



## Particulate Matter (PM) Symposium: Status Report

BAY AREA  
AIR QUALITY  
MANAGEMENT  
DISTRICT

Presentation to BAAQMD Board of  
Directors

By BAAQMD Advisory Council  
July 15, 2020



# PM Symposium: Context

- Following three years of **intense wildfire smoke**, focus on **reducing diesel PM** emissions, and conclusion that PM is overwhelming **health risk driver** in Bay Area air
- Air District asked Advisory Council to **focus on PM**
- Provide Advisory Council's take on **latest and best science**, in science-affirming way
- **Assist Air District** to identify those further PM measures that would most move public health needle, especially in most impacted communities, above and beyond what the Air District is already doing



# PM Symposium: Overview

- Convened by **Air District and Advisory Council**
- Engage **nationally-recognized experts**, including leading experts previously involved at Federal level
- **Support Air District** in identifying health-focused “target” guidelines based on latest science, beyond standards already in effect
- Facilitate **Advisory Council feedback** on Air District planning
- Include **local stakeholders**
- Provide **national leadership**



## Particulate Matter: Spotlight on Health Protection



Date: Oct. 28, 2019 Time: 9:00 am - 4:45pm Advisory Council Chair: Mr. Stan Hayes Facilitator: Jeff McKay

### Agenda Items

8:30 AM	Registration/Coffee and light breakfast	Atrium
9:00 AM	Welcome	Board Room
9:25 AM	PM Health Effects Panel	Board Room
11:05 AM	Break	Atrium
11:15 AM	Joint Discussion: Health Effects Panel	Board Room
12:00 PM	Lunch with Keynote Speaker – Former EPA Administrator Gina McCarthy	Yerba Buena
1:15 PM	PM Exposure & Risk Panel	Board Room
2:55 PM	Break	Atrium
3:10 PM	Joint Discussion: Exposure & Risk Panel	Board Room
4:00 PM	Advisory Council Deliberation	Board Room

#### Additional information

This is a meeting of the BAAQMD Advisory Council.

Public comment will take place during welcome remarks.

For ADA related assistance, please contact Areana Flores at [aflores@baaqmd.gov](mailto:aflores@baaqmd.gov).

375 Beale Street, Suite 600, San Francisco, California 94105 • 415.749.5000 • [baaqmd.gov](http://baaqmd.gov)



## Particulate Matter: Spotlight on Health Protection

- ~160 registrants
- ~Hundreds online
- 2 panels
  - PM Health Effects
  - PM Exposure & Risk
- 9 leading experts

# Gina McCarthy

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- **Former EPA Administrator**
- Finalized the Clean Power Plan and the Clean Water Rule
- Professor of the Practice of Public Health in the Department of Environmental Health at Harvard T.H. Chan School of Public Health
- Director of the Center for Climate, Health, and the Global Environmental
- Member of the Board of Directors of the Energy Foundation and Ceres
- M.Sc. in Environmental Health Engineering, Planning and Policy from Tuft's University







