State of Air Monitoring in California

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Monitoring and Laboratory Division

California Air Resources Board

PQAO Training | February 27-28, 2024

Overview

PQAO Training keynote address review

- Progress and challenges

State of monitoring in 2024

- Wildfire and prescribed fire, community monitoring, toxics
- New technologies
- Changes in operations and regulations

What is around the corner?

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PQAO Training Keynotes

2017 – Amy Zimpfer – U.S. EPA Region 9
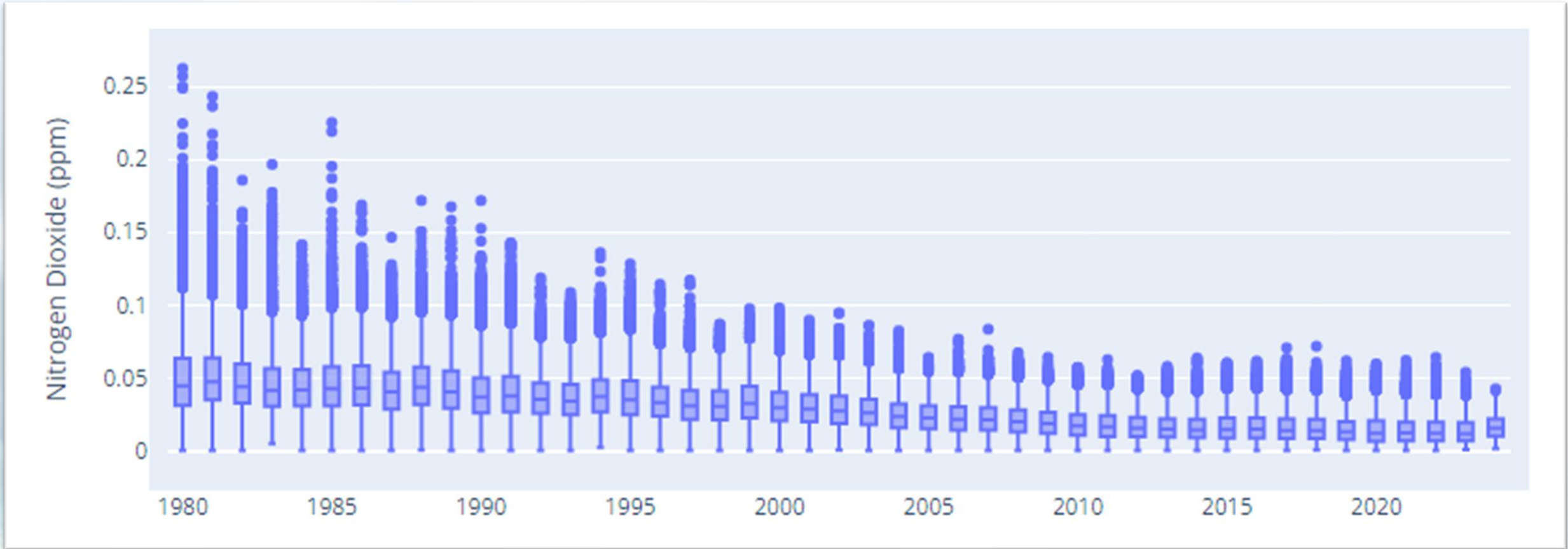Attainment, Litigation

2019 – Eric Stevenson – Bay Area AQMD
Wildfire Impacts, AB 617 Implementation

2021 – Ben Machol – U.S. EPA Region 9
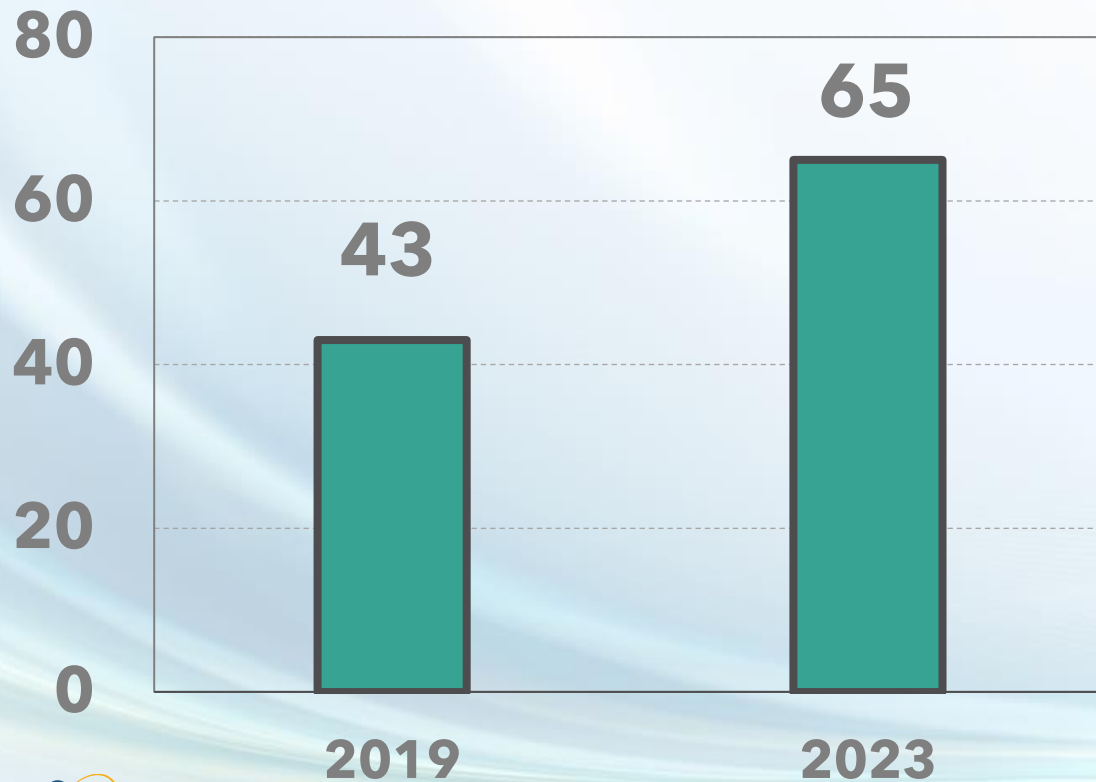Citizen Science, Remote Operations

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NO$_2$ Concentrations since 1980

Remote Operations and Increased Automation

FEM PM$_{2.5}$ Monitors in CARB PQAO

PM$_{2.5}$ Filters Weighed by CARB Laboratory
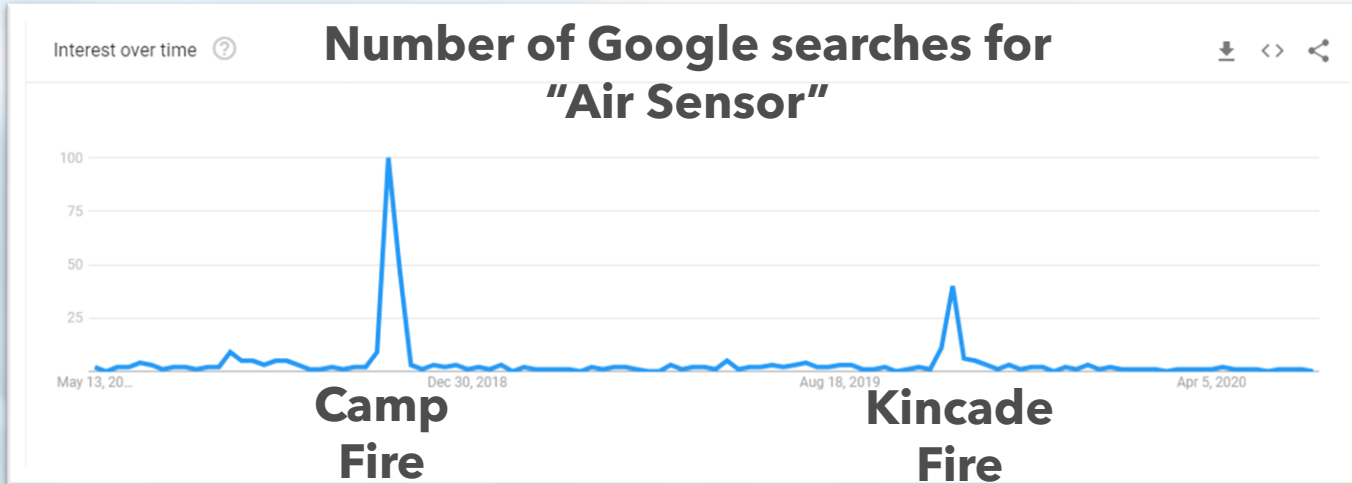
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Wildfires

November 8th

November 16th

Source: MODIS Aqua, NASA Worldview

How bad is Sacramento's air, exactly? Google results appear at odds with reality, some say

THE SACRAMENTO BEE

Number of Google searches for "Air Sensor"

Camp Fire

Kincade Fire

CNET

Tech   Money   Home   Wellness   Home Internet

Home > Smart Home

California fires boost interest in PurpleAir's pollution sensors
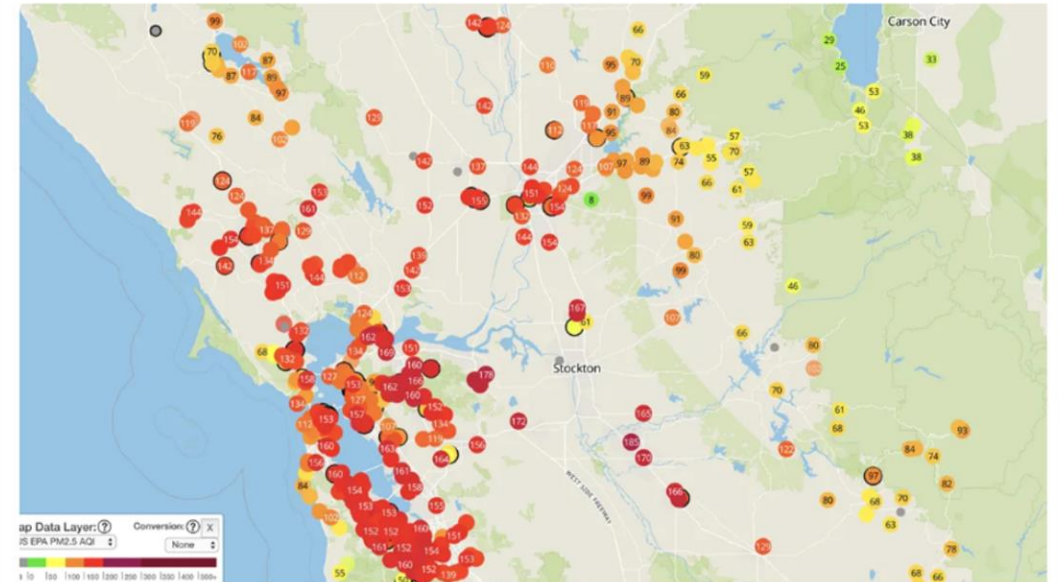
The company's map displays air quality around the world.

