

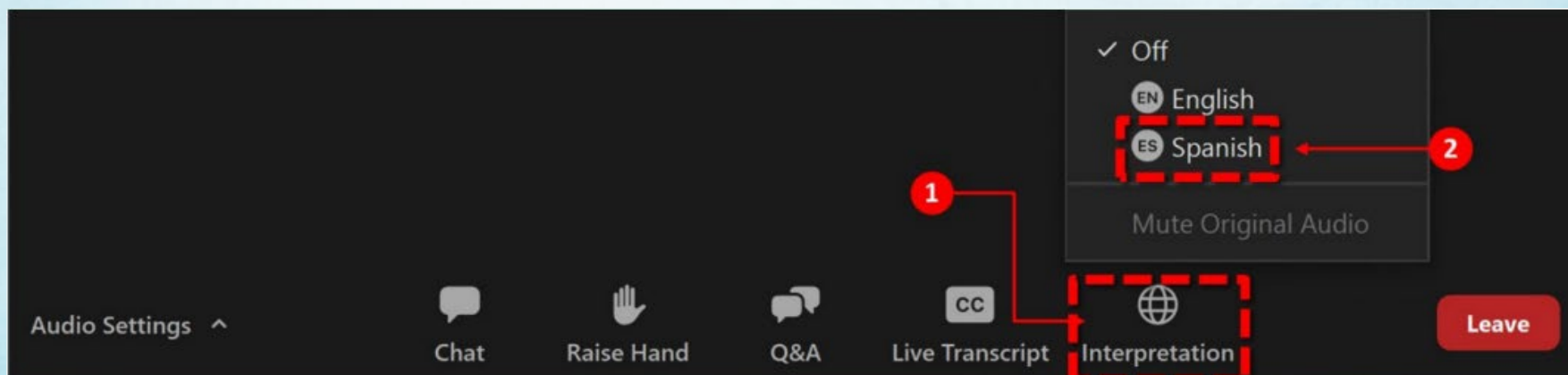


**9  $\mu\text{g}/\text{m}^3$  Annual PM<sub>2.5</sub> Standard  
Workshop  
September 25, 2024**

Mark Hixson, Staff Air Pollution Specialist  
AQPSD

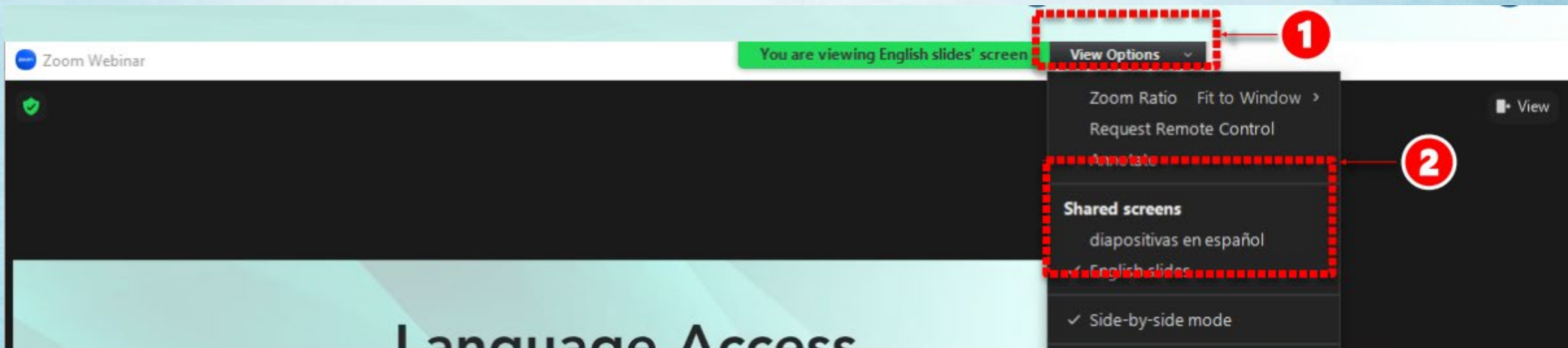
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# Agenda

- New PM2.5 Standard
- Designation Process
- Meeting the New PM2.5 Standard
- Public Engagement
- Understanding PM2.5
- Next Steps

# National Ambient Air Quality Standards

- EPA sets limits on the amounts of certain pollutants that can be in the air outdoors
  - Six pollutants covered by these standards
  - Pollutants are harmful to public health and the environment
- EPA is required to regularly review these standards
  - Standards are updated based on new scientific and technical information every 5 years

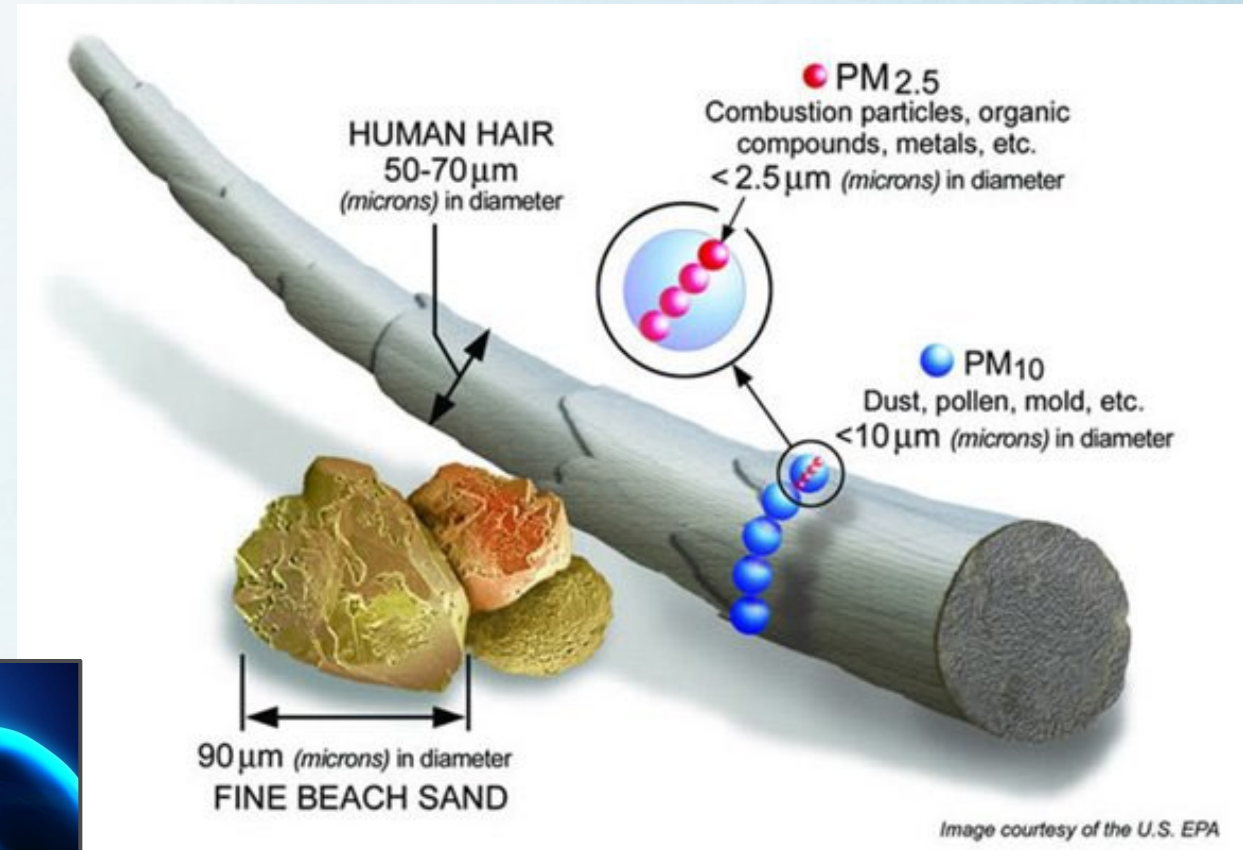
# New PM<sub>2.5</sub> ug/m<sup>3</sup> Standard

- On February 7<sup>th</sup>, 2024, the EPA revised the primary annual NAAQS for PM<sub>2.5</sub> from the annual level of 12.0 micrograms per cubic meter (µg/m<sup>3</sup>) to **9.0 µg/m<sup>3</sup>**.
- No changes to:
  - secondary (welfare-based) annual PM<sub>2.5</sub> standard,
  - primary and secondary 24-hour PM<sub>2.5</sub> standards,
  - primary and secondary PM<sub>10</sub> standards.



