West Oakland Air Pollution Studies

Presented by Environmental Defense Fund

Port of Oakland Maritime Air Quality Improvement Plan
Task Force Meeting
May 9, 2018

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INTRODUCTION

Air Pollution in West Oakland

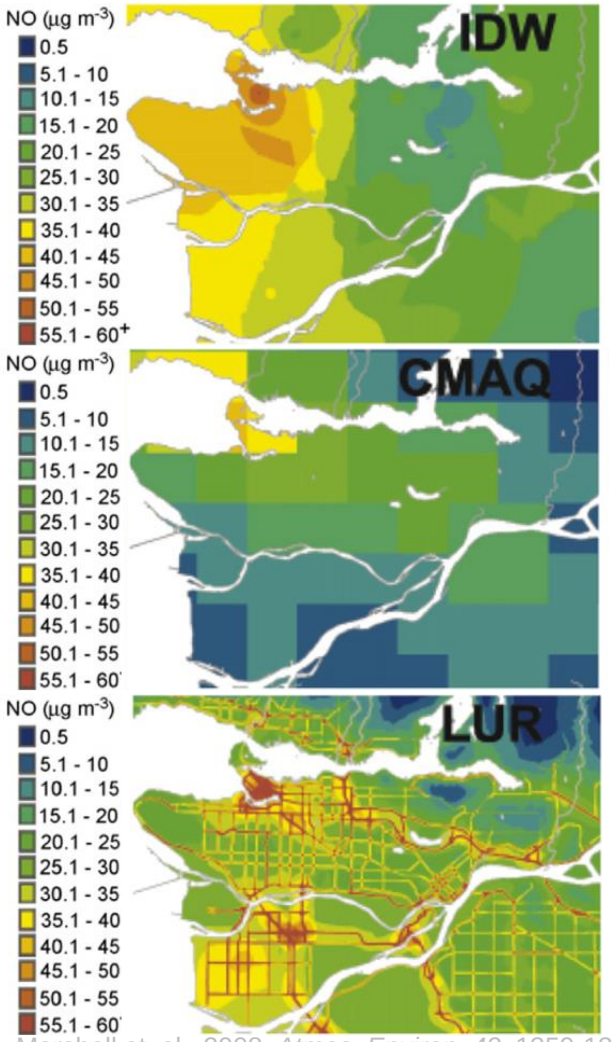
Diesel PM exposure 90th percentile (CalEnviroScreen)

How Is Air Pollution Measured?

stationary networks, satellite, modeling

Example of stationary monitoring site

Examples of modeled air pollution data

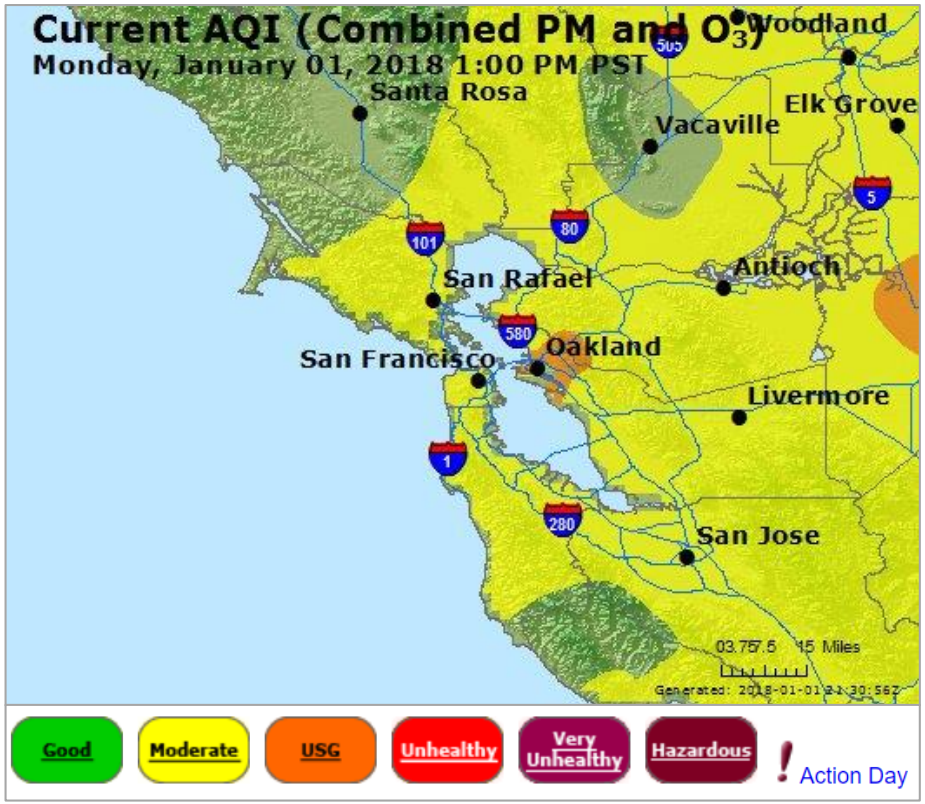


Marshall et. al., 2008, *Atmos. Environ. 42*, 1359-1369

Current status of air pollution and health information available to the public

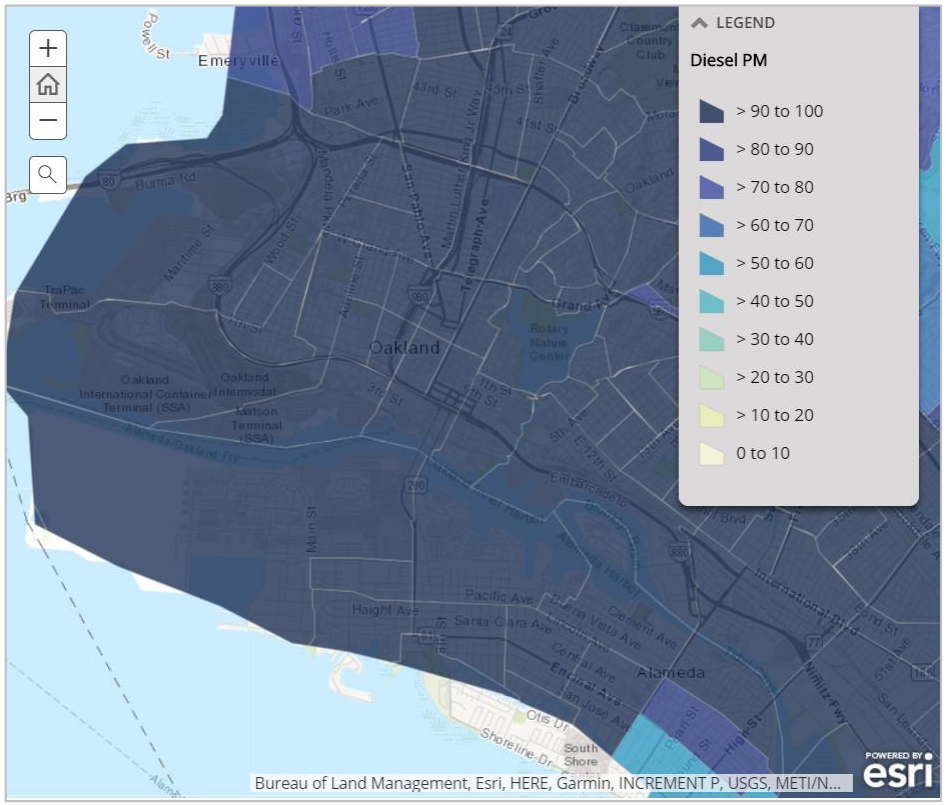
But is air pollution uniform across these area?