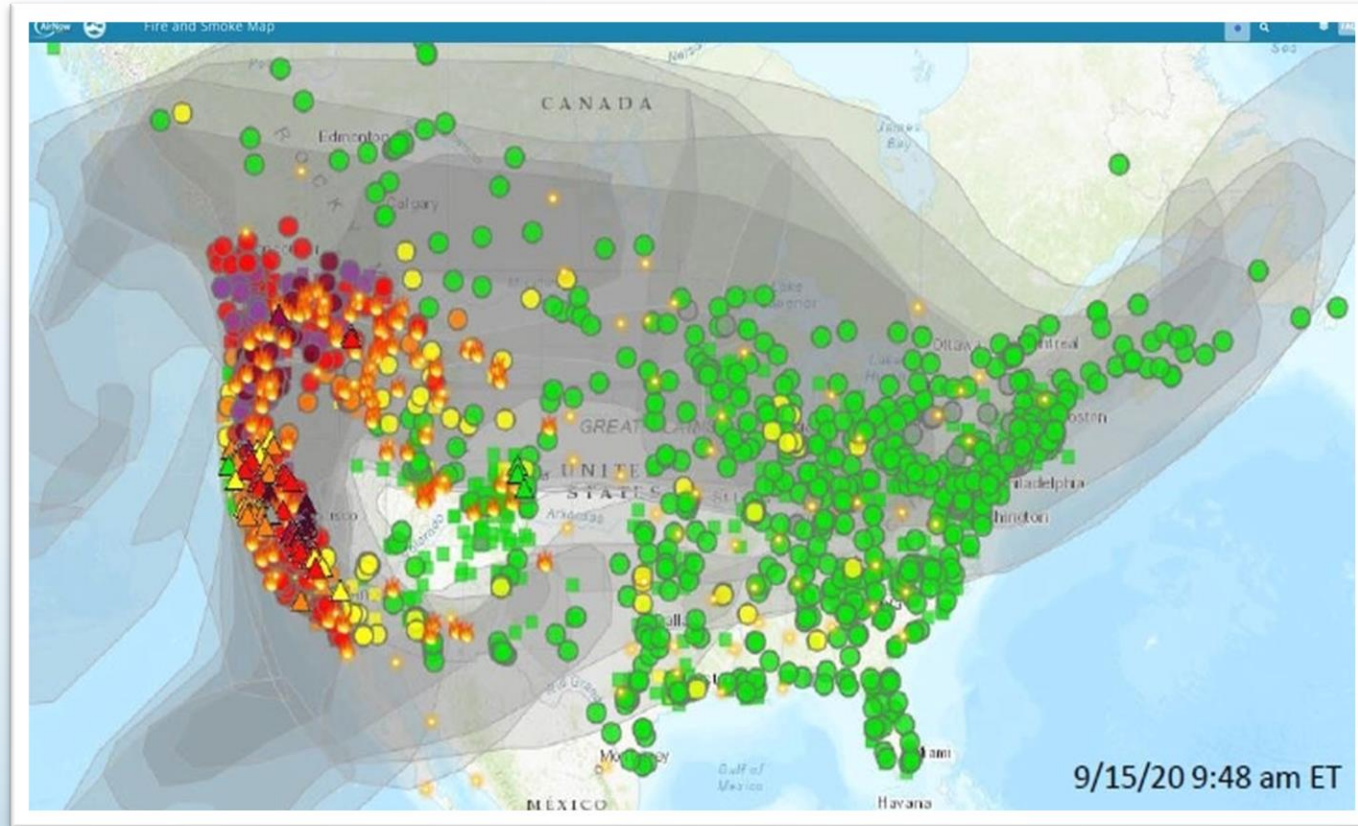Stephen Shankland
Nov. 21, 2018 10:52 a.m. PT   4 min read

PurpleAir's air quality sensors feed data into a map anyone can see. This screenshot shows bad air quality in the San Francisco Bay Area and the number of people who've installed the sensors.

Screenshot by Stephen Shankland/CNET

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Wildfires

9/15/20 9:48 am ET

- Public expectation of timely access to data
- Understand smoke composition
- Clear messaging of health risks

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California Smoke Spotter
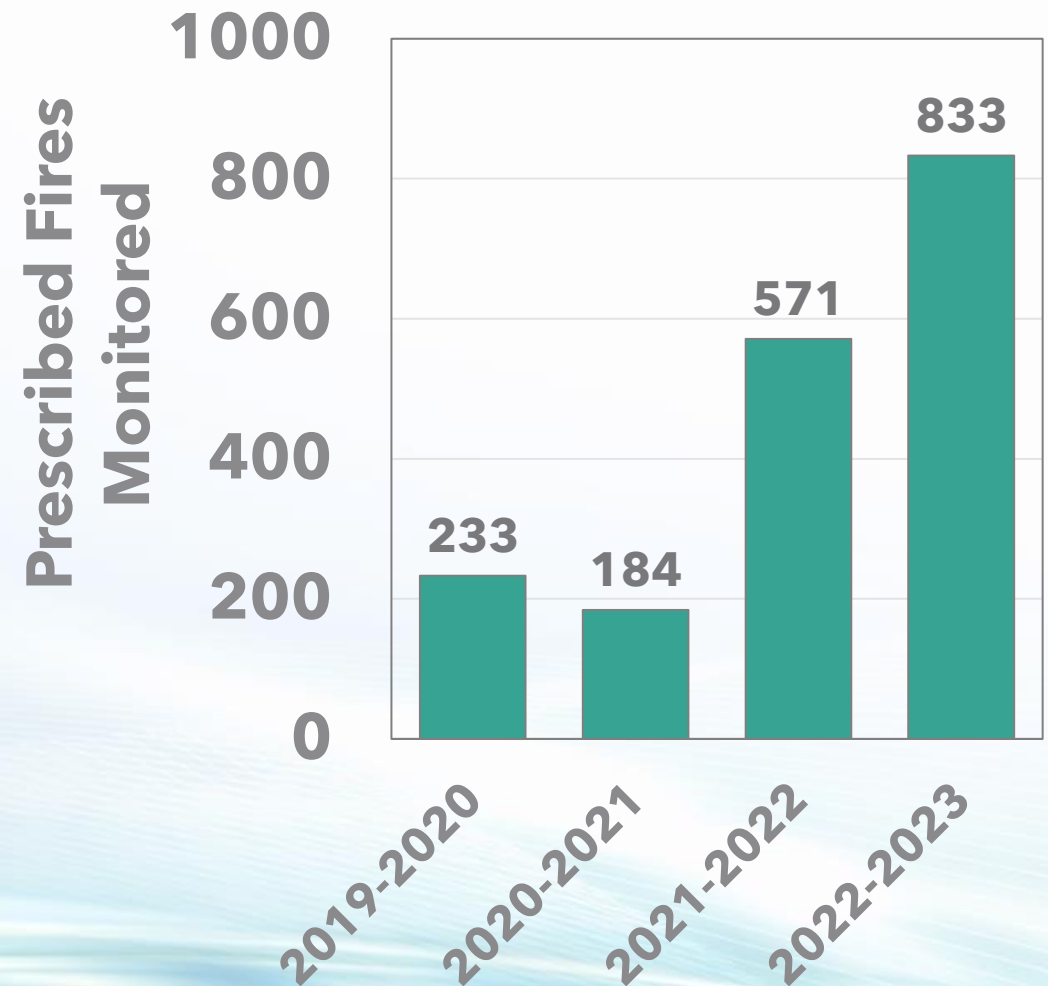

