxics and other trace metals show more variation, with Union Street measuring as much as 3x higher Zn, Pb, and Cu



Open Forum

Open House: 12/3 from 5-7:30pm



Thank you.



West Oakland
Environmental
Indicators
Project