# Fine Particulate Matter (PM2.5)

- PM2.5 can be directly emitted or formed in the air from:
  - Oxides of Nitrogen (NO<sub>x</sub>)
  - Ammonia
  - Oxides of Sulfur (SO<sub>x</sub>)
  - Volatile Organic Compounds (VOCs)
- Health effects include:
  - Lung cancer
  - Ischemic heart disease
  - Stroke



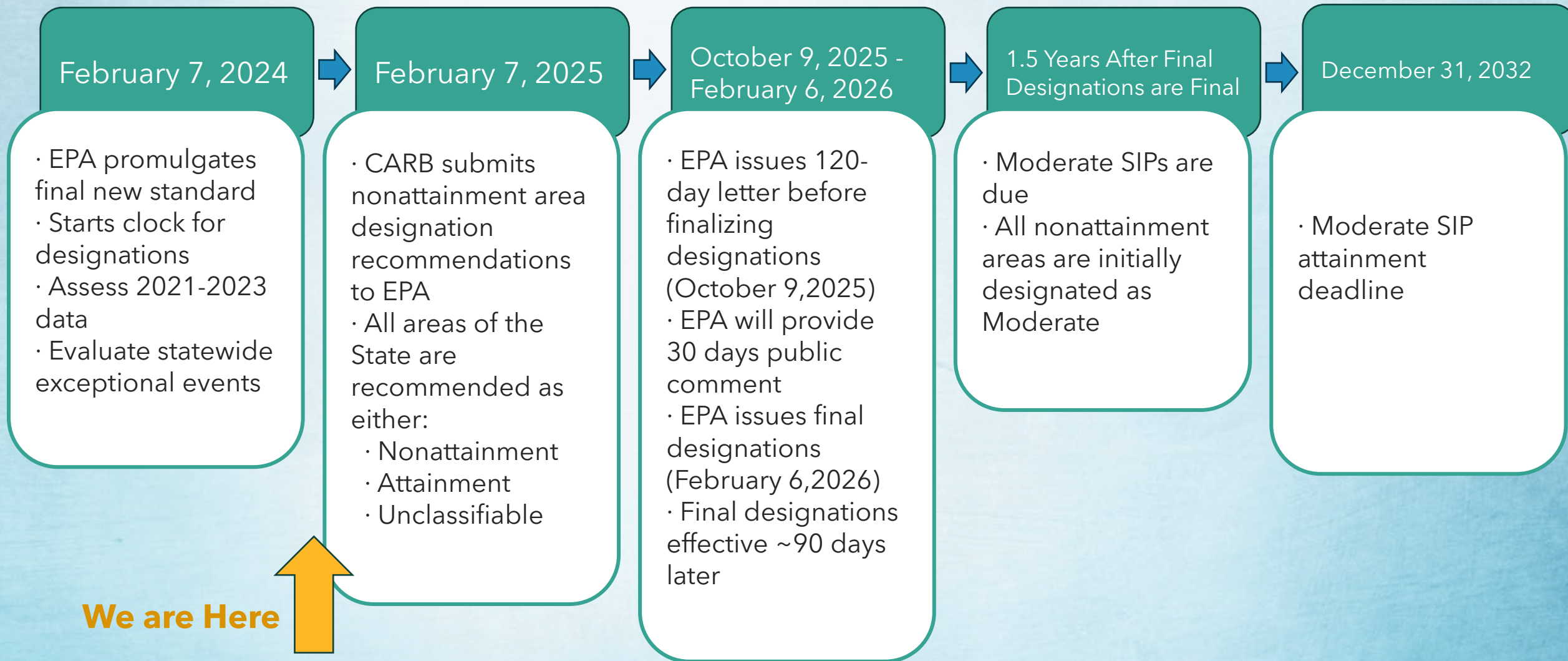
*Image courtesy of U.S. EPA*

# Opportunities With a New PM2.5 Standard

- Better understanding of pollution sources
- Revisit and refocus control strategies
- Reduces the regional air pollution burden on overburdened communities
- Co-benefits may reduce ozone pollution, air toxics, and greenhouse gases



# 9 ug/m<sup>3</sup> PM<sub>2.5</sub> Timeline of Major Milestones



# Designation Process

# PM2.5 Annual Design Values

- Design values are the metric EPA uses to assess compliance with a NAAQS

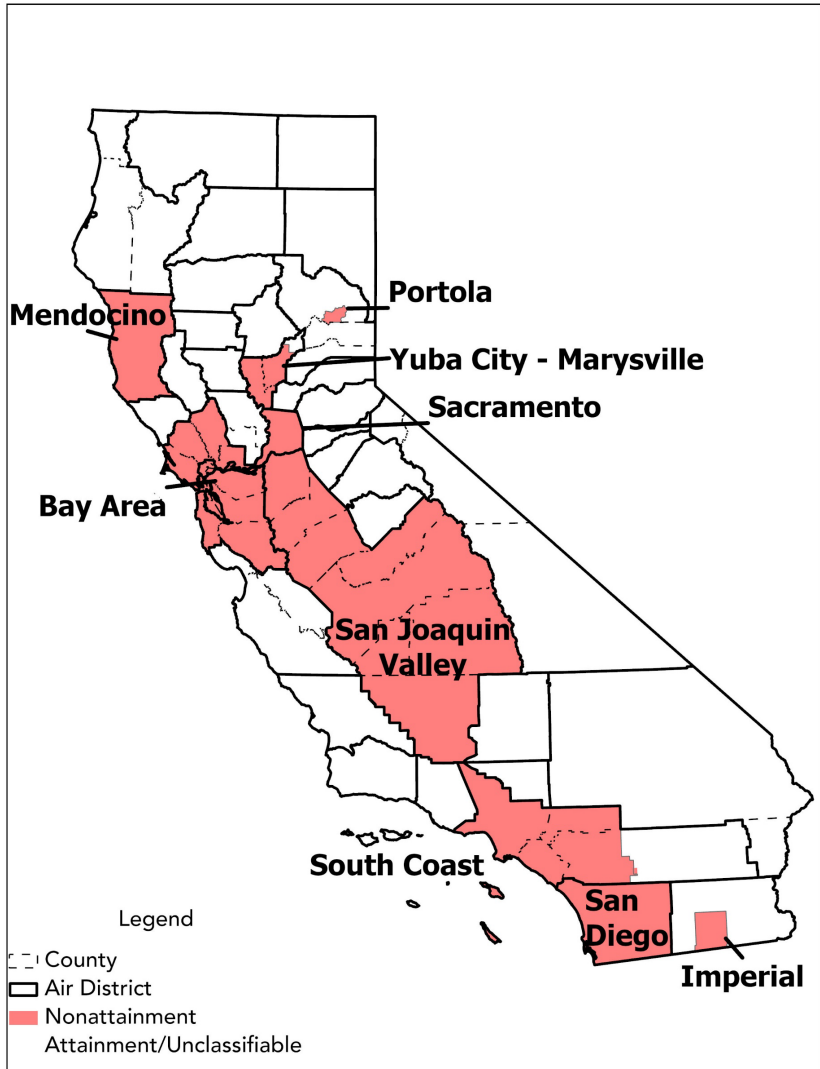
- Design Value 2023 = 
$$\frac{[Ann\ Avg\ 2021]+[Ann\ Avg\ 2022]+[Ann\ Avg\ 2023]}{3}$$

- Example:

Design Value 2023	2021 Annual Average	2022 Annual Average	2023 Annual Average
9	8	9	10

- Only PM2.5 data from federal reference monitors or federal equivalent monitors can be used to determine compliance with the NAAQS

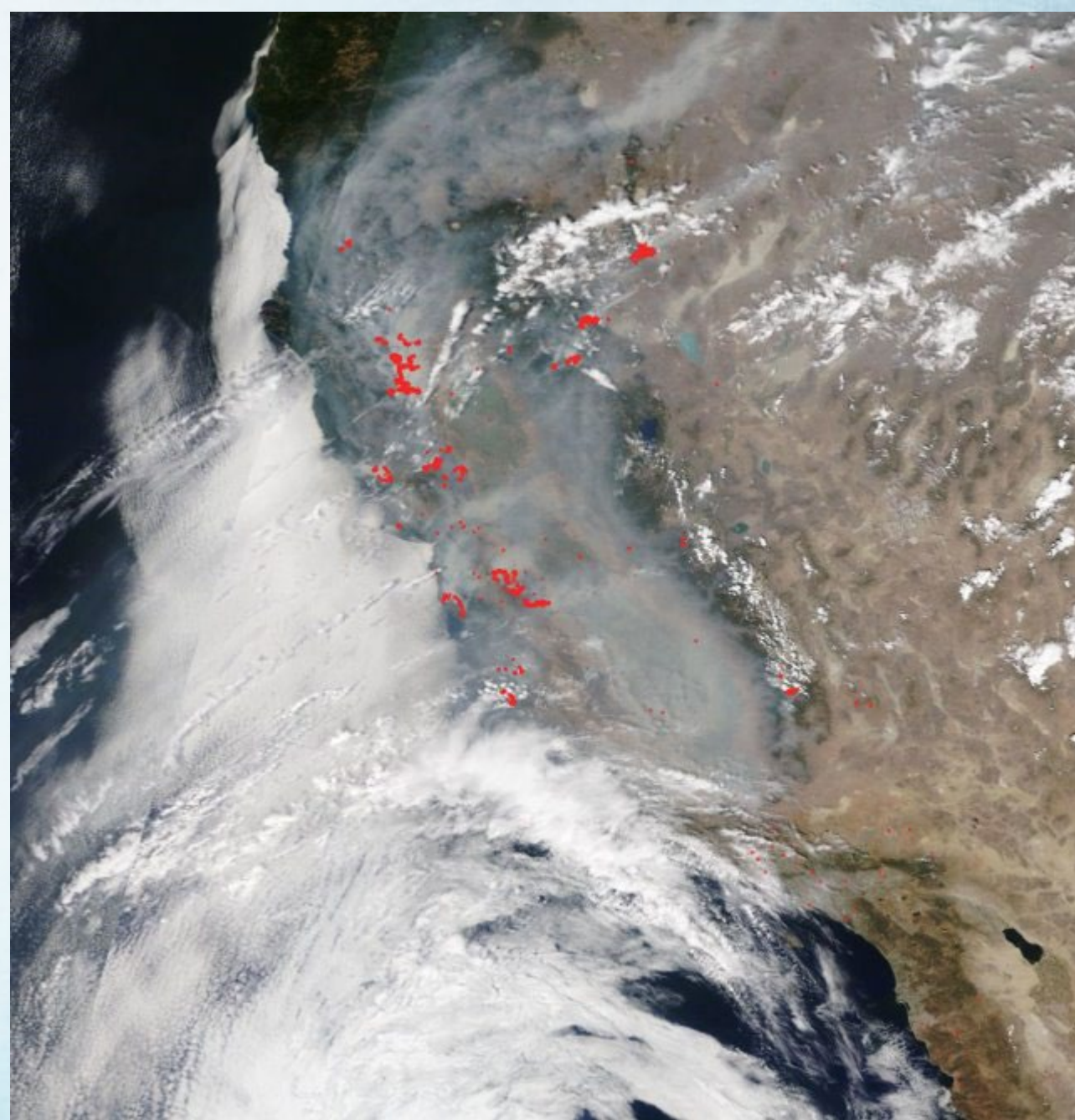
# Areas Exceeding the 9 $\mu\text{g}/\text{m}^3$ Annual PM<sub>2.5</sub> NAAQS