Tailored Reports

Wildfire and Prescribed Fire Smoke Monitoring

- Maintained 100 E-BAMs at 6 storage caches throughout the state

- Distributed ~650 air sensors to air districts over the last 5 years

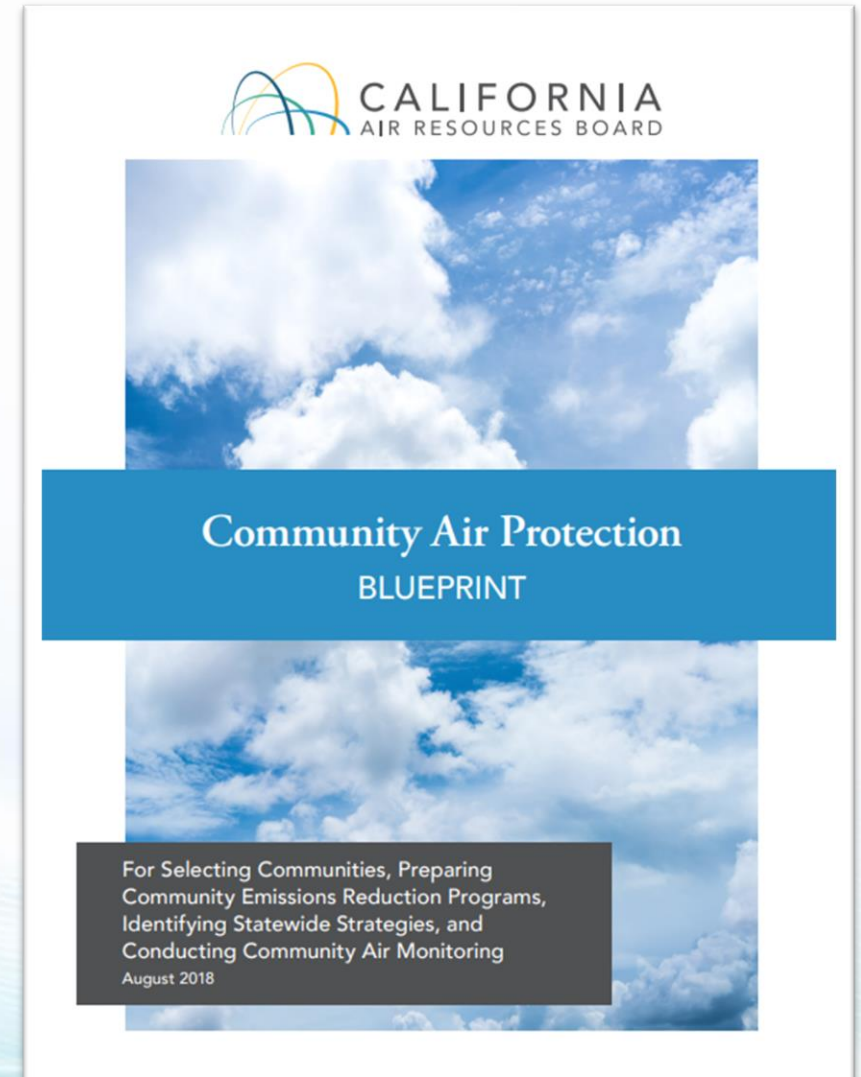- Provided hands on training to 280 operators

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Community Air Monitoring

Six (6) years since Community Air Protection Program under AB 617 began

Expected monitoring challenges?

- Meeting aggressive timelines
- Setting expectations with partners
- Addressing complexity of data communication
- Ensuring availability of data to the public
- On-going planning and evaluation to ensure effectiveness

CALIFORNIA AIR RESOURCES BOARD

Community Air Protection
BLUEPRINT

For Selecting Communities, Preparing Community Emissions Reduction Programs, Identifying Statewide Strategies, and Conducting Community Air Monitoring
August 2018

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Community Monitoring Progress

- Standards for sensor performance and operation
    - Evaluation programs
    - Guidebooks
    - Training grants

- More real-time data requires robust data management and visualization
    - New data portals
    - Tailored visualizations and stories

- Better science communication
    - Our role has expanded – consultants, trainers, and advisors

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Sensor Test Methods and Evaluation Programs

- U.S. EPA enhanced testing protocols for $PM_{2.5}$ and ozone

- ASTM test method D8405-21

- Inter-chamber comparison studies

CARB Test Chamber

AQ-SPEC Chamber

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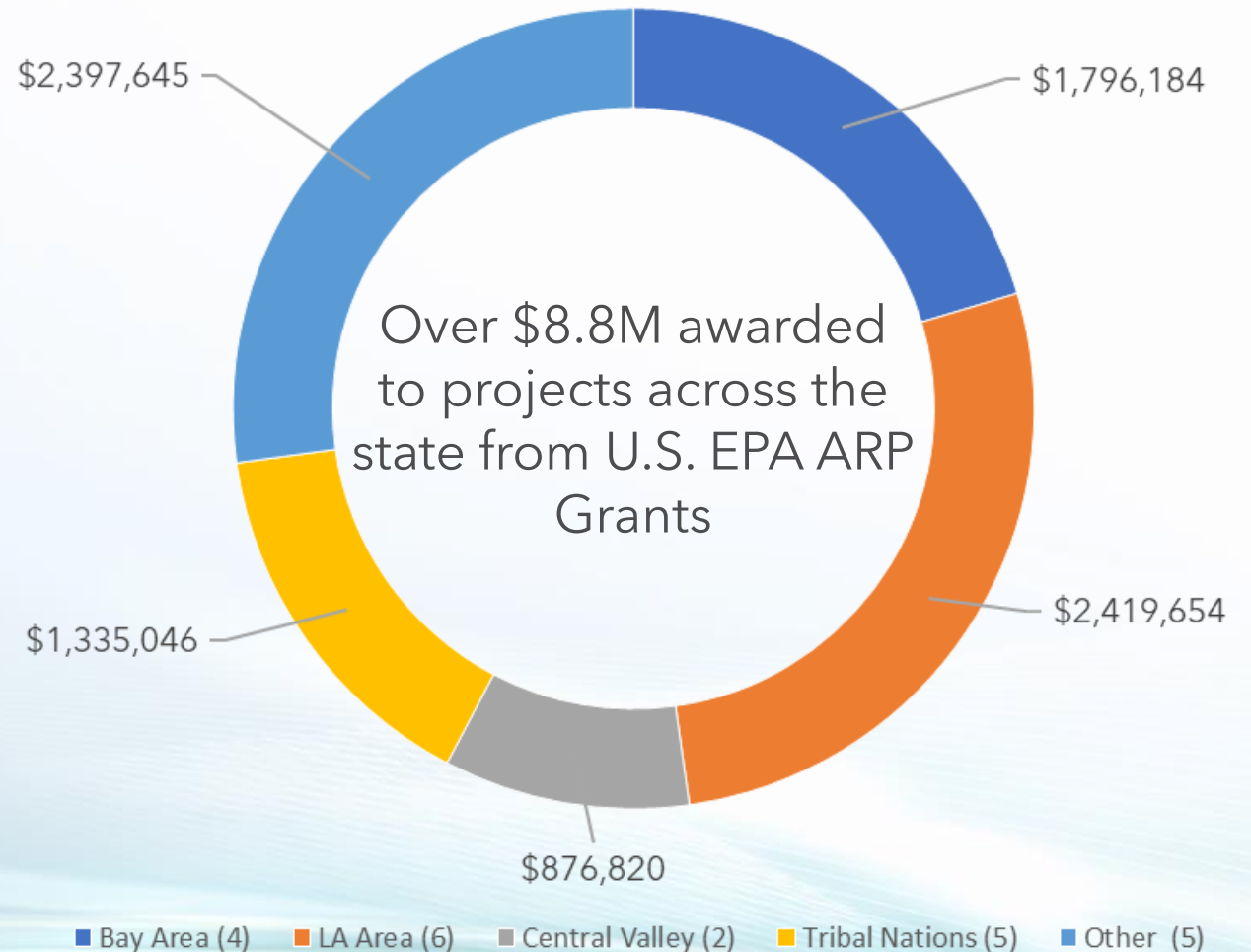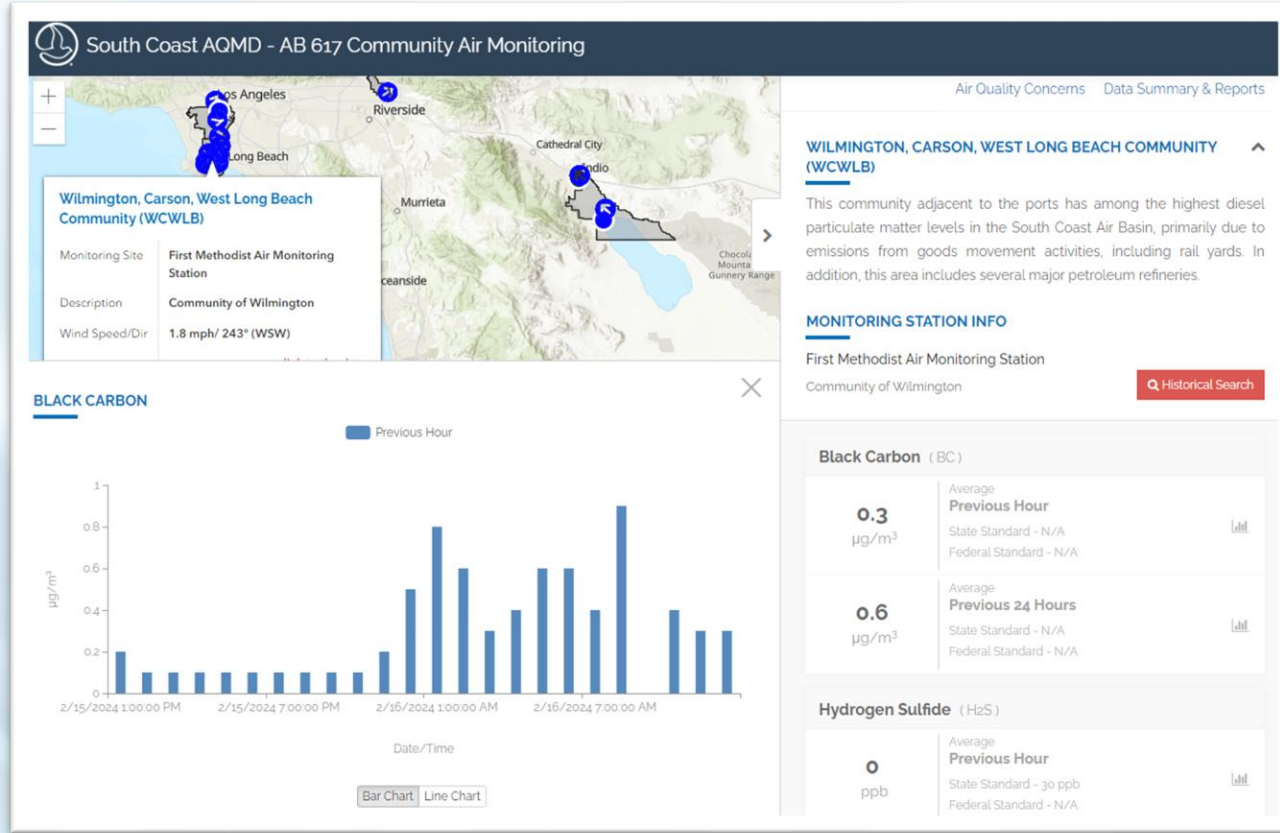**Quality Assurance of Low-Cost Sensors**
Andrea Clements, Ph.D. (U.S. EPA Office of Research and Development) and
Wilton Mui, Ph.D. (South Coast AQMD)
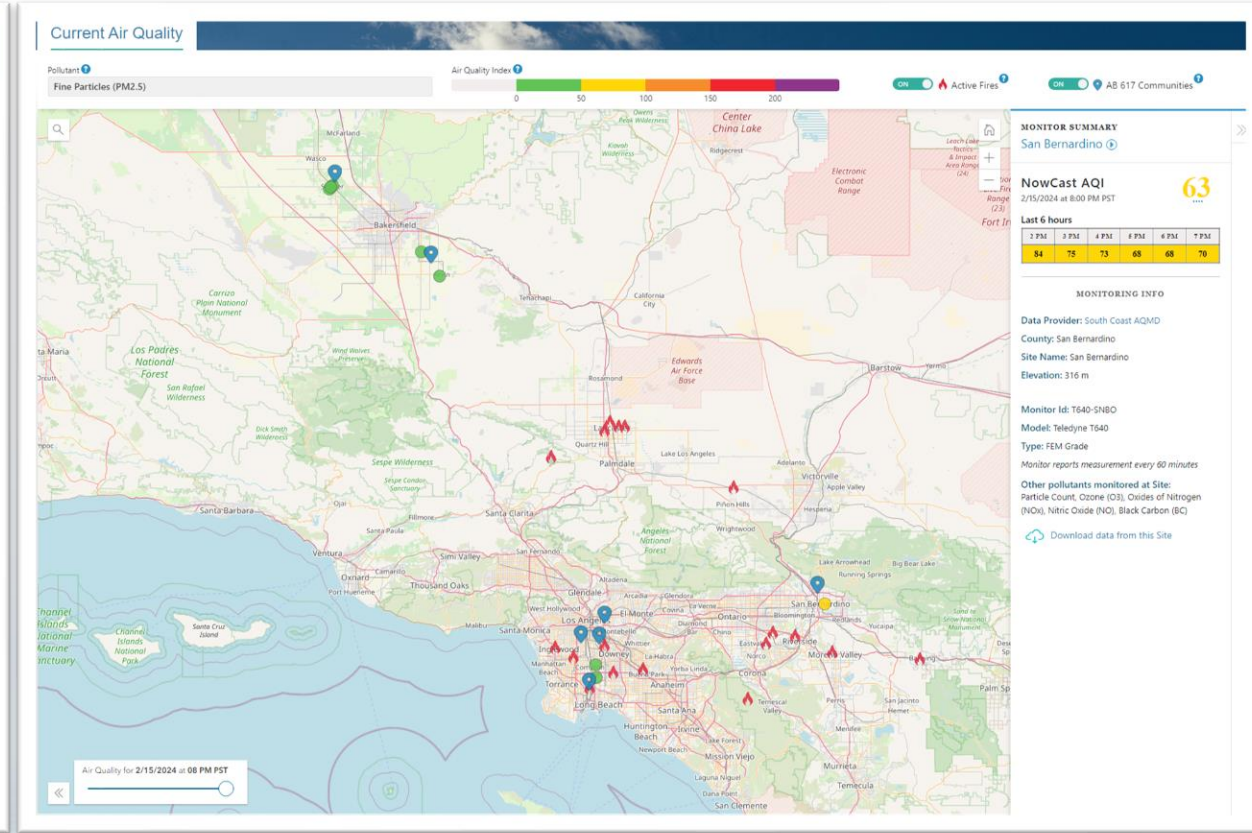
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Community Air Monitoring Grants