EPA AirNow



www.airnow.gov

CalEnviroScreen



oehha.ca.gov/calenviroscreen/maps-data

STUDY 1

100X100 BLACK CARBON SENSOR NETWORK

100×100 Study: A West Oakland Community Air Quality Study

Chelsea Preble

Julien Caubel

Troy Cados

Thomas Kirchstetter

Study Team

UCB/LBNL

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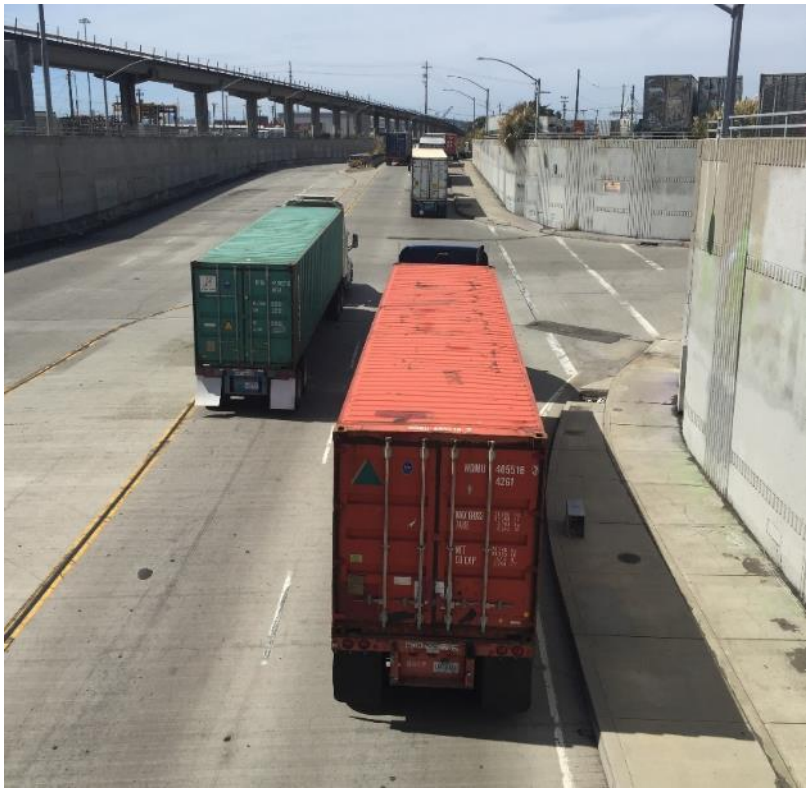
BAAQMD, Steve Randall, Phil Martien

Black Carbon: Sources & Impacts

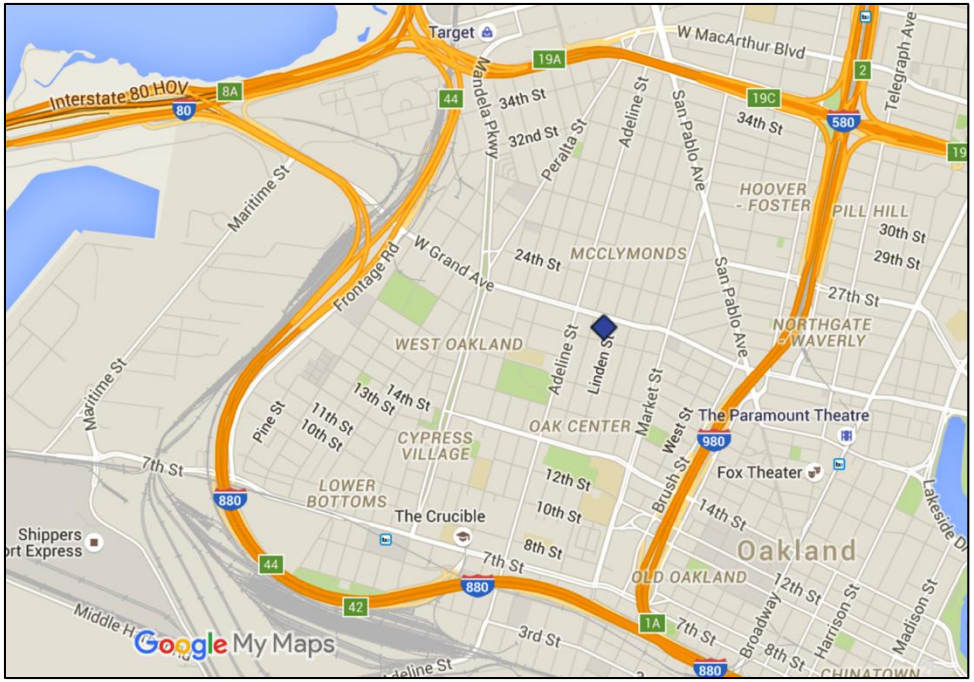
Trucks play a vital role in moving freight, but black carbon (BC) soot emitted from diesel engines is of concern

- Emitted close to people, associated with adverse health outcomes, including cancer, cardiovascular and respiratory disease
- Short-lived climate pollutant, contributes to global warming