Area Name	2023 DV ( $\mu\text{g}/\text{m}^3$ )
San Joaquin Valley	16.2
Portola (Plumas)	14.0
South Coast	13.1
Feather River (Yuba City - Marysville)	11.2
Mendocino County	11.0
Imperial County	10.2
Sacramento County	9.9
San Francisco Bay Area	9.6
San Diego County	9.2

# Exceptional Events

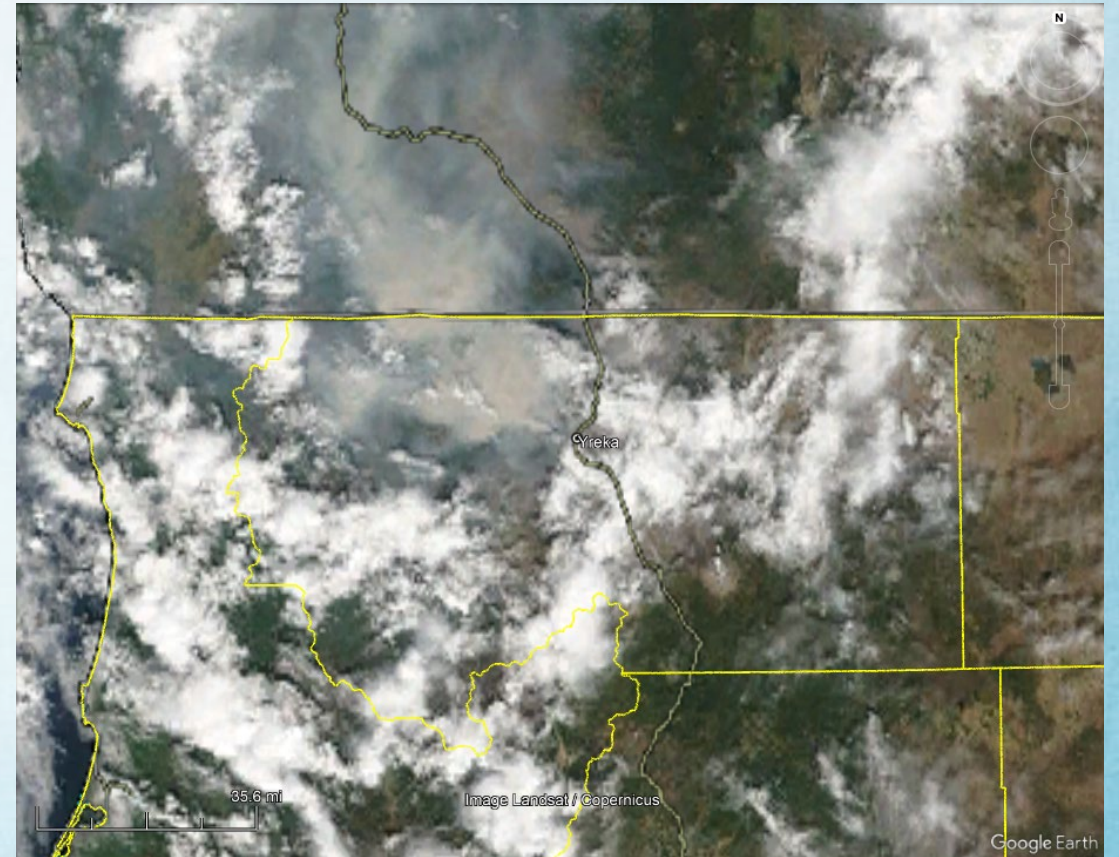
- Only necessary where designation or attainment is impacted by the events
- Exceptional events (like wildfires) can't be controlled through the SIP process



NASA Terra satellite - August 24, 2020

# Wildfires Impact PM2.5 Designations for Siskiyou County: Yreka

- PM2.5 design value = 11.7 ug/m<sup>3</sup>
- 2021 and 2022 exceptional caused site to be over
  - 50 days in 2021
  - 7 days in 2022
- PM2.5 design value after removing exceptional events = 8.2 ug/m<sup>3</sup>
- EPA will only approve days to get to the level of the standard



# Nonattainment Area Boundary Considerations



- Boundaries for each nonattainment areas are evaluated on a case-by-case basis.
- Boundaries are determined by a weight of evidence approach based on consideration of five factors.

# Meeting the New PM2.5 Standard



# Each Agency Has a Role

## FEDERAL



### US EPA

Sets & enforces national air quality standards.  
Regulates interstate transportation.



Trains



Planes



Ships

Approves State Implementation Plans.

## STATE



### CALIFORNIA AIR RESOURCES BOARD

Regulates mobile sources of air pollution,  
greenhouse gases & consumer products.



Cars



Trucks



Buses

Develops State SIP Strategy,  
and works with local air districts to  
develop & adopt SIPs  
for all nonattainment areas.

## LOCAL



### Local Air Districts

Regulates stationary & local  
sources of air pollution.



Fireplaces



Factories



Refineries



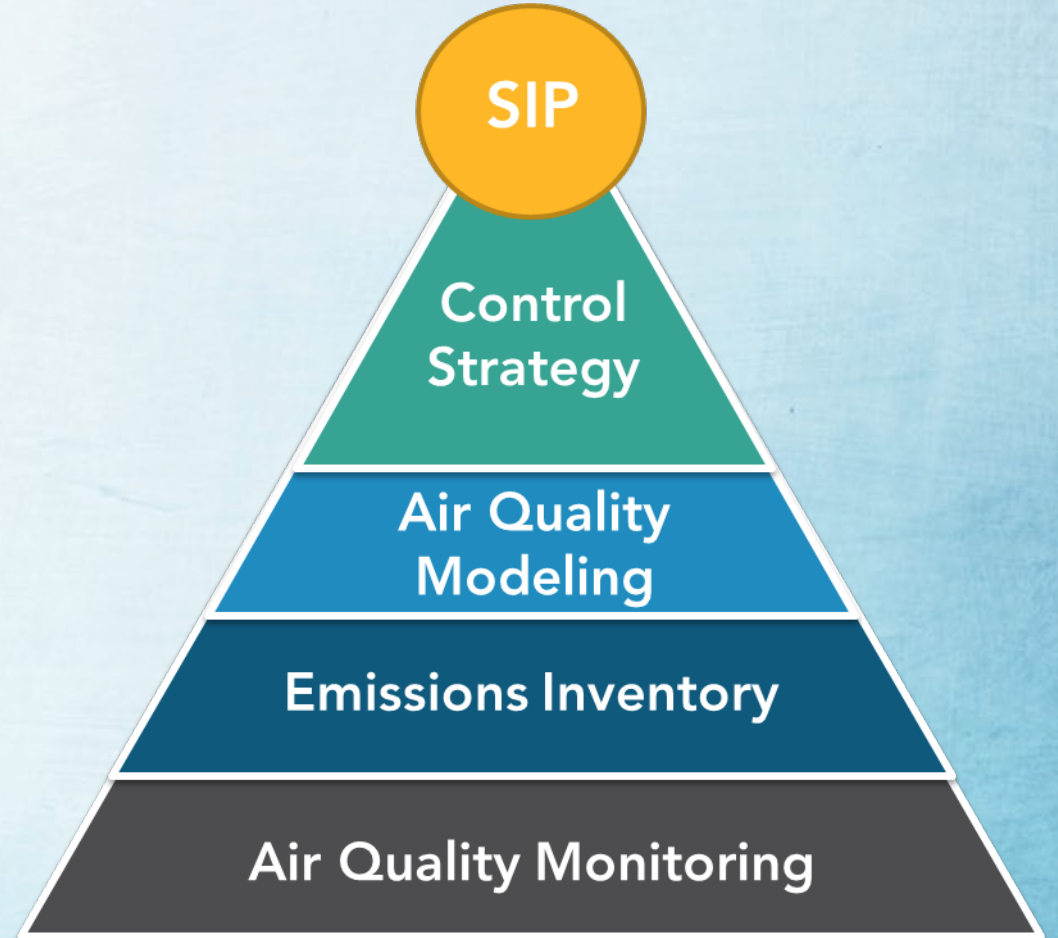
Power plants

Develops & adopts State Implementation  
Plans for nonattainment areas  
within their District.