Since 2018, over $22M awarded to technical projects via CARB's Community Air Grant Program

Over $8.8M awarded to projects across the state from U.S. EPA ARP Grants

$2,397,645

$1,796,184

$2,419,654

$876,820

$1,335,046

■ Bay Area (4) ■ LA Area (6) ■ Central Valley (2) ■ Tribal Nations (5) ■ Other (5)

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Data Portals

AQPortal

AQview

Overview of AQPortal & AQview
Brandon Feenstra, Ph.D. (South Coast AQMD) and
Raiford Hann (CARB)

Tailored Visualizations and Stories

Reimagining the Toxics Network

- 18 toxics and speciation sites collecting 24-hr samples every 12 days

Benzene
Air Monitor Trend - Mean (ppb)

Legend:
- Los Angeles-North Main Street
- Simi Valley-Cochran Street
- San Francisco-Arkansas Street
- Bakersfield-5558 California Avenue
- Chico-East Avenue
- Azusa
- Chula Vista
- San Jose-Jackson Street
- Stockton-Hazelton Street
- Roseville-N Sunrise Blvd
- Riverside-Rubidoux
- El Cajon-Lexington Elementary School
- Fresno-Garland
- Calexico-Ethel Street
- Detection Limit

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Bringing the Lab to the Field

- Aerosol Chemical Speciation Monitors (ACSM)
  - PM mass composition (organics, SO_4, NO_3, NH_4, Cl)

- Auto-GC
  - VOCs
  - MeBr

- XRF
  - Metals
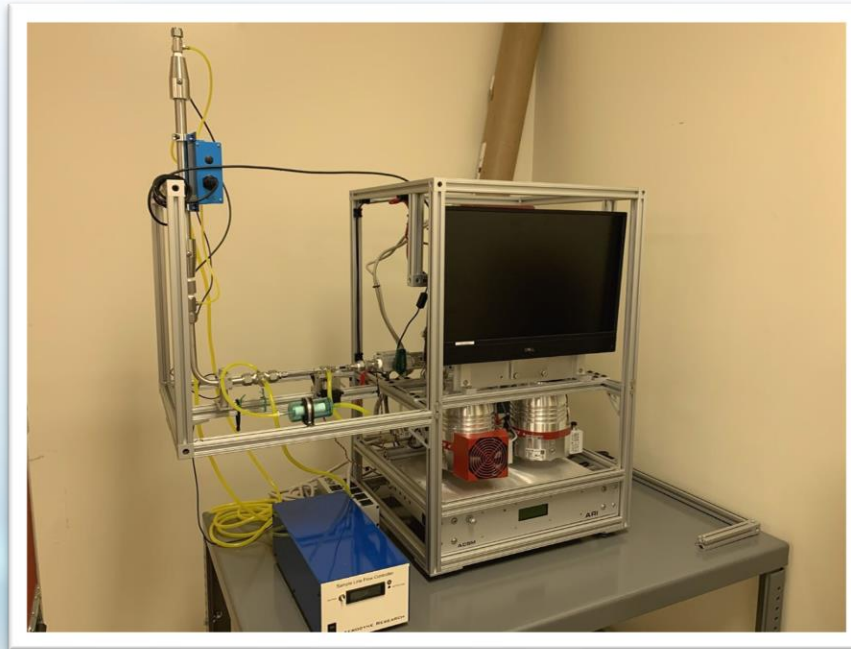
ACSM

Mobile XRF

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Study of Neighborhood Air near Petroleum Sources (SNAPS)

- 1 year deployment in Inglewood Oil Field

- 200+ compounds
  - Auto-GC-MS for 1-hr VOCs
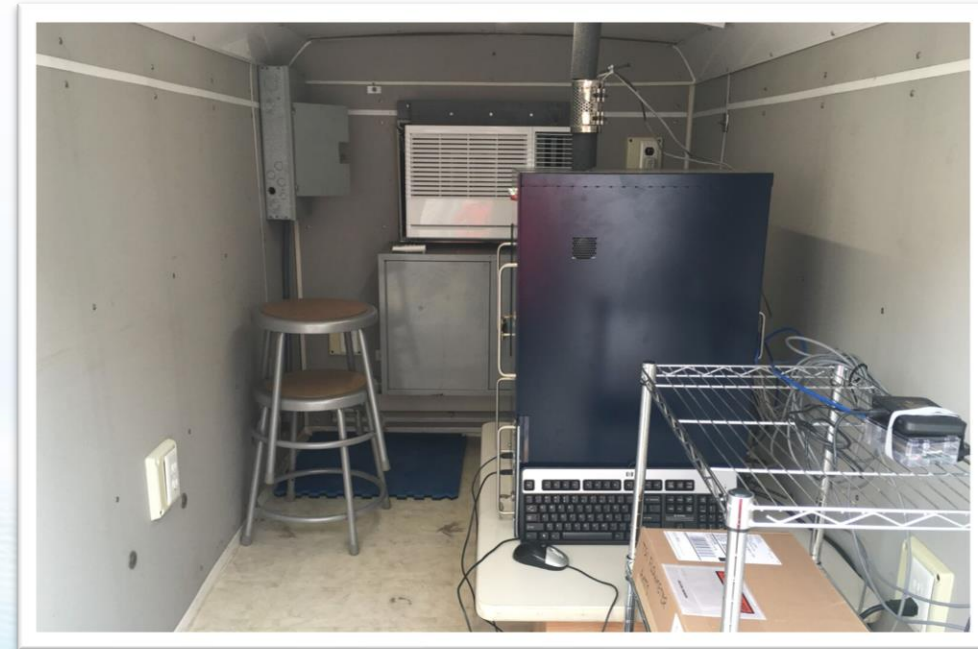 - XRF for 1-hr metals
  - Discrete sampling for carbonyls, PAHs, sulfur compounds, metals, etc.