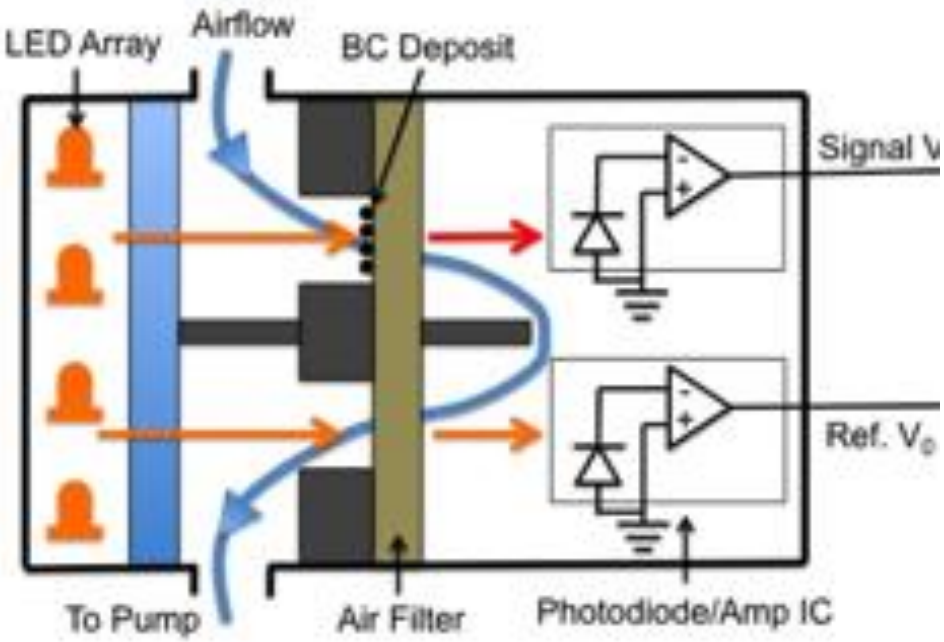
Commercial BC Analyzers: Expensive

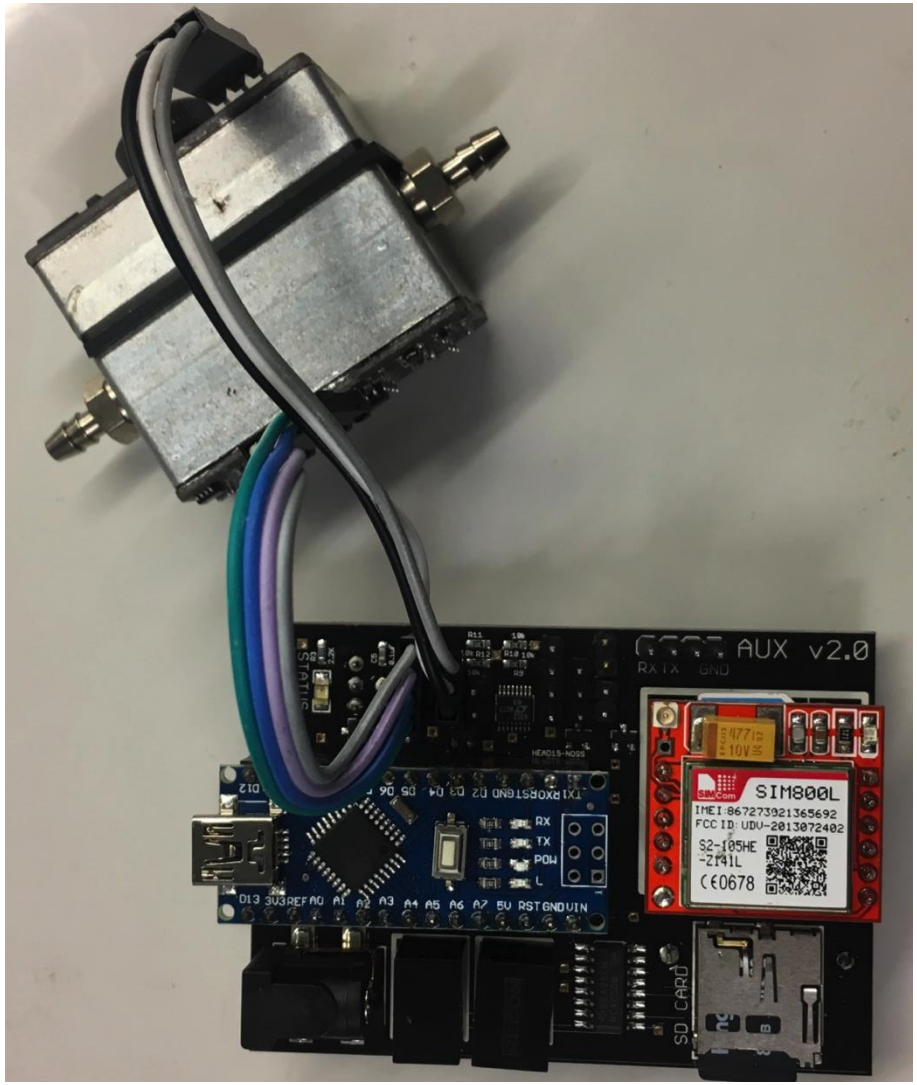
- Commercial sensors are prohibitively expensive to deploy more than one within a neighborhood
- Example: The Bay Area Air Quality Management District operates one black carbon monitor ($25K) in West Oakland



UCB/LBNL Low-Cost BC Sensor

We developed a low-cost BC sensor with similar measurement principle as commercial instruments





UCB Low-Cost BC Sensor

Caubel, Cados, Kirchstetter (2018) A New Black Carbon Sensor for Dense Air Quality Monitoring Networks, *Sensors*

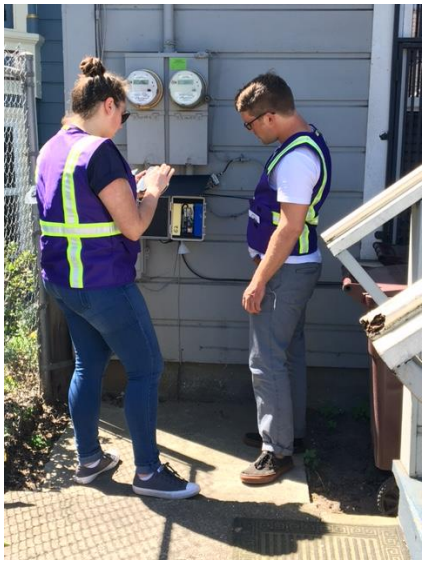
Solar panel
(DC plug optional)