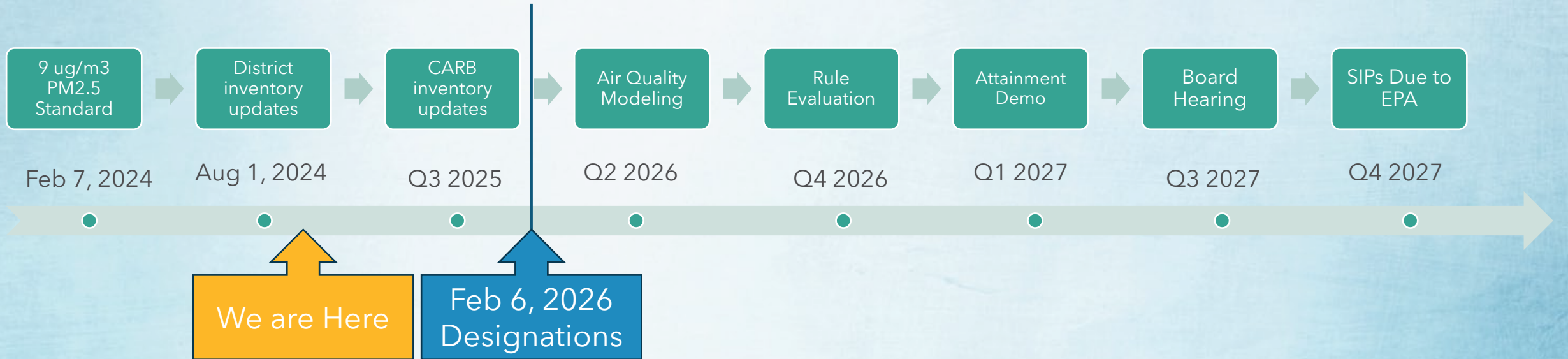
# SIPs Demonstrate How to Meet NAAQS

## Key Elements of a SIP:

- **Air Quality Monitoring**  
CARB and District
- **Emissions Inventory**  
CARB and District
- **Air Quality Modeling**  
CARB
- **Control Strategy**  
EPA, CARB, and District



# SIP Development Timeline



# Public Engagement

# Address Past Public Process Feedback

- Collaboration and engagement - early, and often
- Community member and stakeholder ideas and feedback
- Workshop location in impacted communities
- Posting of information earlier
- Annual Board updates
- Education on the science, the SIP process, and how it works
  - Start to finish
- More opportunities for community involvement
- Translation services (slides, narrative, website)
- Alternative workshop formats

# Public Engagement Opportunities

- CARB workshops series
  - Emission inventories
  - Control strategies
- Designations CARB hearing (January, 2025)
- District workshops
- CARB Regulatory Board Hearings
- EPA 30-day comment period for Final Designations (~October 2025)
- CARB SIP Board Hearings
- District SIP Board Hearings

# How Can You Make a Difference

- Participate in workshops, hearings, and provide ideas and feedback
- Active participation during the public process with your local air district
- Visit CARB website for educational materials and updated information, important dates, and announcements
- Consider using cleaner appliances for cooking and heating
- Check with your local district if it's OK to use your woodstove or fireplace

# **Understanding PM2.5: Leveraging Observing Systems for Inventory Verification and Improvement**

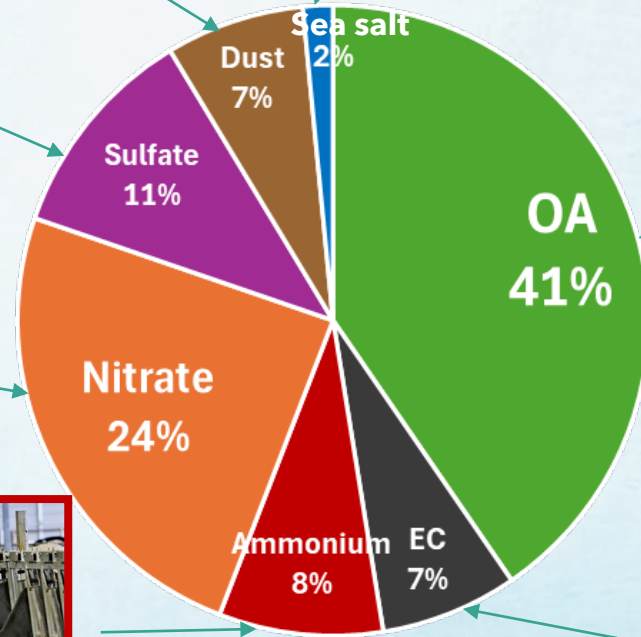


# PM<sub>2.5</sub> in California

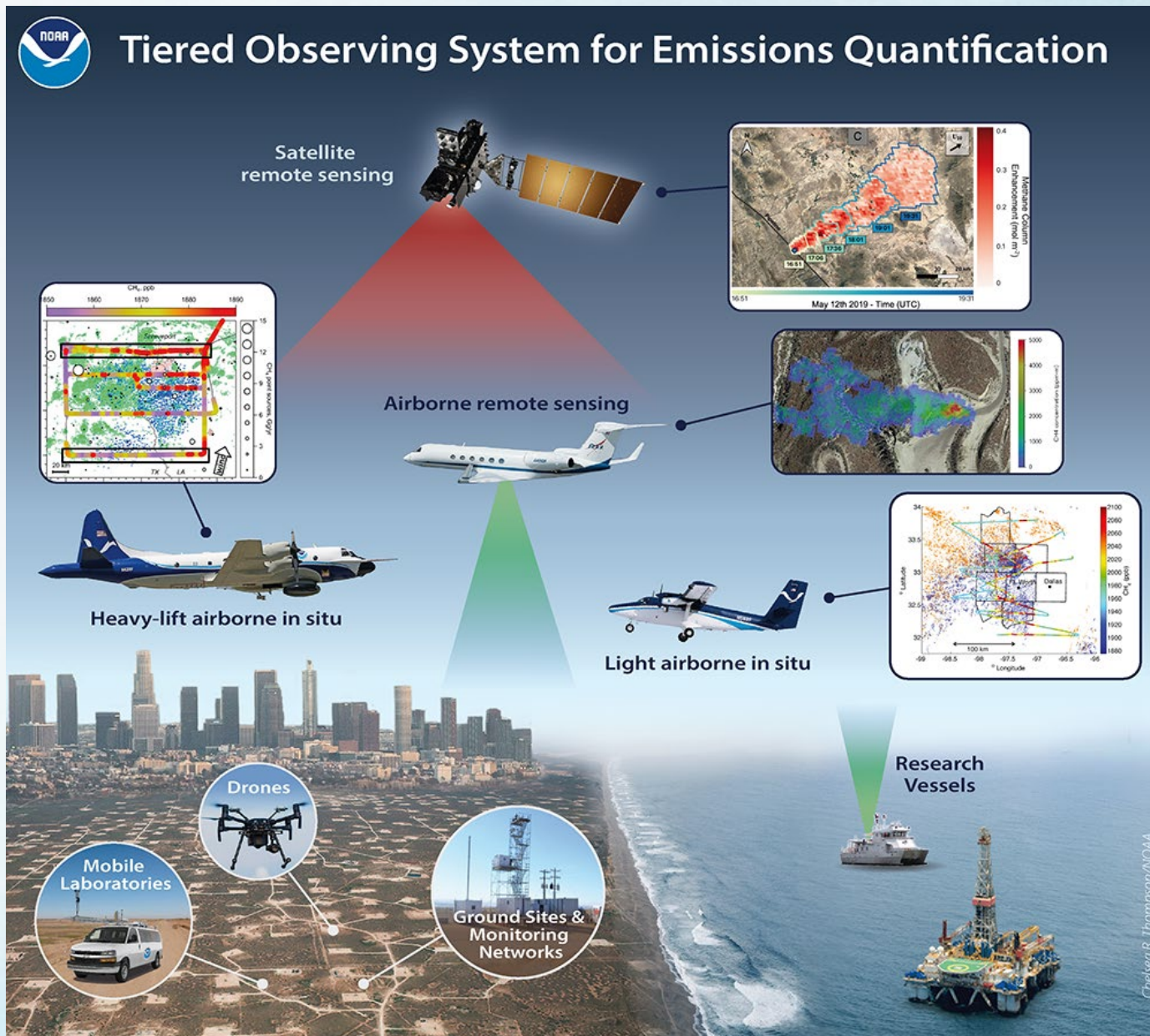
- Sources of PM<sub>2.5</sub> in California
- Verifying emissions and sources (tiered observing system)
  - PM<sub>2.5</sub> composition
  - Seasonal and diurnal variation in PM<sub>2.5</sub>
  - Sources of organic aerosols
  - Gaps in the current inventory