- Mobile air monitoring for CH_4, H_2S, NO_X, and BC

- Source attribution and health risk assessment

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What's around the corner?

Operational Challenges

- Continuing to adapt to pandemic and remote operations
- Addressing recruitment and retention
- Maintaining expertise and training programs
- Addressing resource constraints

- Fortunately, we have inter-agency collaborations and cross training opportunities

Crafting Competence – Training Tomorrow's Air Monitoring Technicians
Rene Bermudez (South Coast AQMD)

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PM$_{2.5}$ NAAQS Update

- Annual PM$_{2.5}$ standard of 9 µg/m^3

- Proposal to apply network data alignment to PM$_{2.5}$ data from T640/640X

- Updating historical data in AQS

Final Revision to AQI for PM$_{2.5}$

AQI Value	Current [µg/m^3]	Revisions [µg/m^3]
0, Good	0	0
50, Moderate	12	9
100, USG	35	35
150, Unhealthy	55	55
200, Very Unhealthy	150	125
300, Hazardous	250	225
500, Hazardous*	500	325

*The 500 breakpoint is used in conjunction with the 300 breakpoint to calculate AQI values within the hazardous category. The approach does not use the 500 breakpoint to determine other breakpoints values.

Revision to NAAQS for Particulate Matter
Julia Carlstad, Ph.D. (U.S. EPA Region 9)

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Existential Challenges

- Machine learning and generative AI have immense potential to improve air monitoring, data management/visualization, and modeling
  - Machine learning to evaluate and adjust sensor data
  - ChatGPT for software development
  - Language models for QA/QC'ing form data

- Important to understand what's happening "under the hood"
  - Can provide inaccurate, misleading, or fake data
  - Difficult to audit

Using AI to Improve Air Monitoring
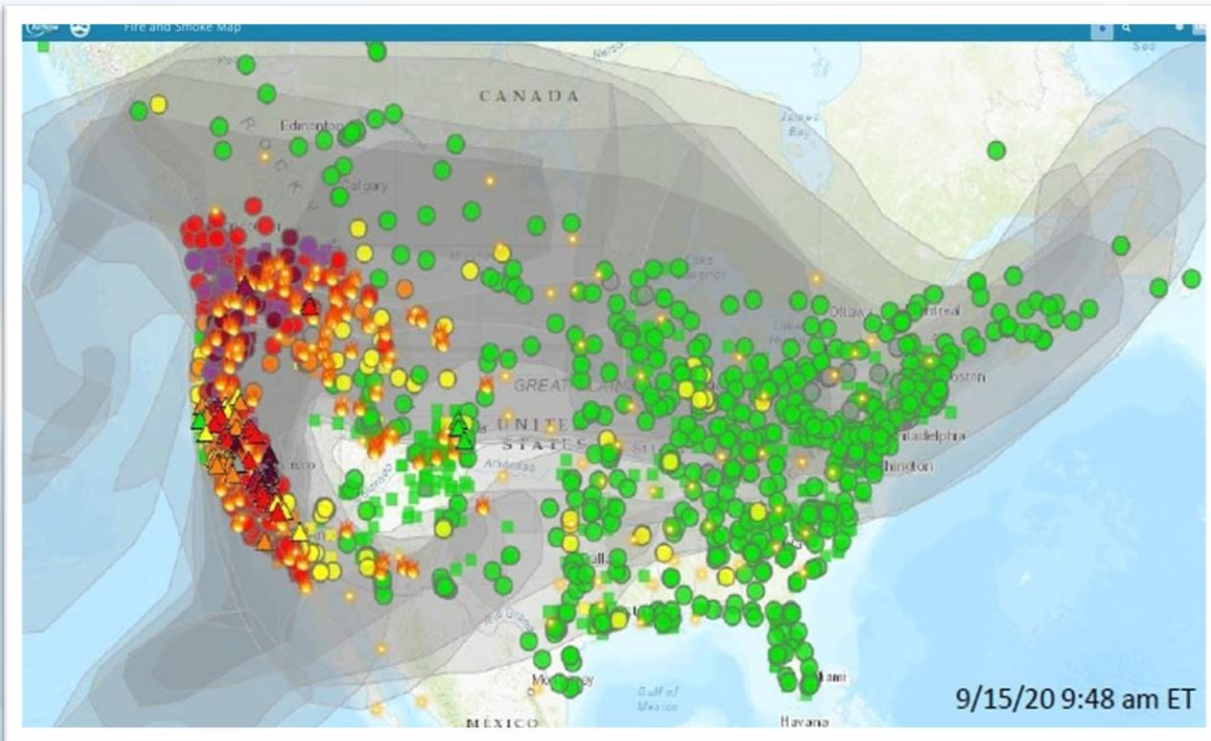Brian Marquardt (Tehama County APCD)

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Summary

- Reliable, accurate data are the foundation of many of our programs
- The breadth and depth of our work continues to expand
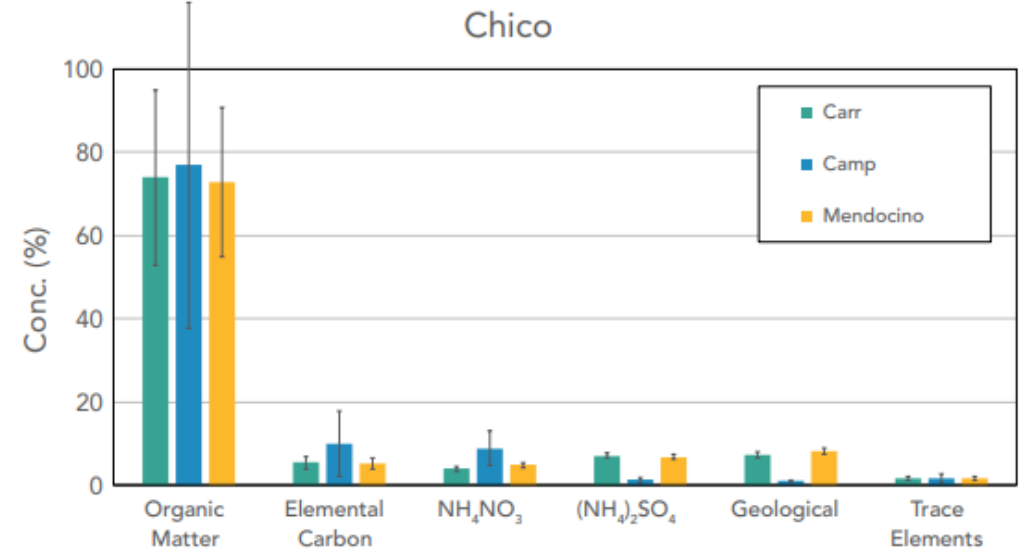- Important to have relationships where we share information and learn from each other

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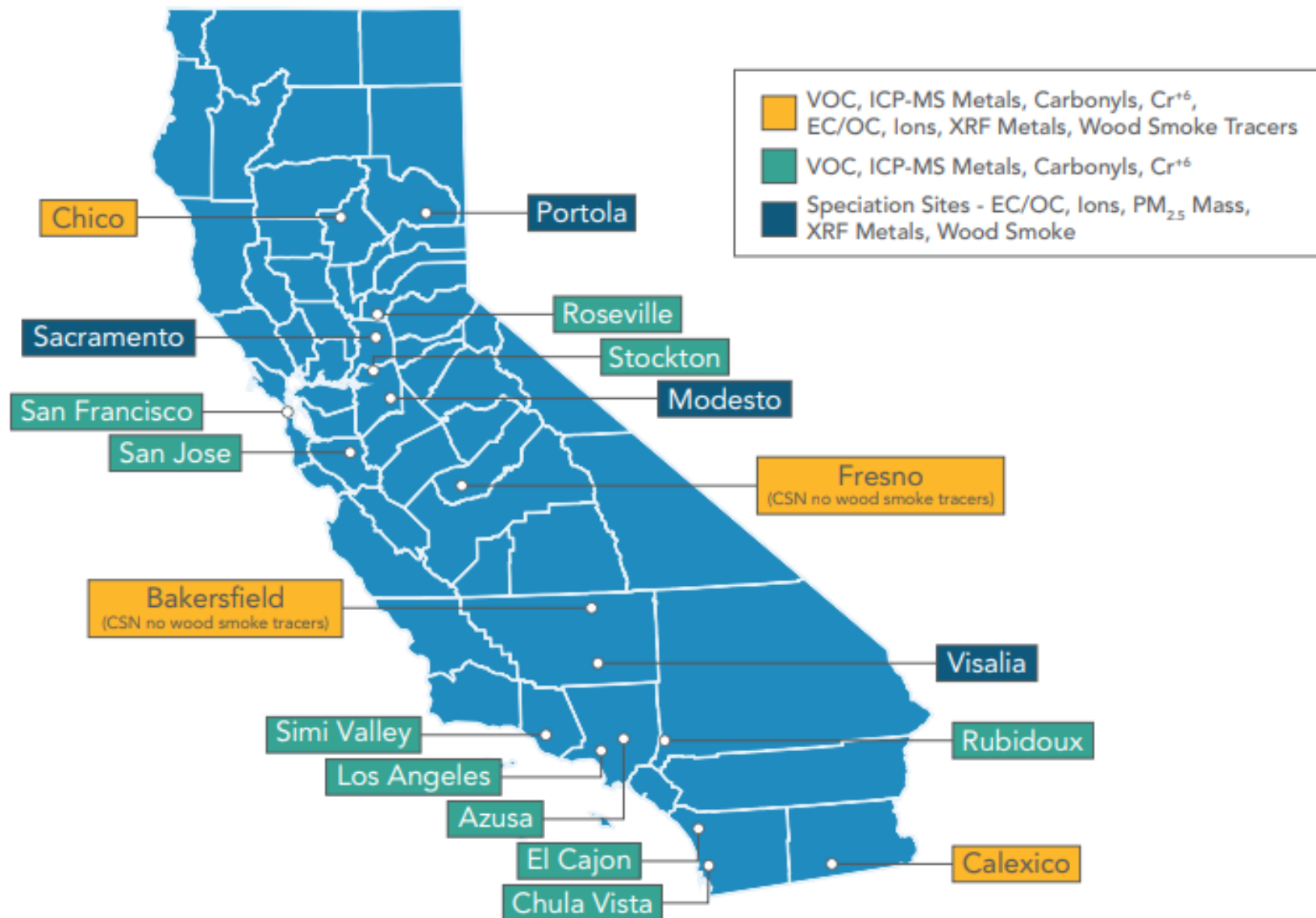
Backup Slides