Zip-tie mounting

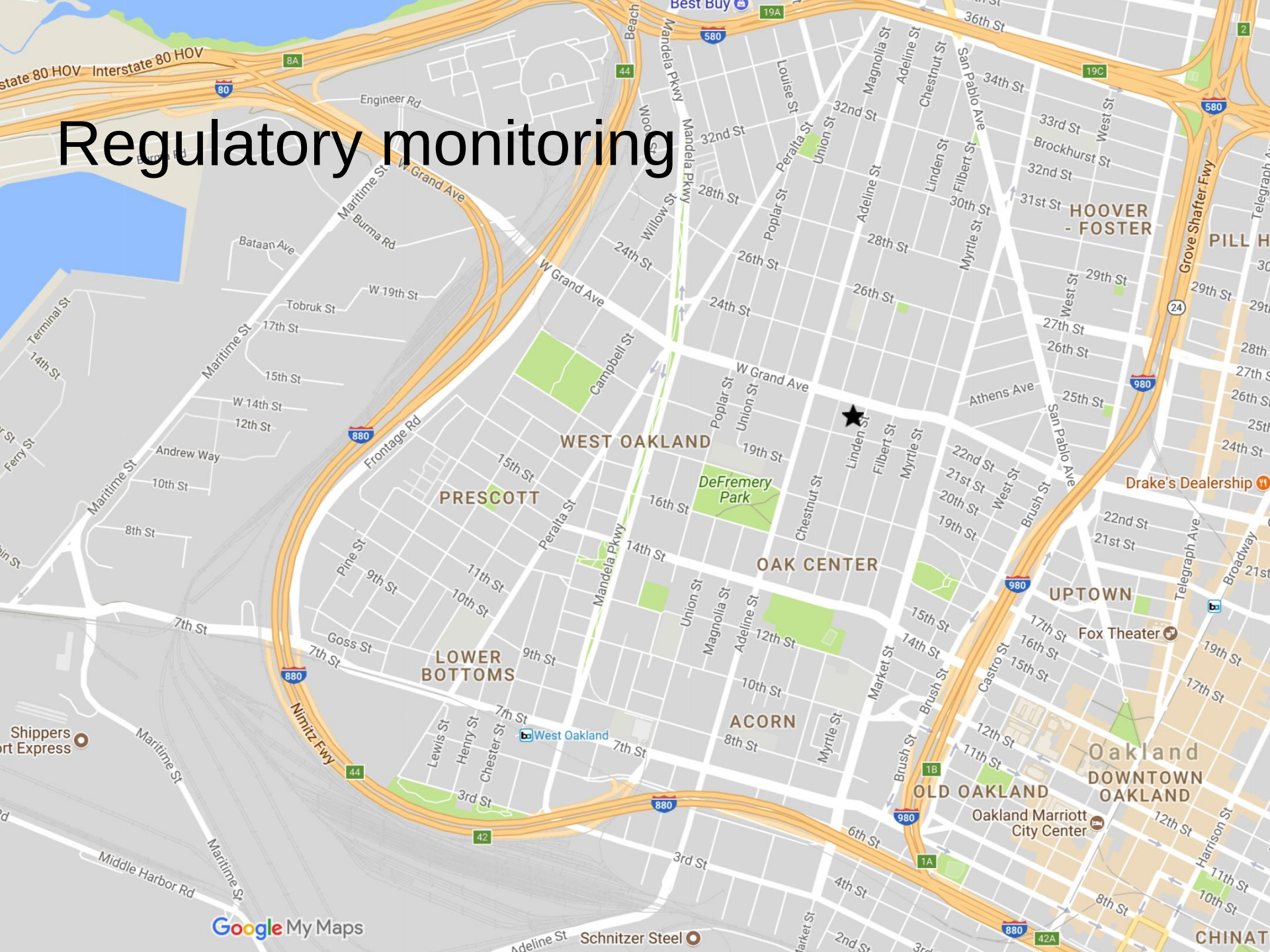
Weather-proof box

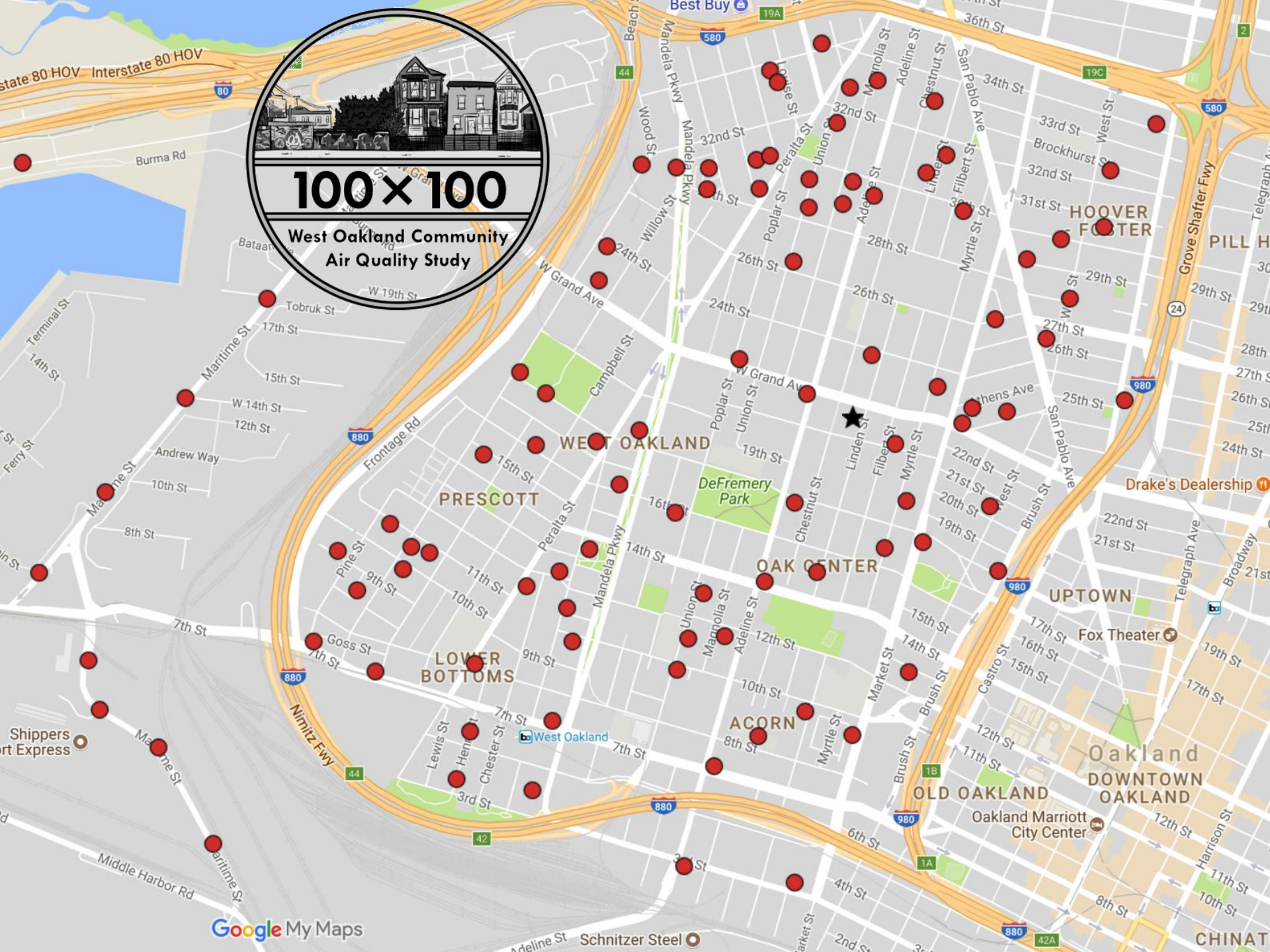
Inlet
(with rain cover)