# Many Different Sources Contribute to PM2.5 (Example: Los Angeles 2021)

Organic Matter
Elemental Carbon
Ammonium
Nitrate
Sulfate
Dust
Sea salt



# Verifying Emissions and Sources

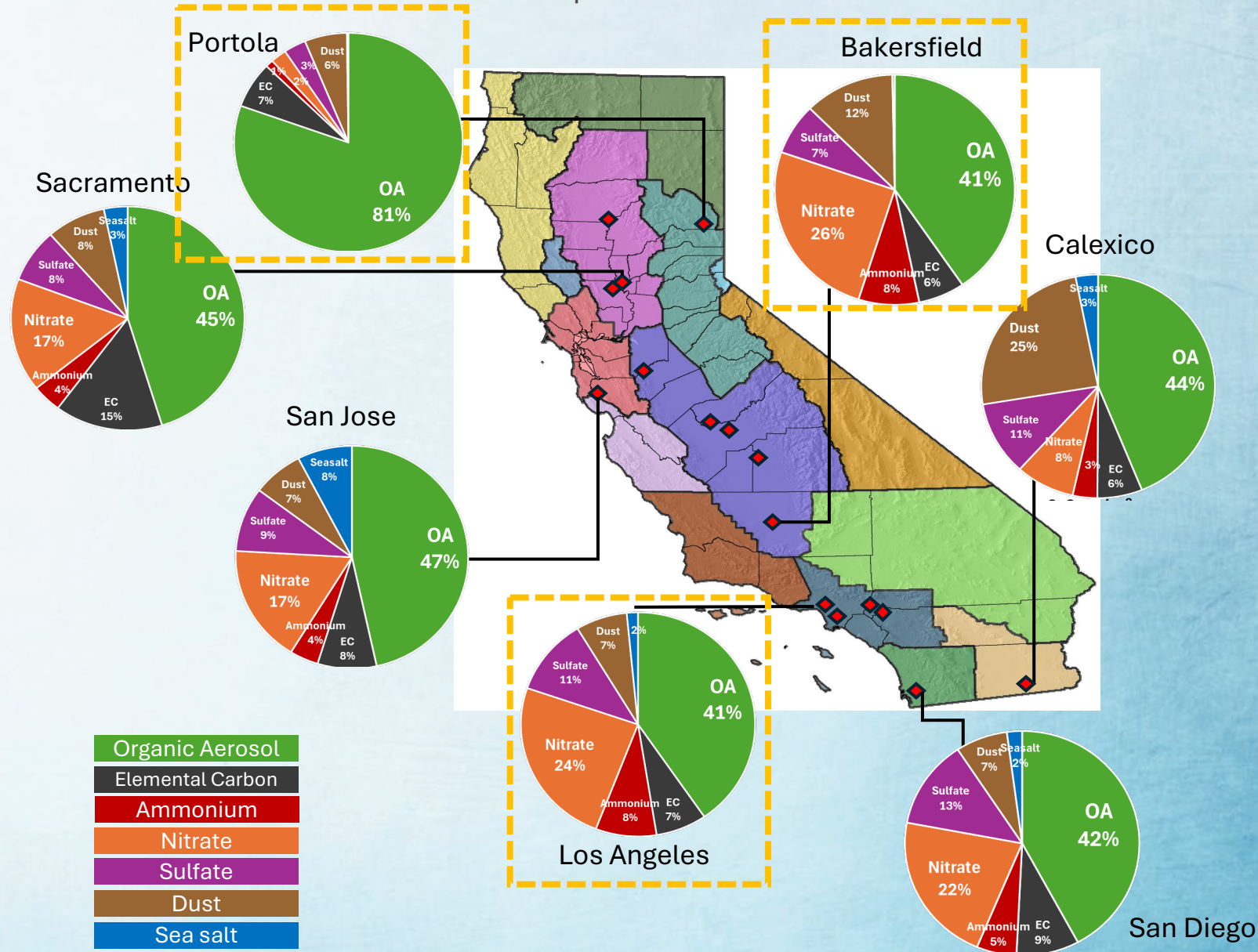


# Surface Monitoring Network

## ◆ Speciation Monitors

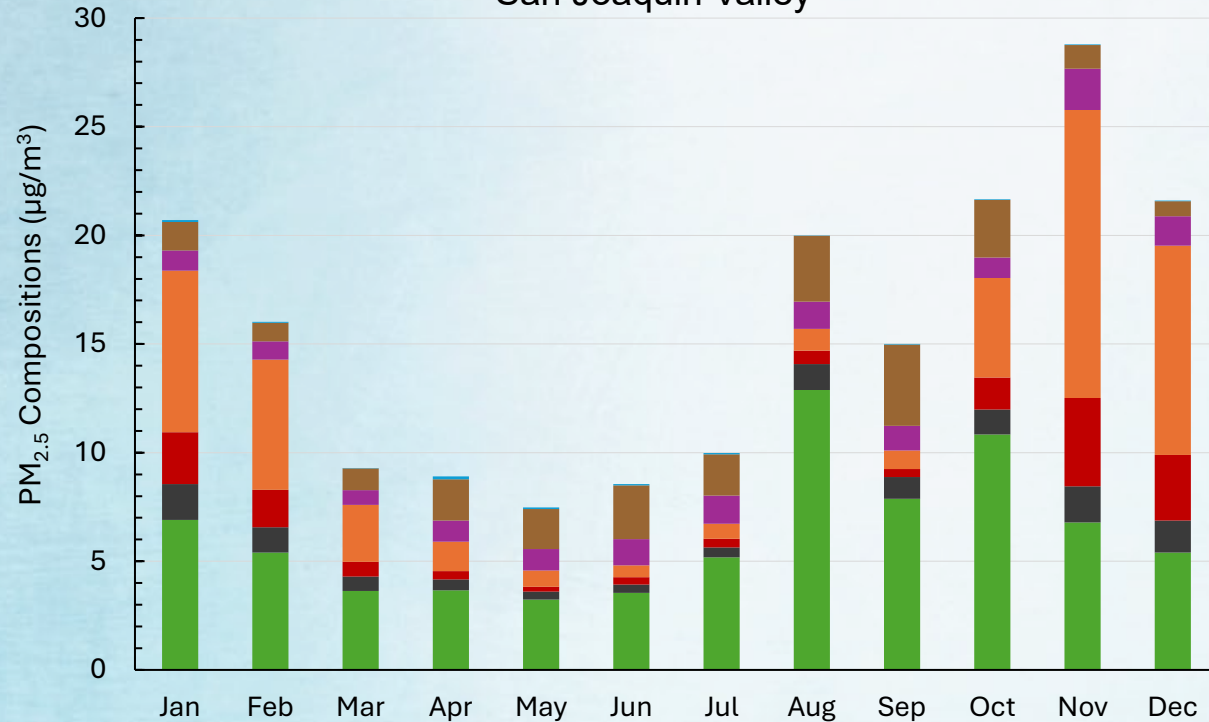
- PM2.5 composition varies across the state
- Organic aerosol is the most abundant component of PM2.5
- PM2.5 composition may look similar at some sites, but the nature of the problem can be very different