CARB
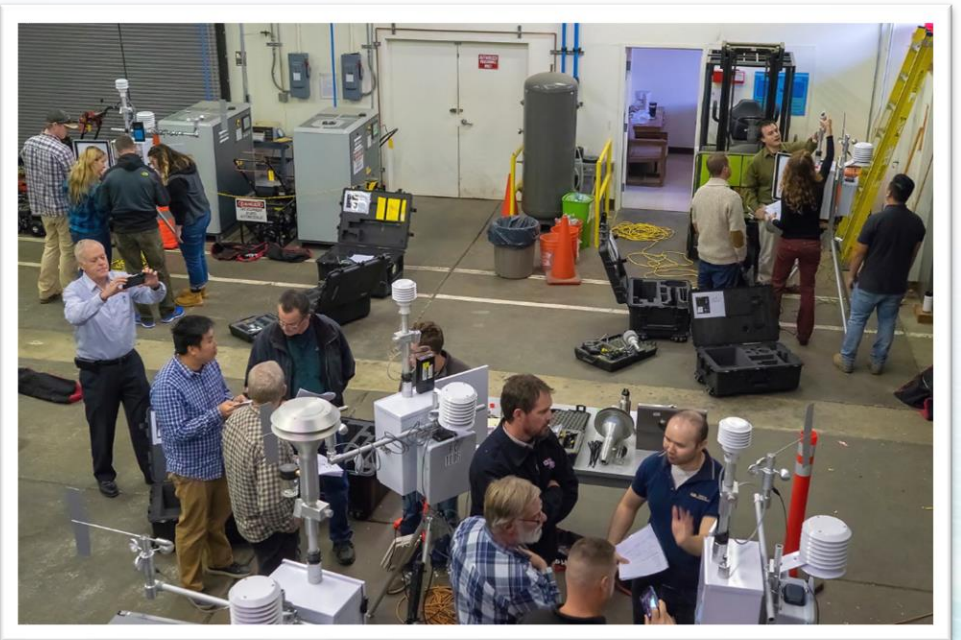
Wildfires

Chico (sampling days: Carr: 7 ; Camp: 3; Mendocino: 9)

At Chico, the $PM_{2.5}$ components on November 10 (17.7 hour sampling time) & 16 (13.0 hour sampling time) were included.

- Public expectation of timely access to data
- Understand smoke composition
- Clear messaging of health risks
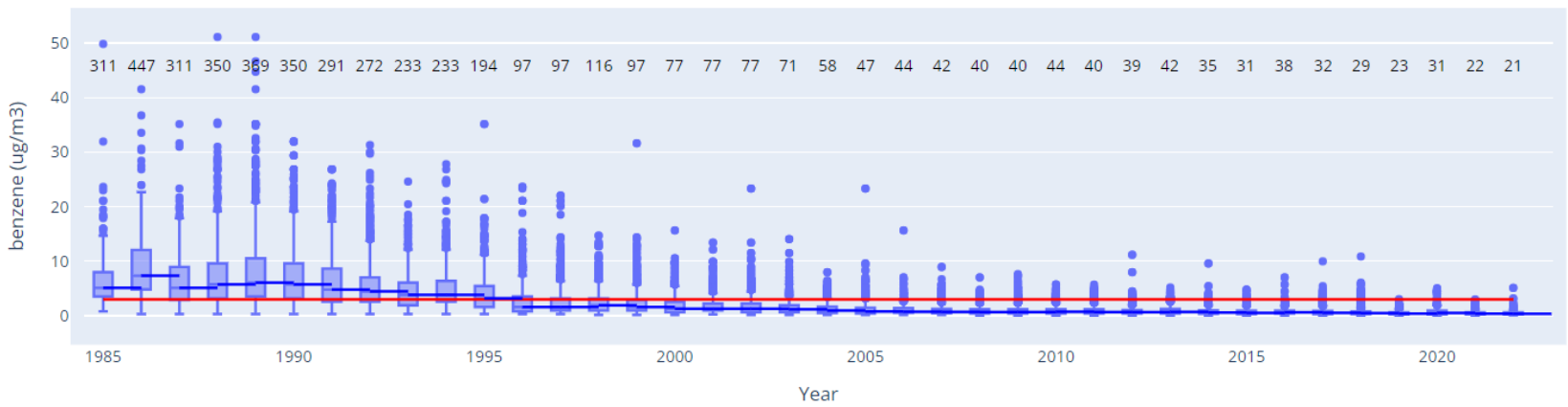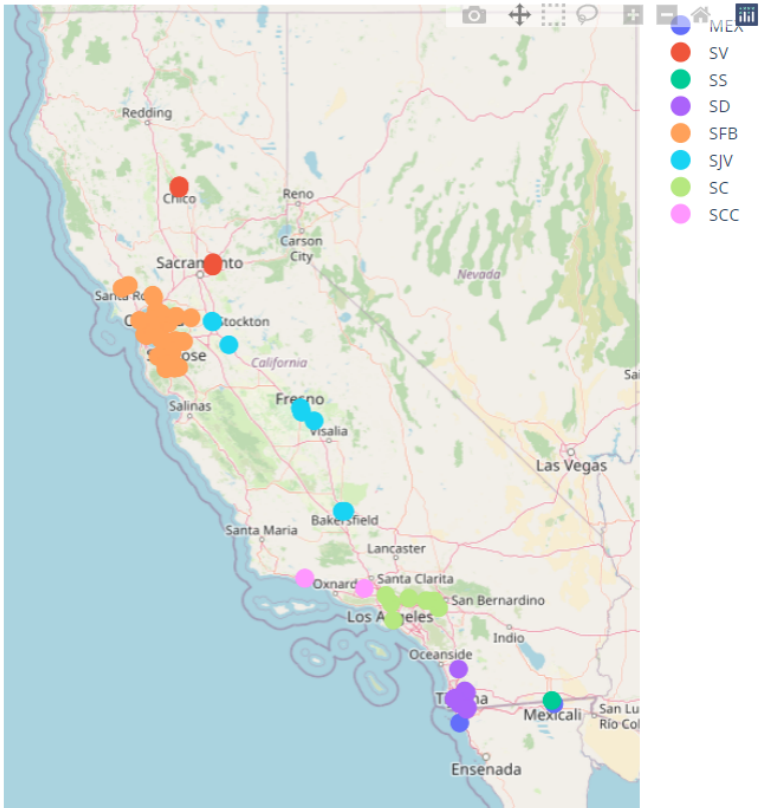
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Toxics and Speciation Sites
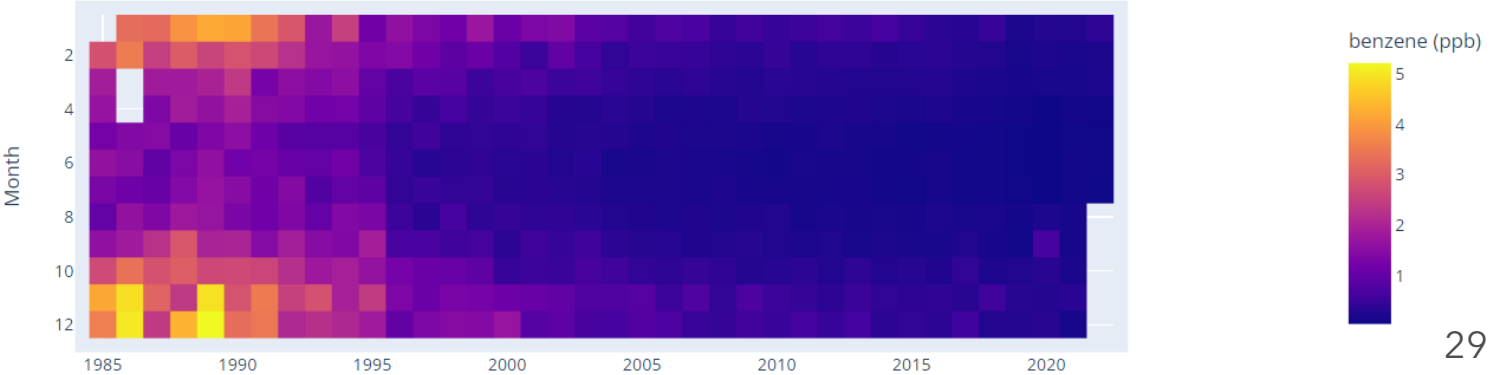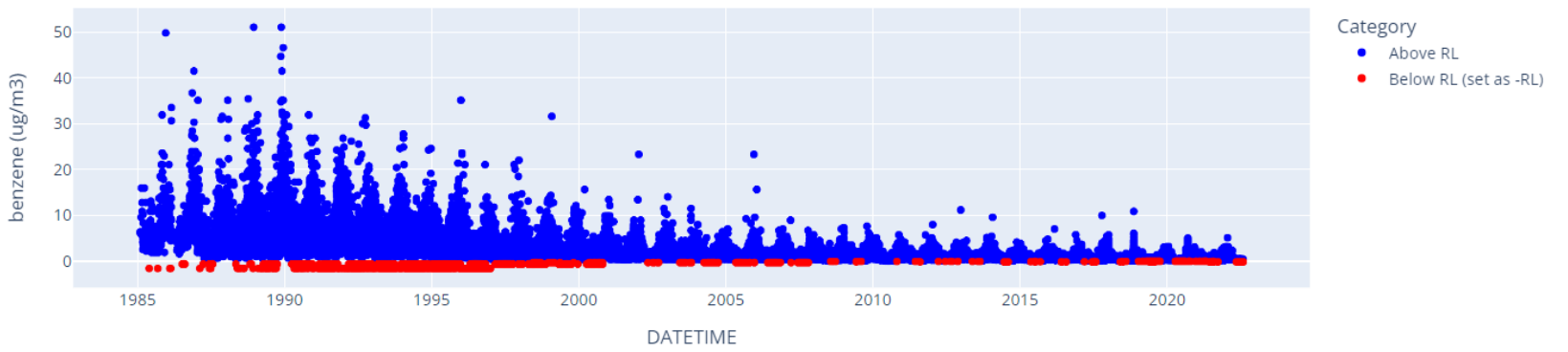
TOXICS VIEWER