Jason Sacks, USEPA



Michael Kleinman, UCI



John Balmes, UCSF



Christopher Frey, NC State

## PM Health Effects Panel



Lauren Zeise, OEHHA



Scott Jenkins, USEPA



Julian Marchall, UWash



Phil Martien, BAAQMD

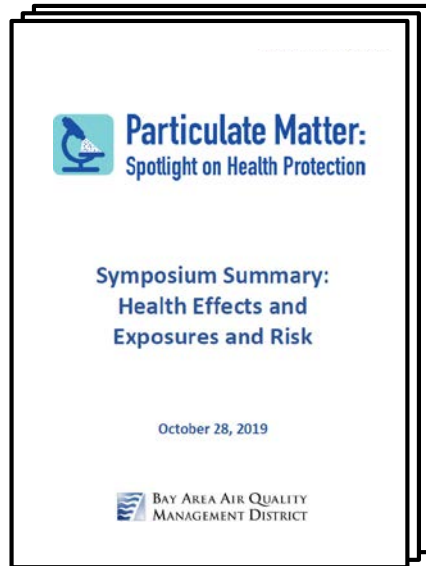
## PM Exposure & Risk Panel

# Advisory Council Discussion with Experts



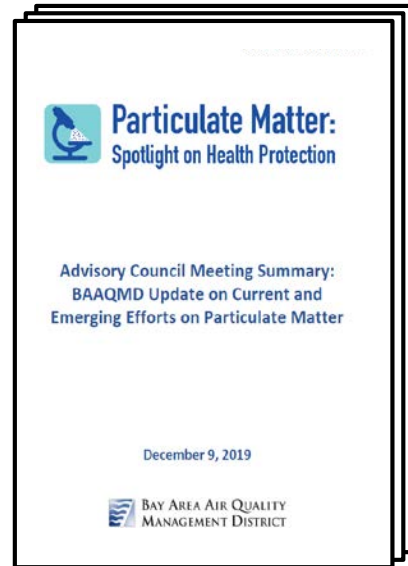
# PM Symposium: Work Products

October



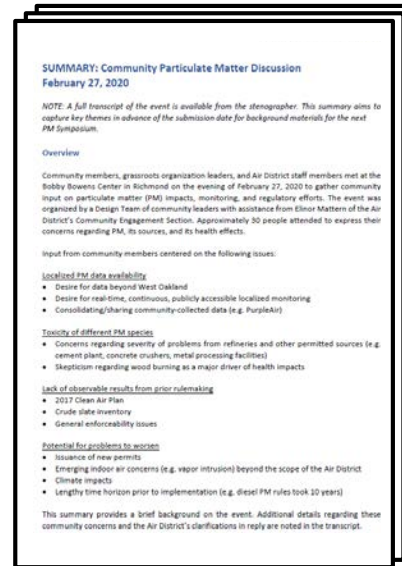
- **State of Science: PM health effects, exposures, risk**
- 9 national experts
- 33-pg report

December



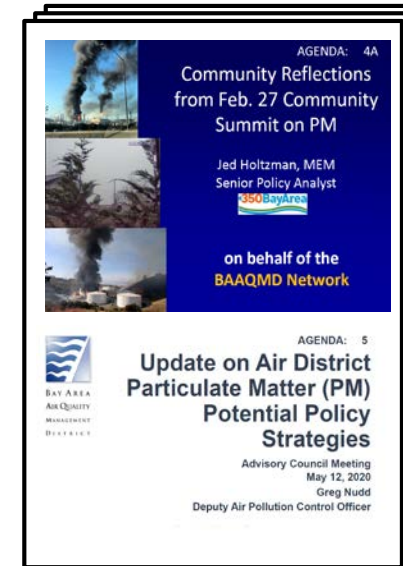
- **Council deliberations**
- District update on emerging PM efforts
- 35-pg report

February



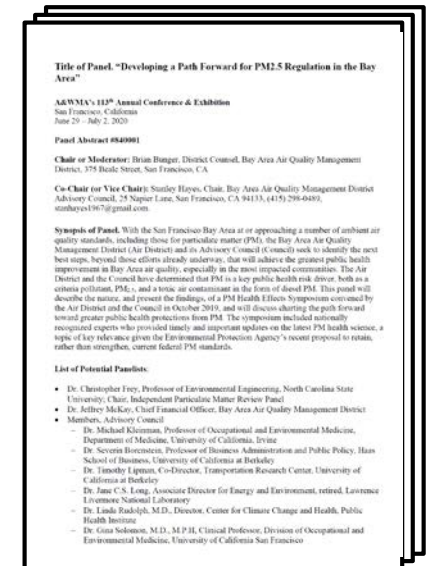
- **Community PM discussion**
- District staff, ~30 community members, ~16 organizations

May



- **Community presentations to AC**
- District update on PM potential policy strategies

June - July



- **Panel Session**
- A&WMA Virtual Annual Meeting
- June 30 - July 2, 2020



# PM Symposium:

## Q&A Document – Health Effects Panel



Are current PM standards sufficiently health protective?

**NOT SUFFICIENTLY PROTECTIVE; MORE STRINGENT STANDARDS NEEDED URGENTLY; LOWER STANDARD WOULD SAVE THOUSANDS OF LIVES IN U.S. EACH YEAR; NO EVIDENCE OF A “NO EFFECT” THRESHOLD – ADDITIONAL PM REDUCTION, EVEN BEYOND STANDARDS, WILL ACHIEVE ADDITIONAL PUBLIC HEALTH IMPROVEMENT**

Are some species of PM more dangerous than others?

**QUITE POSSIBLY, BUT NOT ENOUGH INFORMATION; NO PM SPECIES “EXONERATED”; NEED BETTER PM SPECIATION AND MORE MONITORING**

What is role of ultrafine particles (UFPs)?

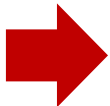
**TOXICOLOGICAL STUDIES SHOW EFFECTS OF SERIOUS CONCERN; NEED REFERENCE TESTING METHOD, MORE MONITORING; NEED EPIDEMIOLOGICAL STUDIES RELATING HEALTH EFFECTS TO UFP EXPOSURE**

Should PM expand “target” to account for more than just mass?