2021 Speciation Data

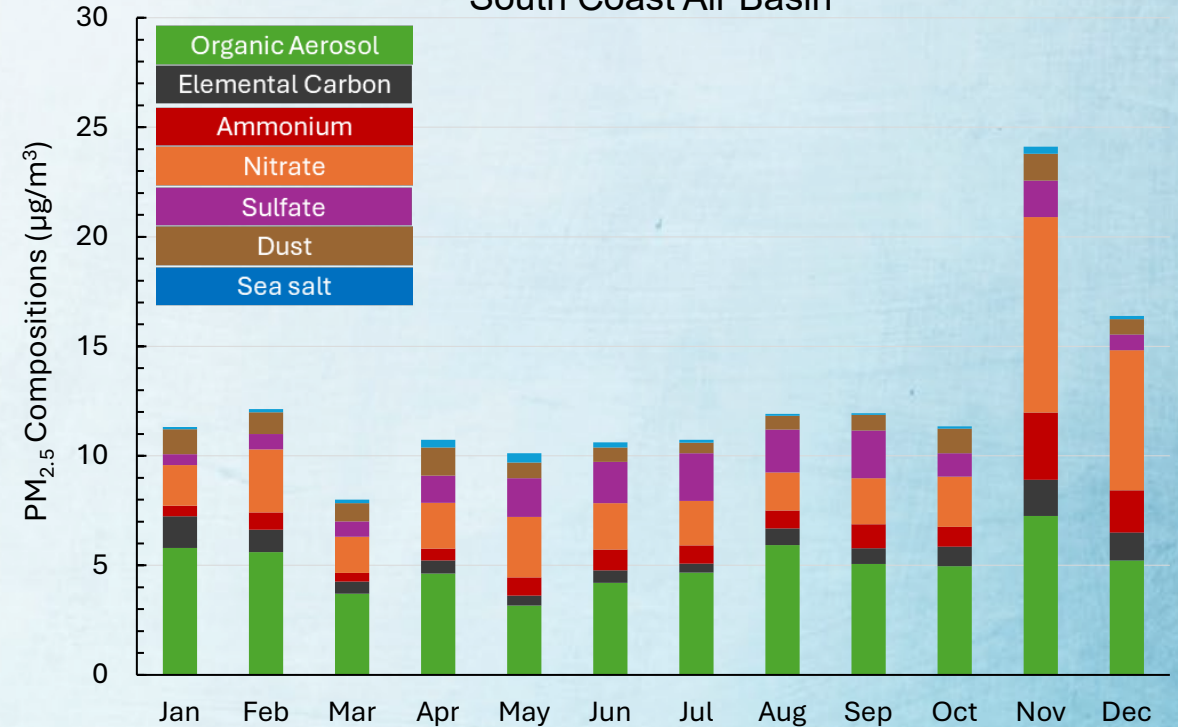


# PM<sub>2.5</sub> Composition Varies Throughout the Year

Bakersfield  
San Joaquin Valley



Los Angeles  
South Coast Air Basin

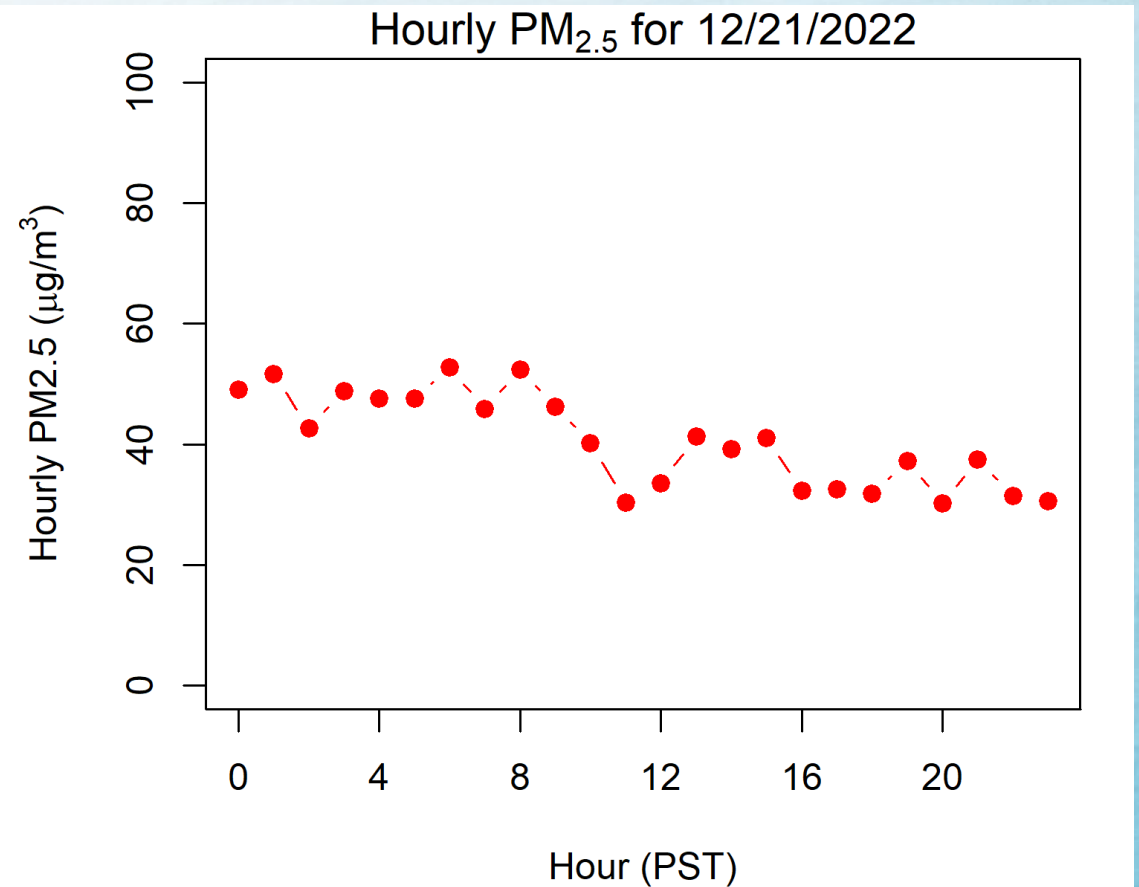
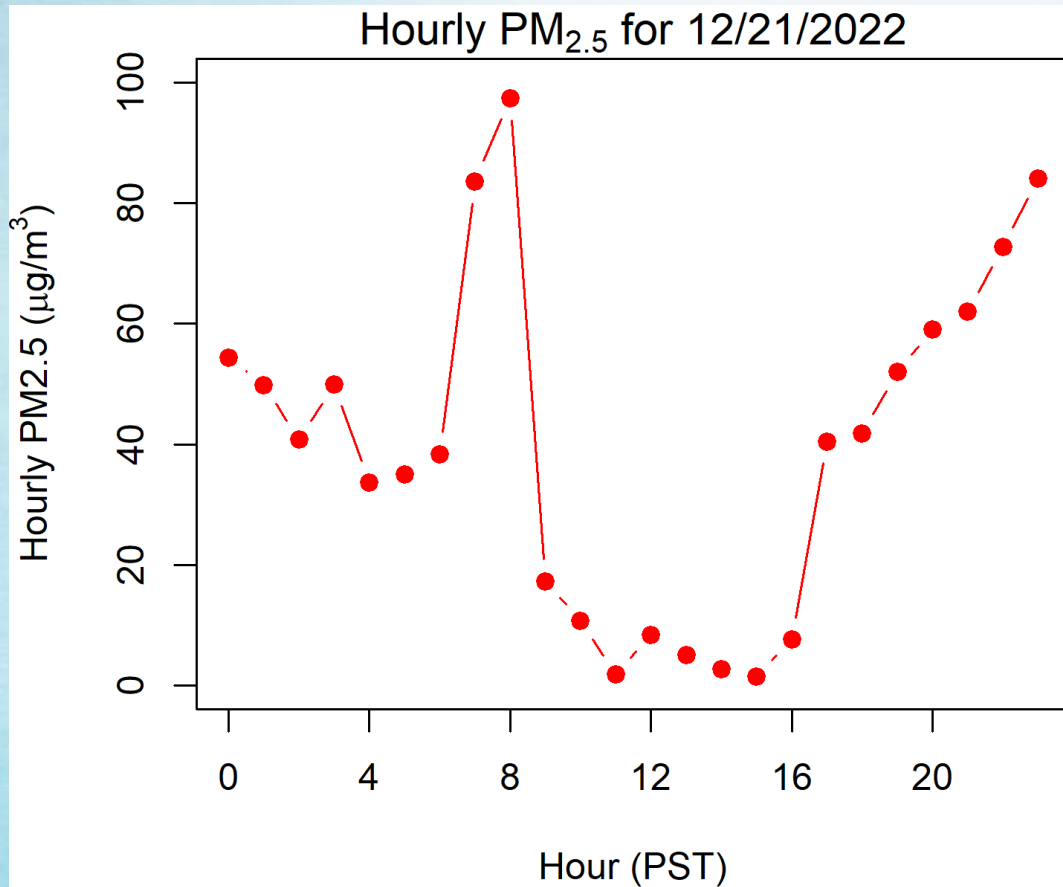


Annual average composition may look similar, but monthly composition can be very different depending on the season and emission sources impacting the monitor.

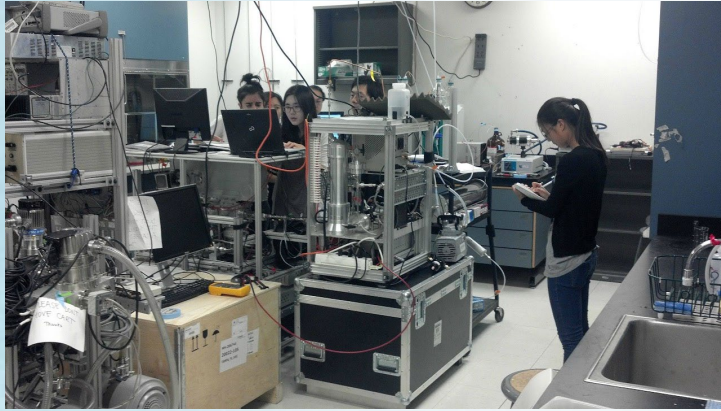
# Hourly Patterns Help Identify Sources

Portola Daily Average PM2.5: 39.5  $\mu\text{g}/\text{m}^3$

Bakersfield Daily Average PM2.5: 40.5  $\mu\text{g}/\text{m}^3$



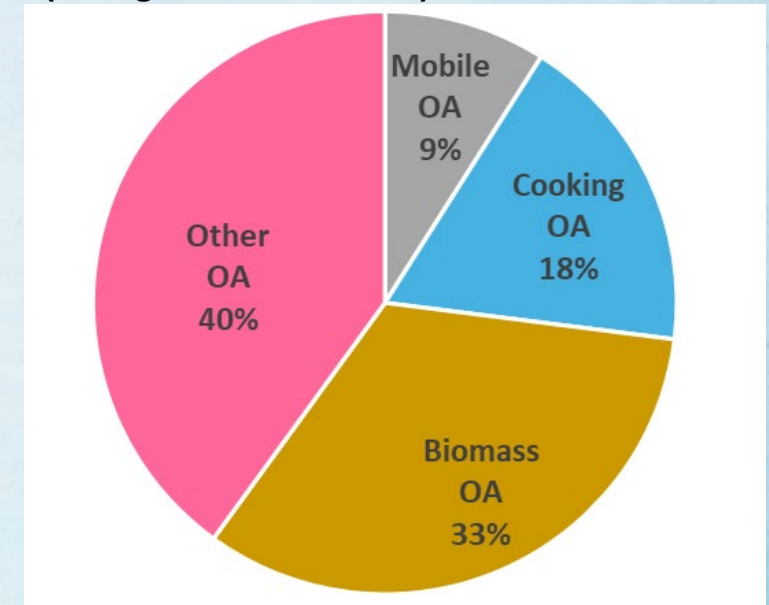
# Research Field Studies



- Provide information not available through the monitoring network
- Example: detailed organic aerosol composition to identify contributions from cooking, mobile sources, and biomass burning