Assembly of the 100×100 network at homes and businesses across West Oakland



Regulatory monitoring




100 × 100
West Oakland Community
Air Quality Study
Interstate 80 HOV
Best Buy
Burma Rd
Bataan
W 19th St
Tobruk St
17th St
15th St
W 14th St
12th St
Andrew Way
10th St
8th St
7th St
Terminal St
14th St
Maritime St
Frontage Rd
Nimitz Fwy
Middle Harbor Rd
Shippers
rt Express
Google My Maps
Schnitzer Steel
Adeline St
Wood St
Mandela Pkwy
Willow St
Campbell St
Poplar St
Union St
Peralta St
Magnolia St
Adeline St
Chestnut St
Linden St
Filbert St
Myrtle St
Market St
Brush St
Castro St
Harrison St
Telegraph Ave
Broadway
Grove Shafter Fwy
Brockhurst St
West St
Athens Ave
Drake's Dealership
Fox Theater
Oakland
DOWNTOWN
OAKLAND
OLD OAKLAND
Oakland Marriott
City Center
UPTOWN
HOOVER
FOSTER
PILL H
WEST OAKLAND
PRESCOTT
DeFremery
Park
OAK CENTER
LOWER
BOTTOMS
ACORN
West Oakland
Pine St
Goss St
Lewis St
Chester St
Henry St
3rd St
4th St
6th St
8th St
9th St
10th St
11th St
12th St
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27th St
28th St
29th St
31st St
32nd St
33rd St
34th St
36th St
Beach St
Louise St
Union St
Adeline St
Chestnut St
San Pablo Ave
Myrtle St
Filbert St
Linden St
West St
Brush St
Market St
Castro St
Harrison St
Telegraph Ave
Broadway
Grove Shafter Fwy
Google My Maps