Select pollutant:

benzene

Select how to average:
○ SITE   ○ BASIN   ● STATE

Select site/basin/state:

CA

U.S. EPA ARP Air Monitoring Grants in California


22 total air monitoring grants awarded across CA

- 11 new air monitoring networks/systems will be added
- 11 focus on expanding, enhancing, or continuing operation of existing systems
- Air monitoring plan development
- Relocating air monitoring equipment
- Sensor loan program
- Mobile monitoring (PM, VOCs, toxics)

All require public air monitoring data sharing

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Community Air Monitoring

CARB reviewed and adjusted program in 2023 to include:

- Support for consistently nominated communities
- Local CERPs via Community Air Grants
- Flexibility to tap Community Air Protection Incentives
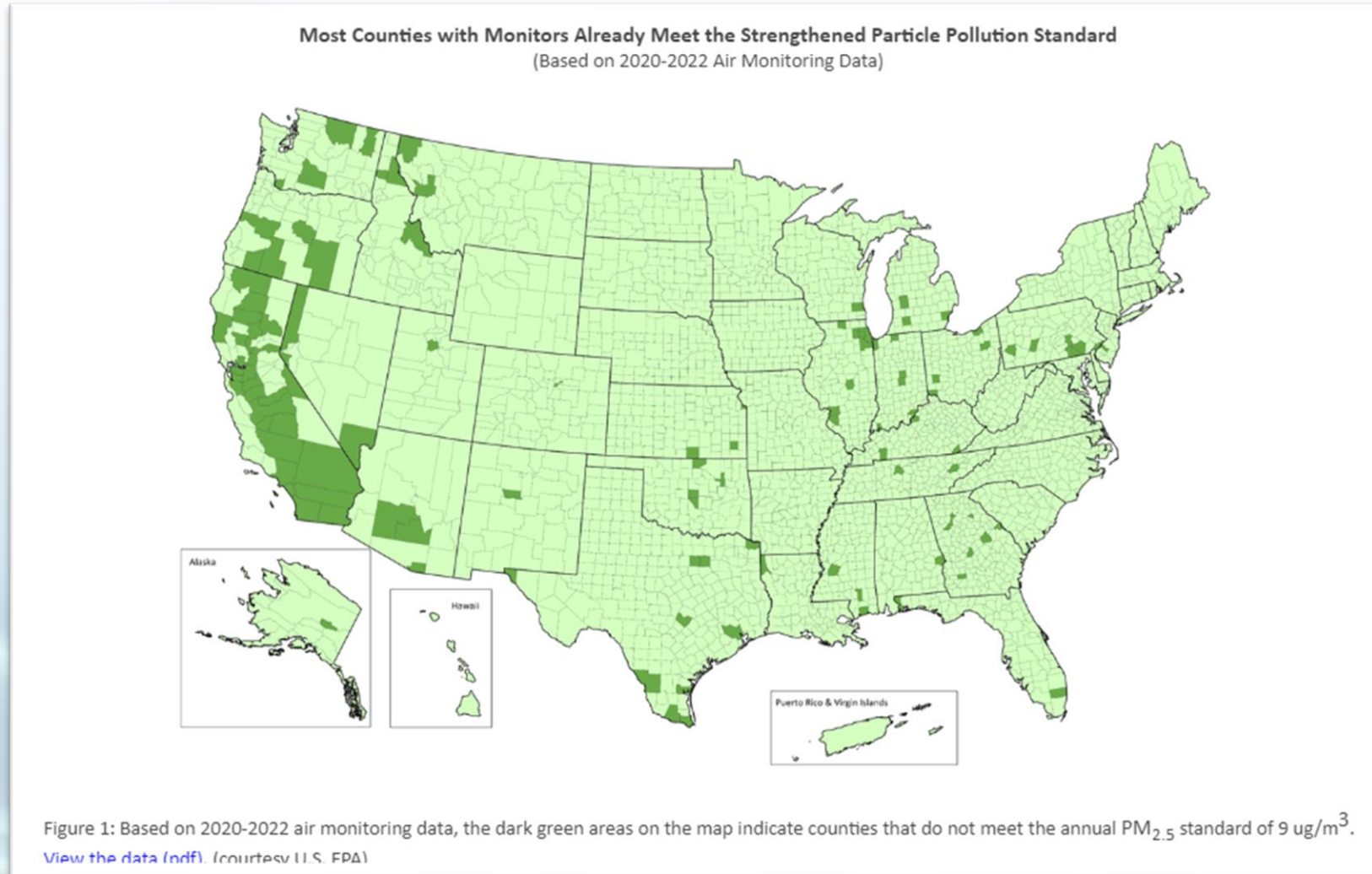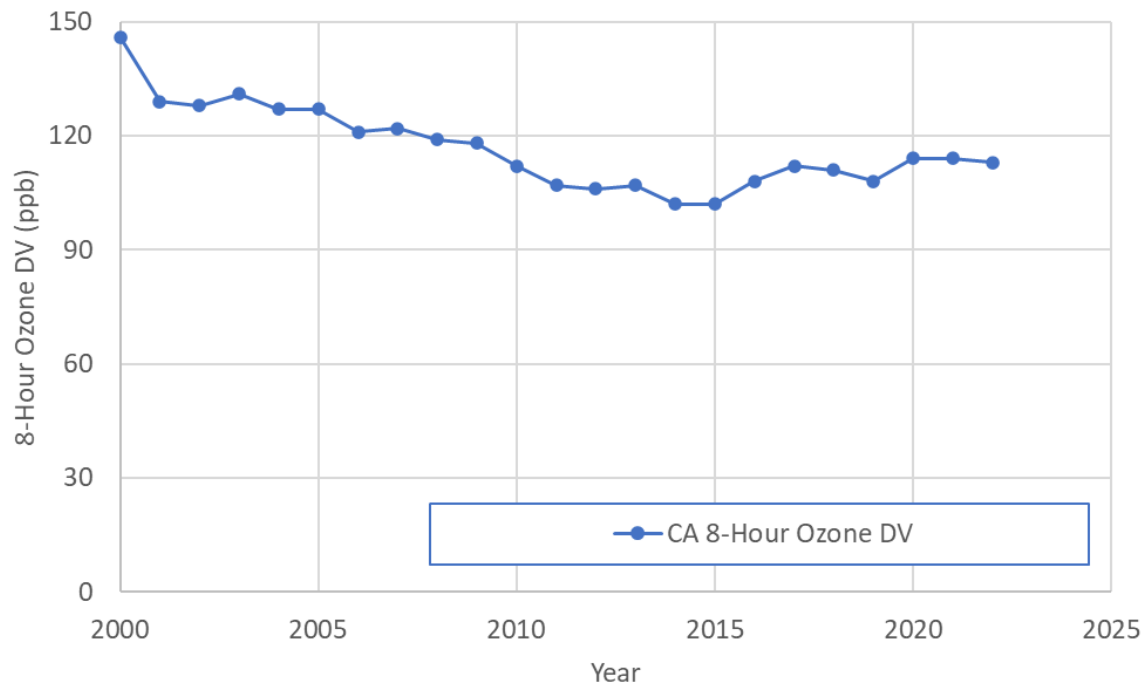- Community-focused enforcement
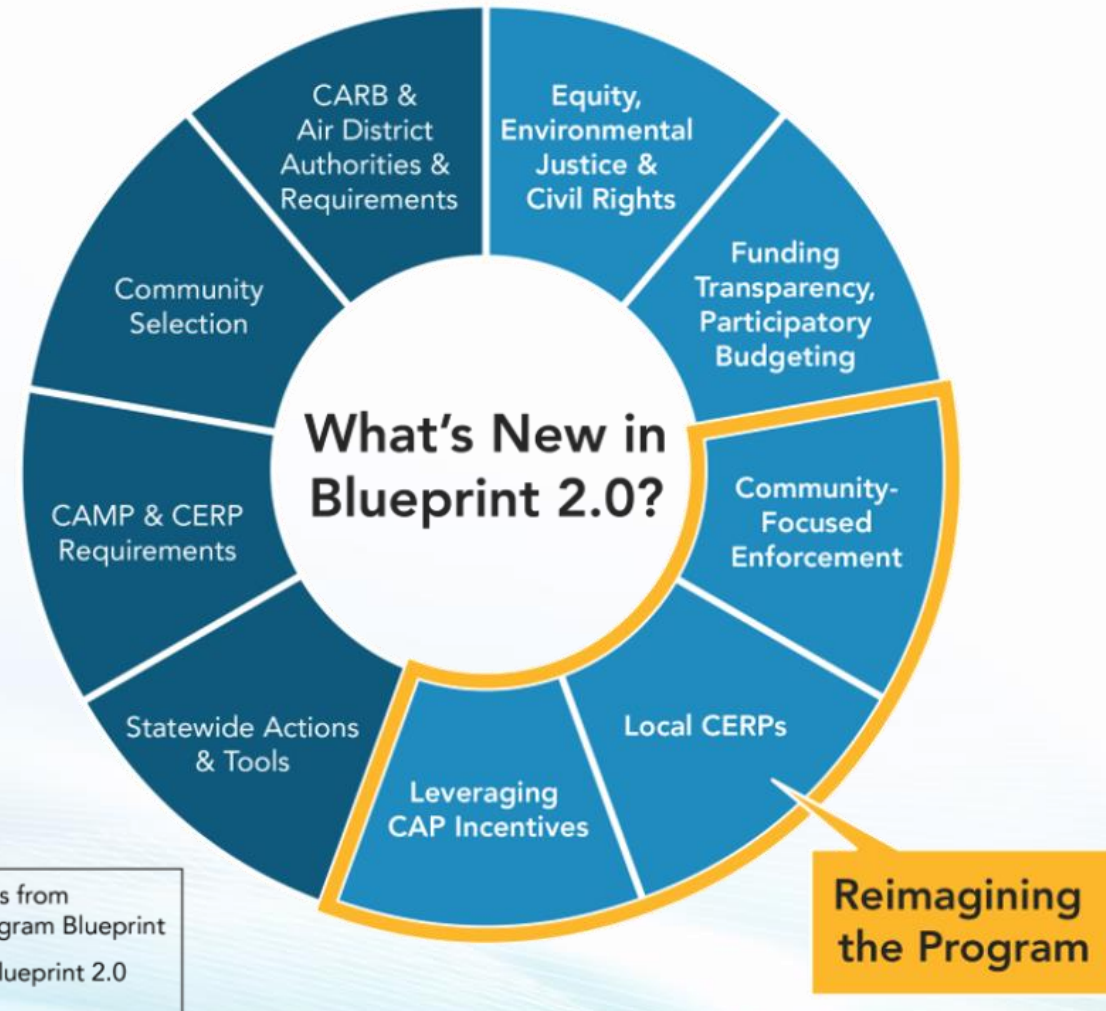
Mobile Air Monitoring Platforms