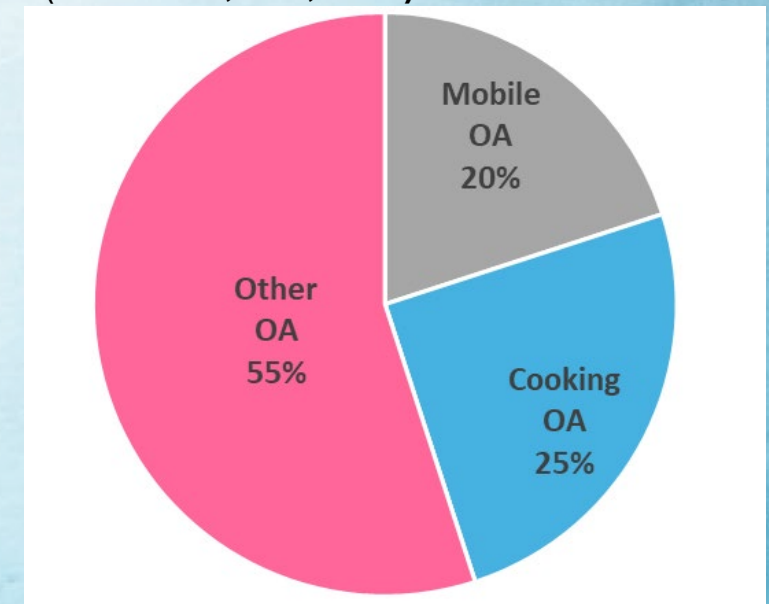
**Fresno, Jan-Feb 2013**

(Young et al., ACP, 2016)



**Oakland, Summer 2017**

(Shah et al., ACP, 2018)



# Research Field Studies

- Example: aircraft measurements (concentrations and emission fluxes)
  - Expensive (limited time)
  - Better spatial coverage
- Compare to the gridded emissions inventory and modeling to better understand uncertainties

Surface Fluxes of Volatile Organic Compounds over Los Angeles derived by Airborne Eddy Covariance

Eva Y. Pfannerstill, Caleb Arata, Qindan Zhu, Bryan Place, Robin Weber, Paul Wooldridge, Benjamin C. Schulze, Ryan Ward, Roy Woods, John H. Seinfeld, Anthony Bucholtz, Ron Cohen, Allen H. Goldstein

AMS Atmospheric Chemistry Meeting  
January 27, 2022

**Berkeley**  
UNIVERSITY OF CALIFORNIA



**NPS**  
NATIONAL PARK SERVICE

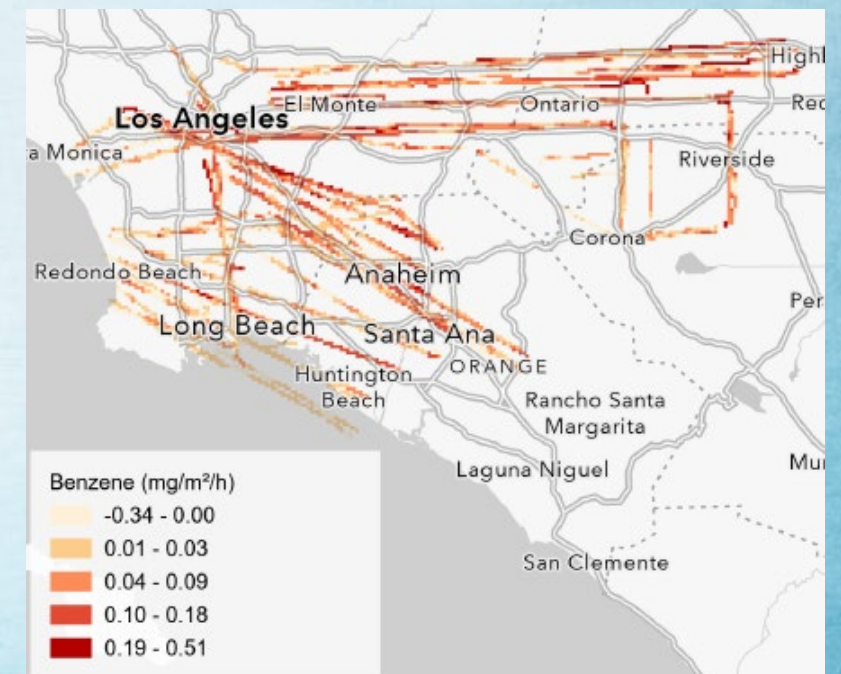
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**CARB**  
CALIFORNIA AIR RESOURCES BOARD

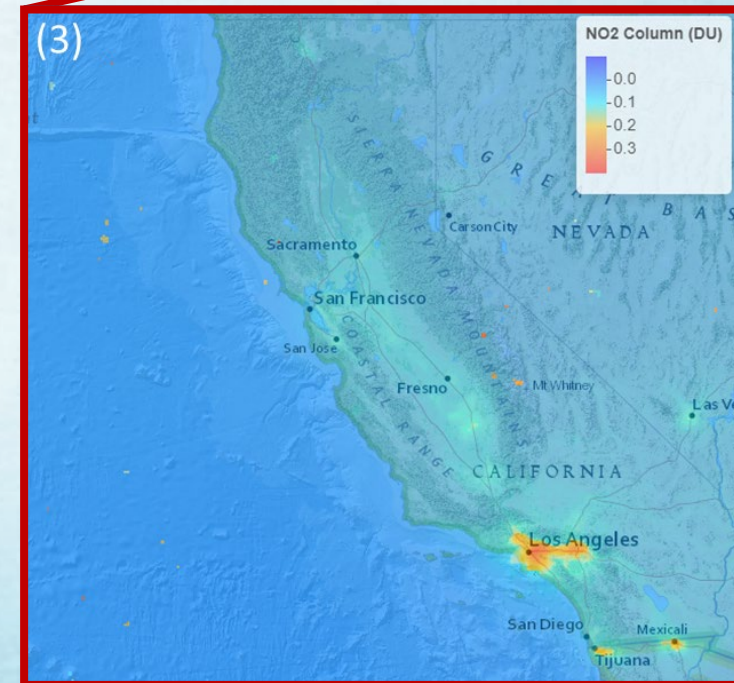
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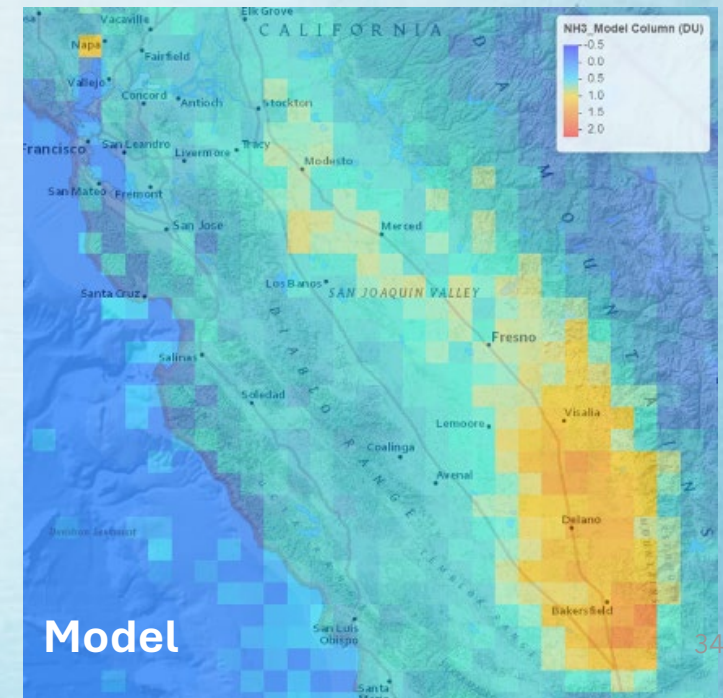
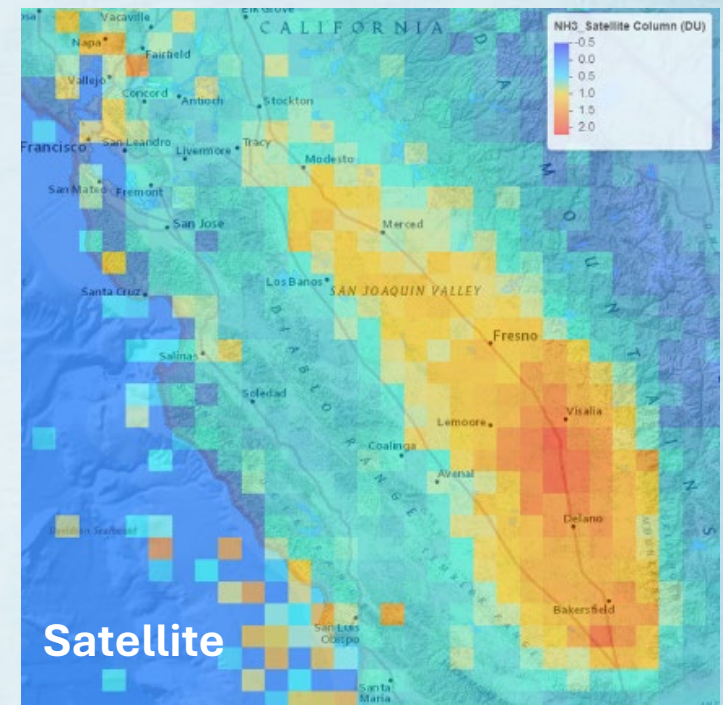
# Space-Based Measurements (satellites)

- Provide spatially resolved measurements to compare with emissions inventory and modeling
- Identify gaps in the emissions inventory
  - Biases in the emissions inventory
  - Missing sources
  - Errors in the location of emissions in the inventory