Thank You

STUDY 2

AIR POLLUTION MAPPING WITH GOOGLE STREET VIEW CARS

High Resolution Air Pollution Mapping with Google Street View Cars

www.edf.org/airqualitymaps

EDF ENVIRONMENTAL DEFENSE FUND
Finding the ways that work

Google Earth Outreach

TEXAS
The University of Texas at Austin

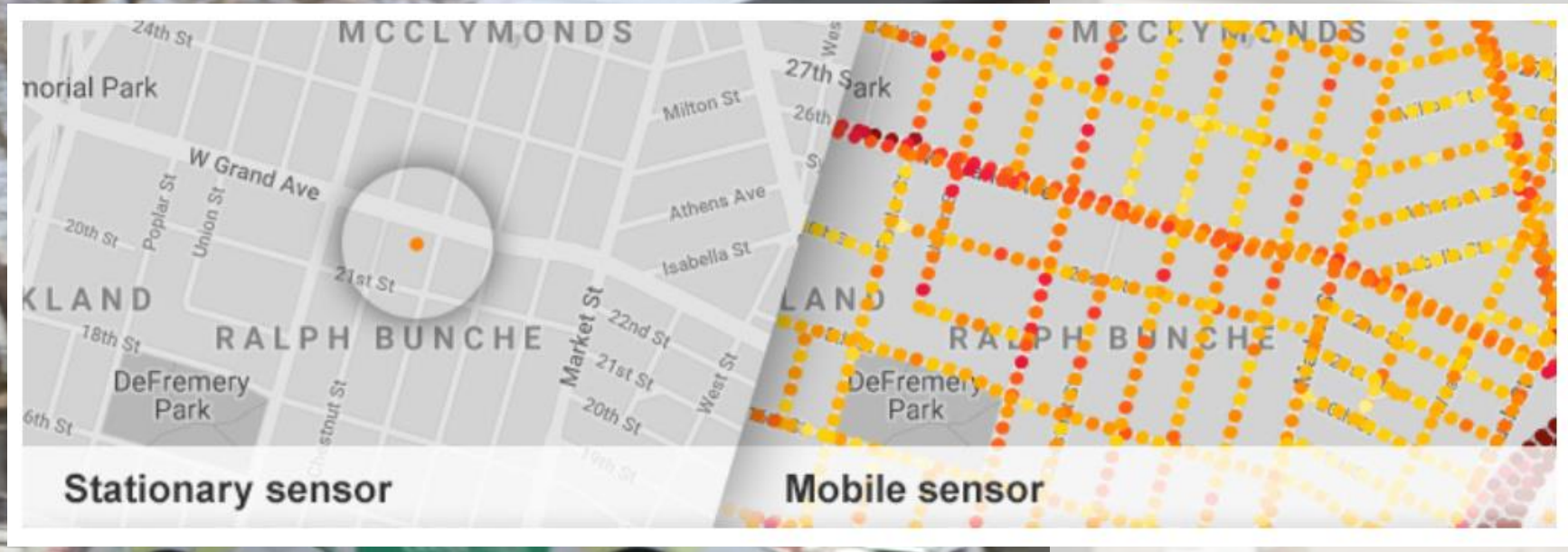
aclima

BAY AREA AIR QUALITY MANAGEMENT DISTRICT

KAISER PERMANENTE®

Mobile Monitoring with GSV

www.edf.org/airqualitymaps



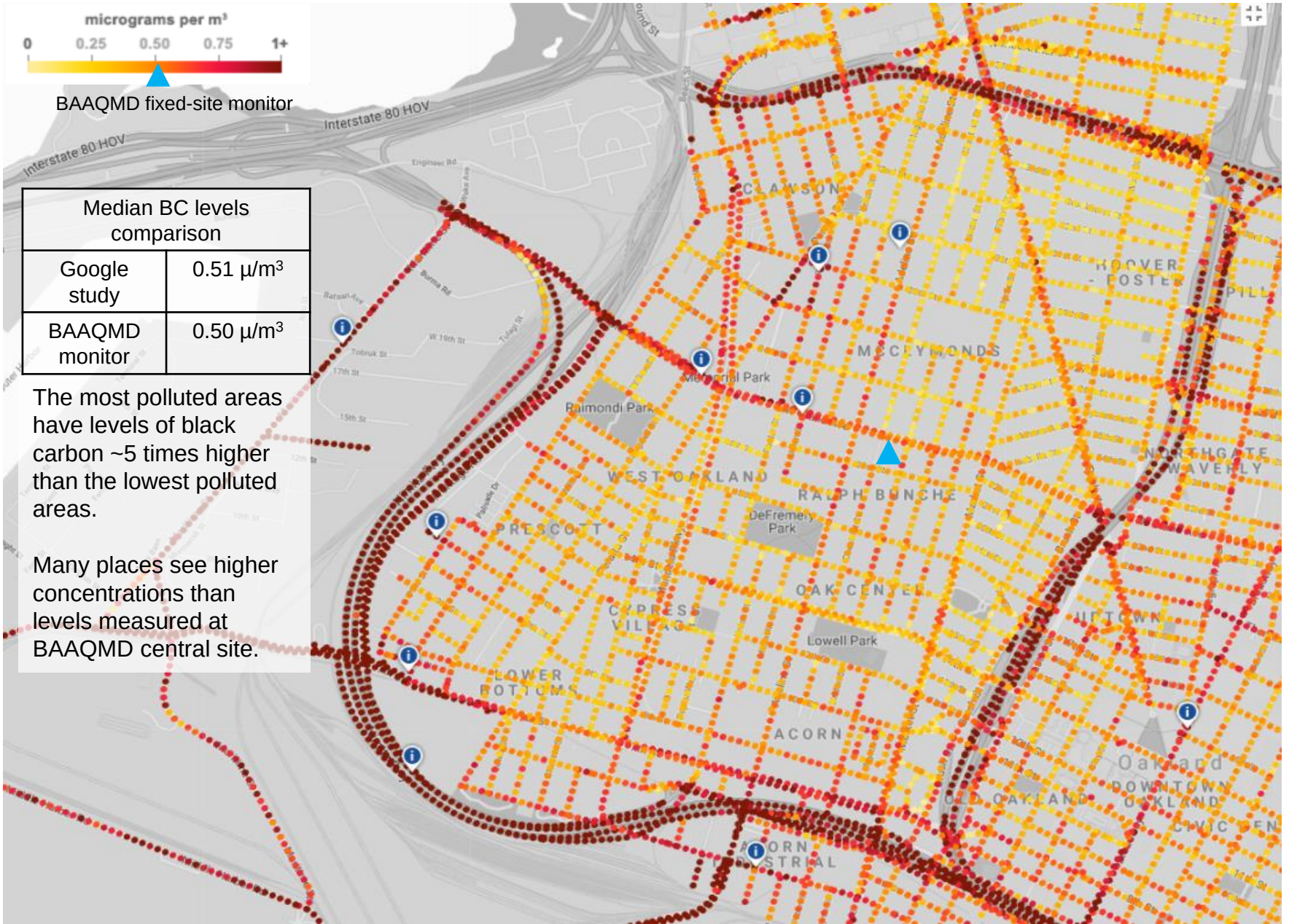
DATA COLLECTION

Each road segment (30 m) has ~100 observations

3×10^6 data points

Air pollution is unevenly distributed

West Oakland – Black Carbon www.edf.org/airqualitymaps



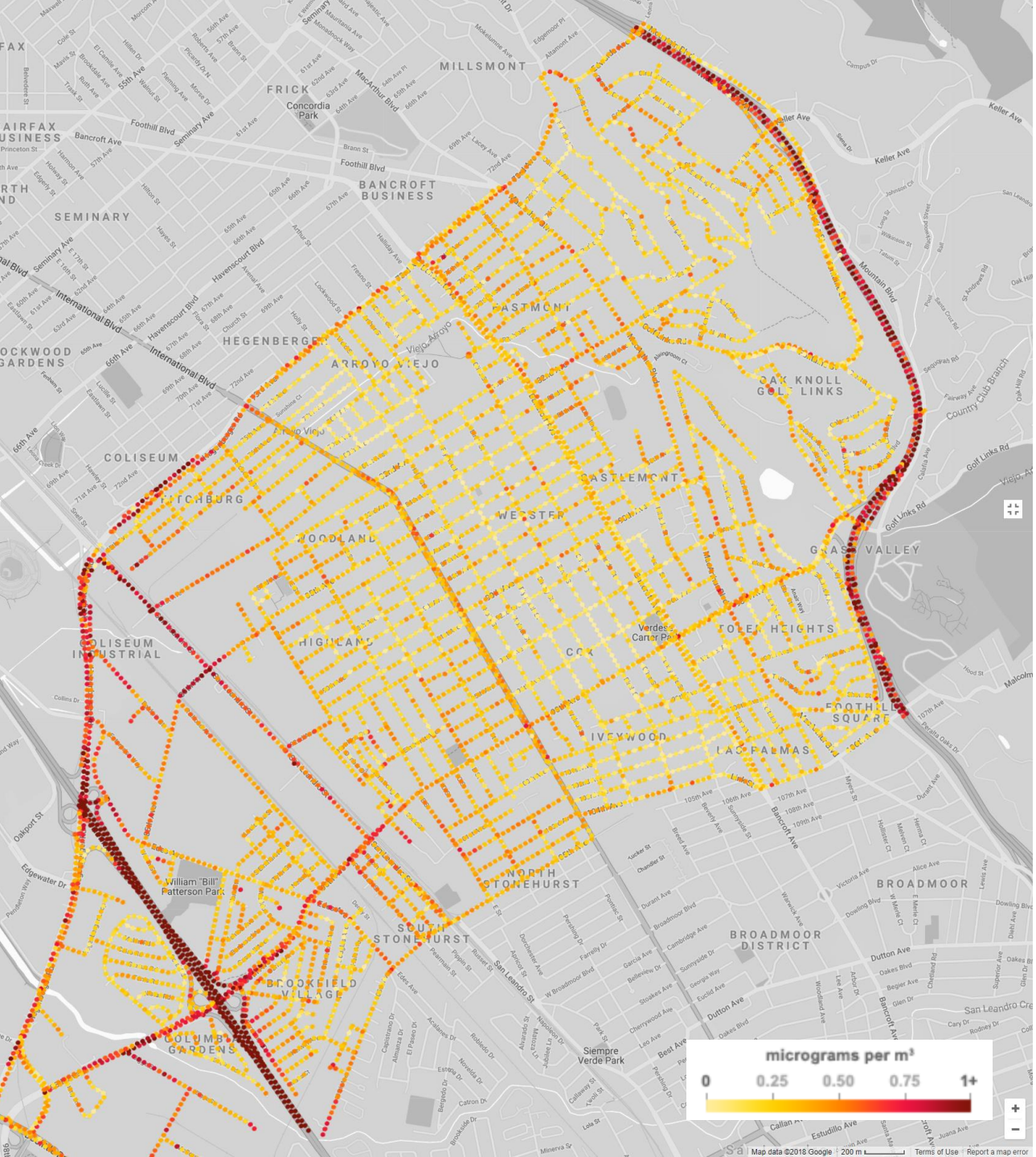
Median BC levels comparison	
Google study	0.51 μ/m³
BAAQMD monitor	0.50 μ/m³

The most polluted areas have levels of black carbon ~5 times higher than the lowest polluted areas.