CARB and SCAQMD mobile air monitoring platforms supporting community-focused enforcement

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PM$_{2.5}$ NAAQS Revision

Most Counties with Monitors Already Meet the Strengthened Particle Pollution Standard
(Based on 2020-2022 Air Monitoring Data)

Figure 1: Based on 2020-2022 air monitoring data, the dark green areas on the map indicate counties that do not meet the annual PM$_{2.5}$ standard of 9 ug/m^3.
View the data (pdf). (courtesy U.S. EPA)

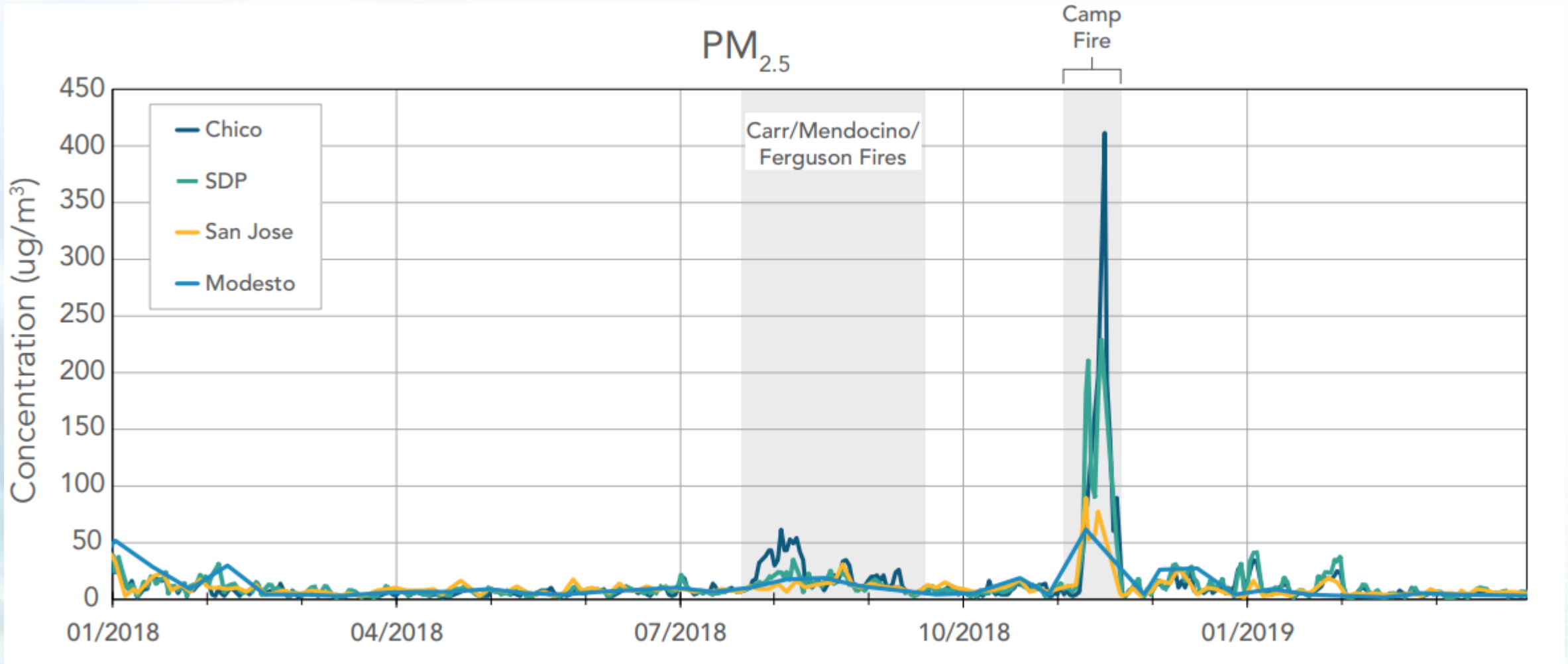# California Ozone and PM$_{2.5}$ Design Value Trends

CA 8-Hour Ozone DV Trend

CA Annual PM2.5 DV Trend

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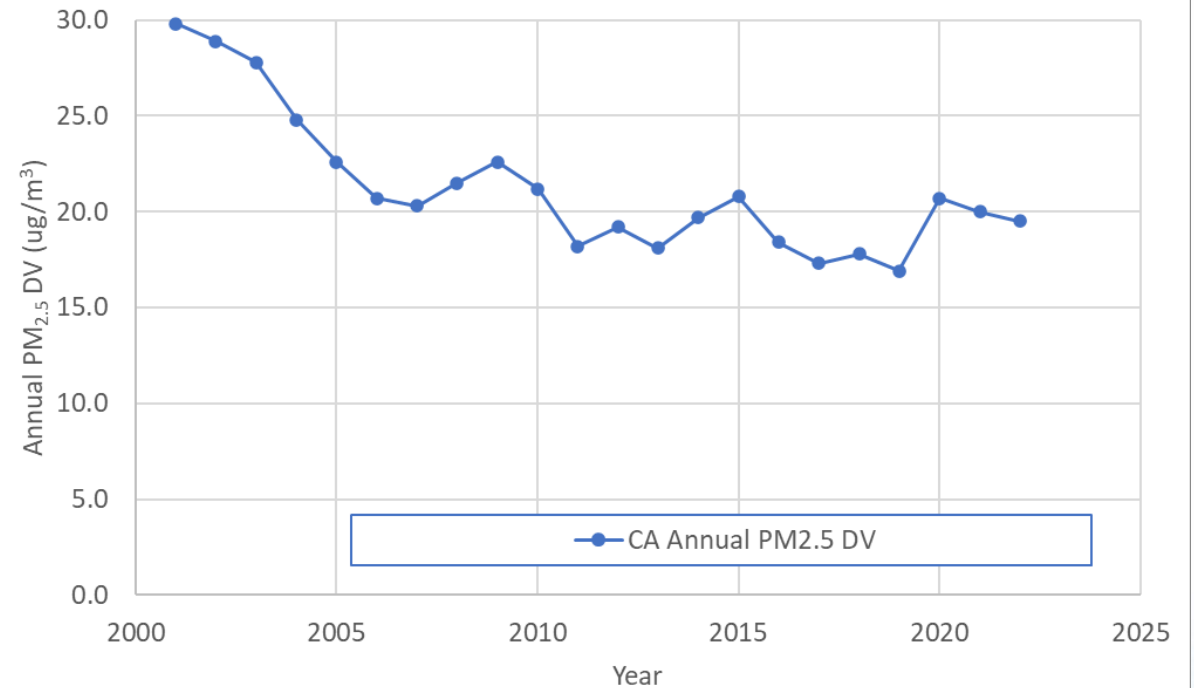
Camp Fire PM$_{2.5}$ Concentrations

Sensor Evaluation Programs

- Meeting U.S. EPA enhanced testing protocols for PM$_{2.5}$ and ozone

- Supporting inter-chamber comparison studies

- Developing chambers to meet ASTM test method requirements

Number of publications referring to "Low-cost air quality sensor" (Google Scholar)

CARB