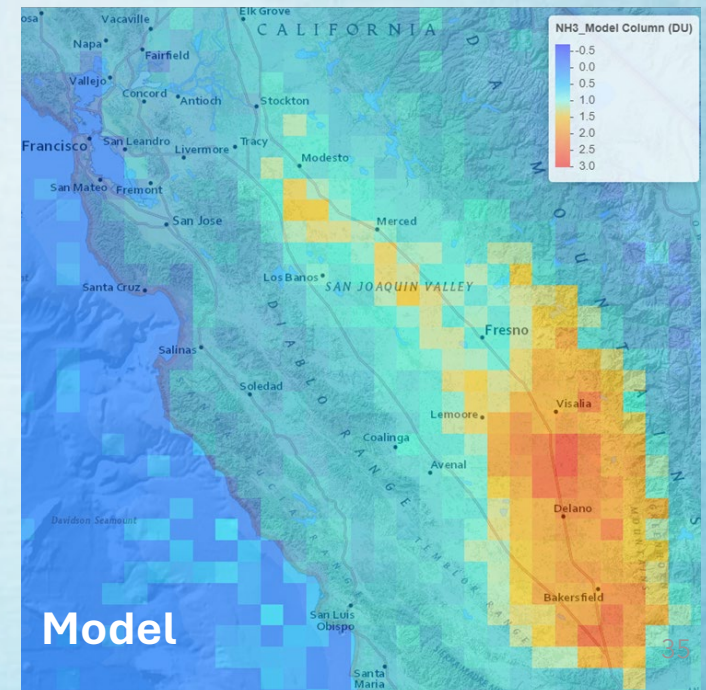
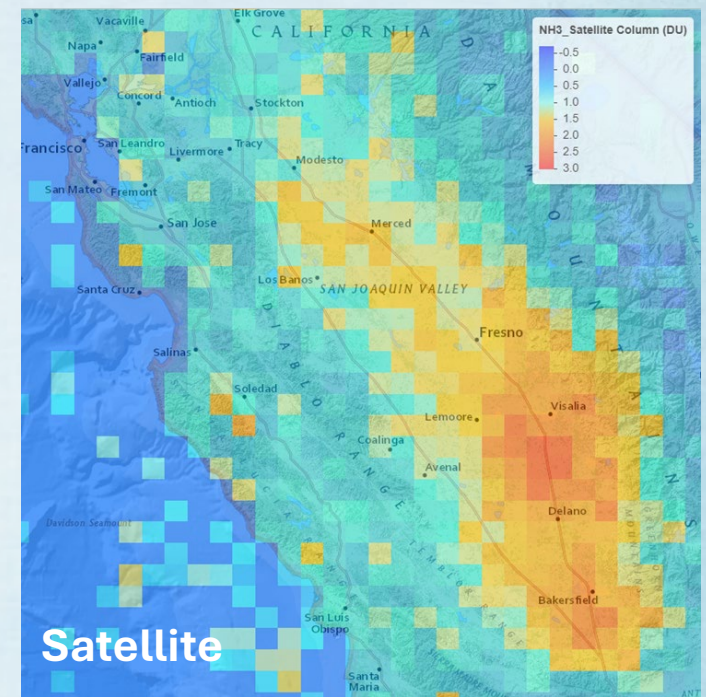
# Space-Based Measurements (satellites): NH<sub>3</sub>

- Satellite (top) and modeled (bottom) NH<sub>3</sub> for 2017
- Highest NH<sub>3</sub> levels occur in the SJV (dairies and fertilizer)
- Modeled NH<sub>3</sub> is generally lower than satellite measurements
- Updates to the NH<sub>3</sub> emissions inventory planned for the SIP (next slide)

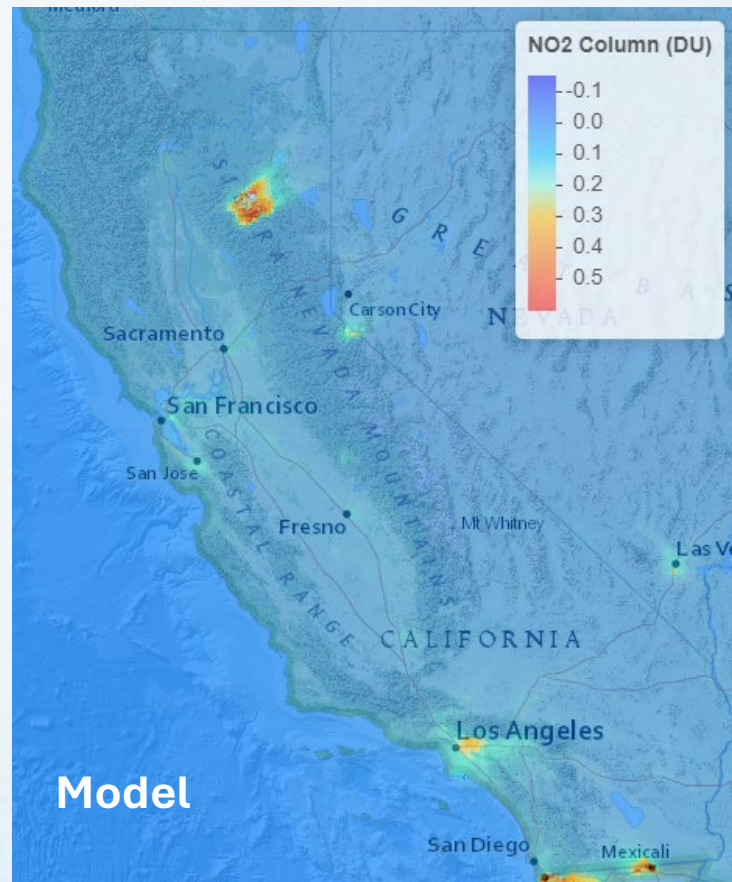
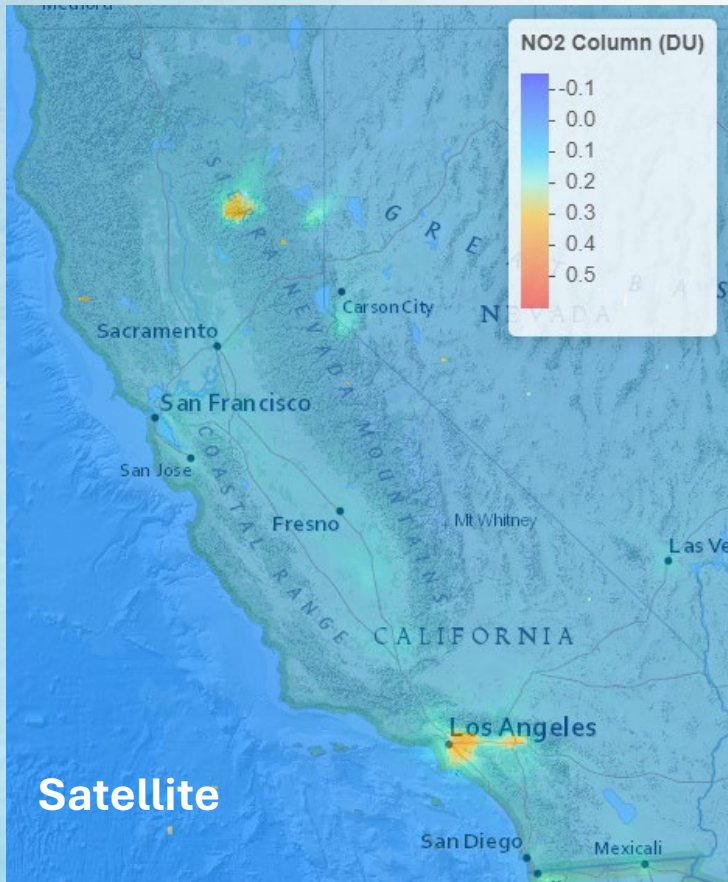


# Space-Based Measurements (satellites): NH<sub>3</sub>

- Satellite (top) and modeled (bottom) NH<sub>3</sub> for 2021
- Includes preliminary updates to the dairy emissions inventory discussed at the August 22 Dairy Sector Workshop (<https://ww2.arb.ca.gov/our-work/programs/slcp/meetings>)
- Improved representation of dairy emissions



# Space-Based Measurements (satellites): NO<sub>2</sub>



- Satellite (left) and modeled (right) NO<sub>2</sub> for 2021
- Spatial distribution is well represented in the inventory (including fires)
- Positive/negative bias in the inventory varies by location (urban vs. rural)

# Key points

- Sources contributing to PM2.5 can vary significantly across the state and seasons.
- Not a one size fits all solution, emission control strategies need to be tailored to specific areas.
- Utilize various measurements and studies to inform emission inventory improvements

# Next Steps

- Establish nonattainment area boundary recommendations
- Understand key sources in areas with limited monitoring
- Update critical emissions inventories
- Work with stakeholders, districts and advocates throughout the process
- Discuss emission inventory improvements and air quality modeling in future workshop



# December 2024 Workshop Preview

- CARB Recommendations: Nonattainment, attainment, unclassifiable
- Nonattainment Boundaries
- Emission Inventory Updates
  - Preliminary categories to update
  - Feedback from public on potential emission inventory updates
- Public Feedback

# PM2.5 Resources

- Website:
  - <https://ww2.arb.ca.gov/our-work/programs/california-state-implementation-plans/statewide-efforts/sips-9-mgm3-pm2-5>
  - Educational videos
  - Helpful links and resources for more information
  - Workshop recordings
  - Announcements, important dates, workshop materials
- Email for questions: [siplanning@arb.ca.gov](mailto:siplanning@arb.ca.gov)
- Local District webpages
- Comments and responses