Many places see higher concentrations than levels measured at BAAQMD central site.

East Oakland – Black Carbon

www.edf.org/airqualitymaps/air-pollution-and-health-east-oakland



We found multiple hotspots/areas of high pollution

Example: Metal recycler on Peralta/Poplar and 28th st. Black carbon levels here are more than 3x the median for WO.

Newly built children's playground across the street from the recycler.

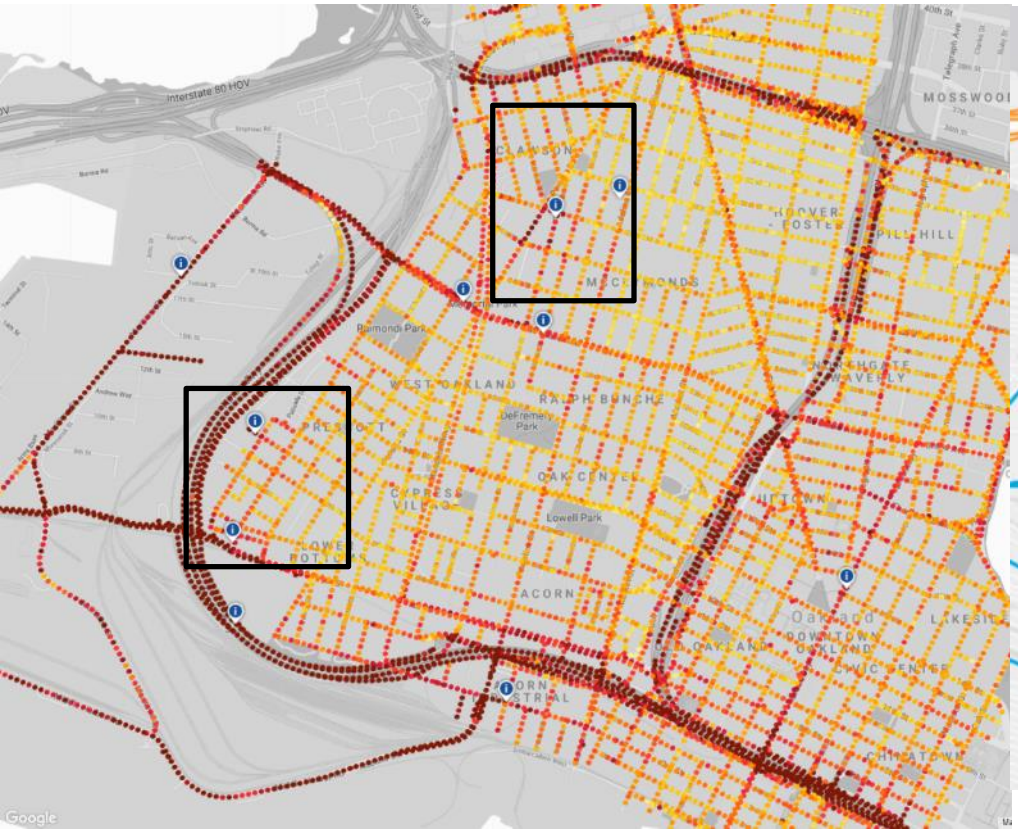
Street View and aerial imagery of metal recycling cluster show frequent visits by heavy duty trucks at the facilities.

www.edf.org/airqualitymaps

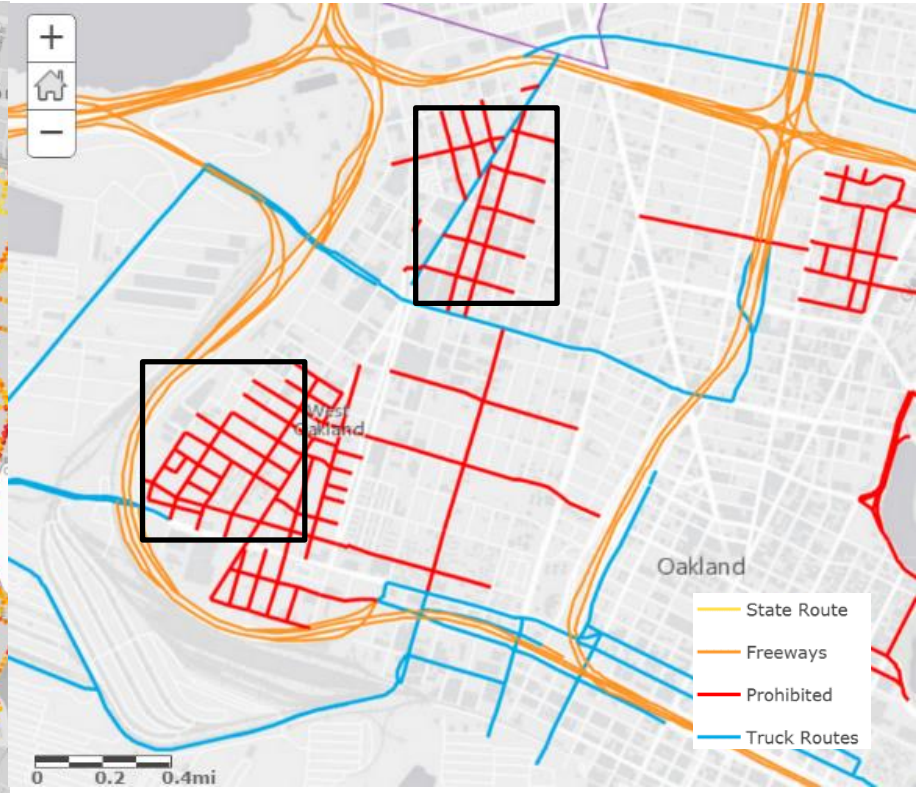
Air pollution high on prohibited truck routes

Generally, black carbon levels on residential streets are similar to urban background level. However, our map reveals elevated levels of pollution on many streets where trucks are prohibited.

EDF Black Carbon Map



Oakland Truck Routes and Truck Prohibited Streets



www.edf.org/airqualitymaps

Elevated pollution levels on streets where trucks are known to queue or have high truck volume

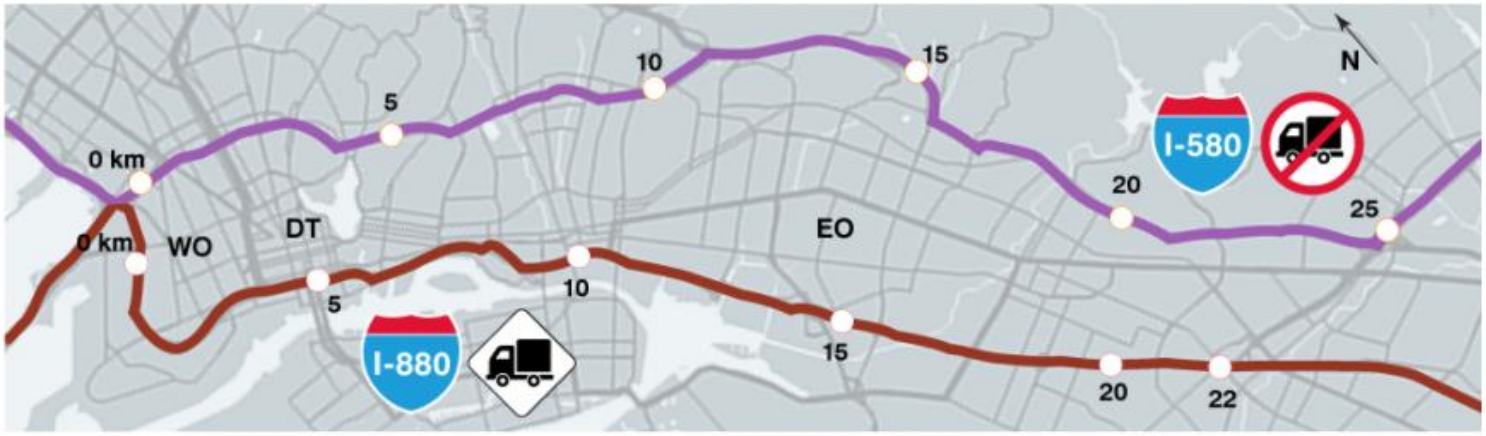
micrograms per m³
0 0.25 0.50 0.75 1+

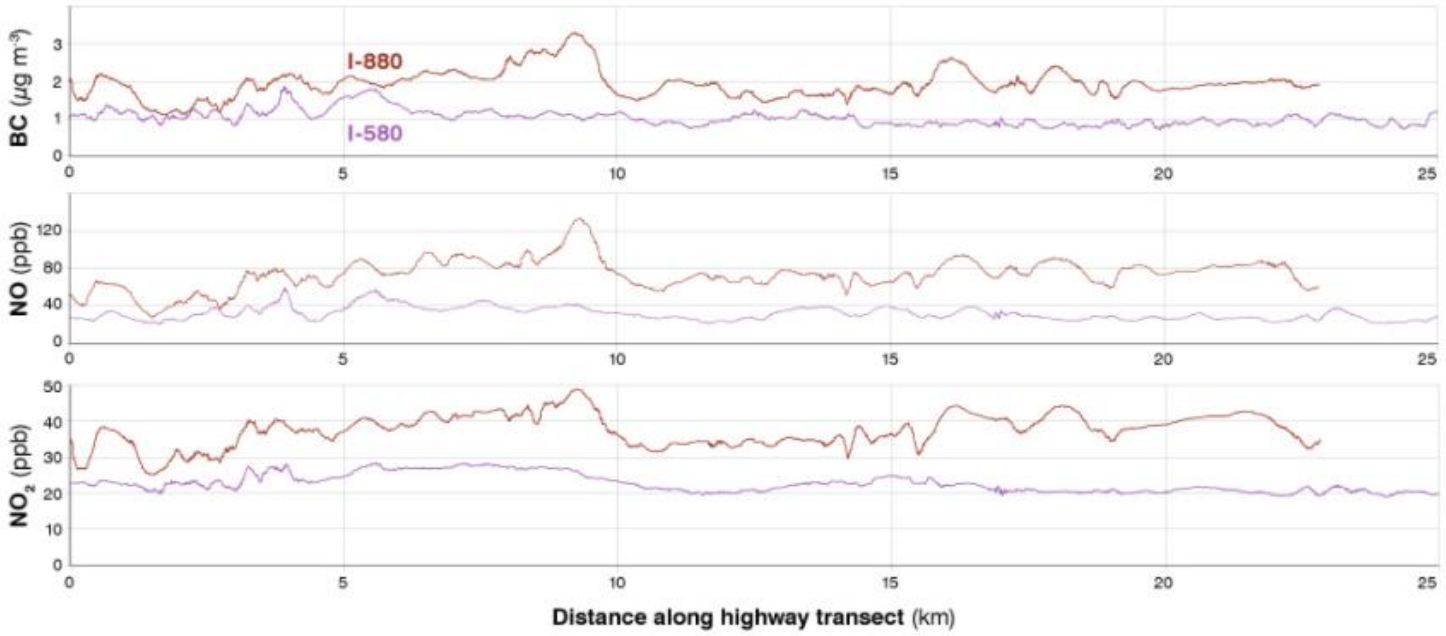
Example 1: Trucks queuing on Frontage Road leading to port entrance

Example 2: Elevated BC levels on 7th St a busy truck route with housing nearby

www.edf.org/airqualitymaps

A Tale of Two Freeways: air pollution much higher on I-880 than I-580





How much higher is pollution on I-880 vs. I-580?

BC: ~80%

NO: ~130%

NO2: ~60%

www.edf.org/airqualitymaps/tale-two-freeways

STUDY 3

AIR POLLUTION & HEALTH

Do local differences in air quality affect health?

Study Question: Do people living in areas of Oakland with higher pollution have higher cardiovascular health risks?

Researchers used:

- Individual electronic medical records from Kaiser Permanente patients living in West Oakland, Downtown Oakland and East Oakland
  - Heart disease, stroke and death

- Analyzed difference in health risk for people living at addresses with higher vs. lower air pollution
  - Accounted for neighborhood socioeconomic factors and individual data on medications, other health problems, medication, smoking, age, race, sex, and body mass index.

Implications

Proximity	• Revise Conditional Use Permits to sunset industrial use permits near residential areas • Provide alternative locations and incentives / financial support for businesses to move out of residential areas • “Receptor side” mitigations (pollution barriers, air filtration etc)
Enforce-ment	• More enforcement officers; proper training • Truck signage; truck driver education • Improve truck routes
Emissions	• Adopt cleaner technologies; invest in zero emission equipment & infrastructure • Reduce emissions from existing technologies

Thank you

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