**IN RESEARCH, ABSOLUTELY; IN REGULATION, MAY BE TOO SOON, BUT WE SHOULD BE THINKING ABOUT HOW TO MOVE IN THAT DIRECTION**

How should we include draft PM ISA’s new “likely-causal” health endpoints (nervous system effects, cancer) and new more sensitive populations (children, lower socio-economic status)?

**MUCH STRONGER EVIDENCE SUPPORTING MORTALITY/MORBIDITY AS CAUSAL; ADDITIONAL HEALTH EFFECTS NOW “LIKELY-CAUSAL”; PLUS MORE SENSITIVE HIGH-RISK GROUPS (E.G., CHILDREN AND LOW SES); NEED TO INCORPORATE THIS INFORMATION INTO REGULATORY EFFORTS**



What are health impacts of high-concentration short-term events (e.g., wildfires)? How should we compare them to longer-term PM impacts?

**ISSUE OF URGENT CONCERN; DATA ON SUB-DAILY ACUTE EXPOSURES IS LIMITED; SERIOUS EFFECTS REPORTED IN EARLY STUDIES; NEW STUDIES ONGOING; MORE RESEARCH NEEDED**







# PM Symposium:

## Q&A Document – Exposure & Risk Panel

What are major sources of PM in the Bay Area?

**WEST OAKLAND (LOCAL EMISSIONS):** PM2.5 – PORT (17%), STREET (17%), HIGHWAY (16%), RESTAURANTS (16%), STATIONARY SOURCES (14%)  
DIESEL PM – PORT (57%), STREET (7%), HIGHWAY (8%)

**ONROAD BRAKE AND TIRE WEAR NOW SIGNIFICANT REGIONAL SOURCES OF PM2.5 – DIFFICULT TO ADDRESS THIS PROBLEM**

What PM levels exist in Bay Area? What health risks do they pose?

**WEST OAKLAND (AVERAGE):** PM2.5 = ALL SOURCES - 8.7 ug/m<sup>3</sup>, LOCAL SOURCES – 1.7 ug/m<sup>3</sup>  
DIESEL PM = ALL SOURCES - 0.7 ug/m<sup>3</sup>, LOCAL SOURCES – 0.3 ug/m<sup>3</sup>

How much additional health benefit can be achieved?

**REDUCING ANNUAL PM2.5 FROM CURRENT FEDERAL STANDARD OF 12 ug/m<sup>3</sup> TO 10 ug/m<sup>3</sup> COULD REDUCE MORTALITY RISK BY 10-15%; WOULD SAVE THOUSANDS OF LIVES IN U.S. EACH YEAR; NO THRESHOLD; COULD REGULATE BELOW 10 ug/m<sup>3</sup> BASED ON THE SCIENCE**

How should we account for spatial scale of effects (i.e., regional versus local-scale impacts, including proximity to major sources)?

**REGIONAL VS. LOCAL VS. HYPER-LOCAL IMPACTS – ALL CAN BE IMPORTANT, AND SHOULD BE ADDRESSED**

**WEST OAKLAND:** PM2.5 – OVERALL = 80% FROM REGIONAL SOURCES, 20% FROM LOCAL SOURCES  
DIESEL PM – OVERALL = 40% FROM REGIONAL SOURCES, 60% FROM LOCAL SOURCES  
(BUT HYPER-LOCALIZED HOT SPOTS FROM LOCAL SOURCES COULD BE HIGHER)

How should we determine which measures would most move public health needle?

**WE NEED TO TAKE ACTION NOW, AND WE NEED MORE SCIENCE; MONITORING AND RESEARCH NEEDED; DISTRICT STAFF WILL PROPOSE ACTIONS; NO SINGLE ANSWER, WILL NEED TO ADDRESS MULTIPLE SOURCES**





# PM Symposium:

## Possible Findings (DRAFT, For Discussion Only)

Number	Possible Findings
1	PM is the health risk driver in Bay Area air.
2	Addressing risk in the most impacted areas is a high priority.
3	The current PM national ambient air quality standards (NAAQS) are not sufficiently health protective; more stringent standards are needed and would save thousands of lives in the U.S. each year.
4	Excluding wildfire smoke days as exceptional events, the Bay Area has attained the current federal annual/24-hour 12/35 ug/m3 PM2.5 NAAQS.
5	The Bay Area also would attain alternative, more stringent 10/25 ug/m3 NAAQS (except for West Oakland, whose annual average PM2.5 in 2018 was above an alternative 10 ug/m3 standard by 0.7 ug/m3, or 7%).
6	There is no evidence of a health effects PM2.5 threshold; thus, additional PM reductions beyond the current standards will achieve additional public health improvement.
7	An Air District guideline "target" below the current PM2.5 NAAQS is warranted; it would need to be at or below an annual average of 10 ug/m3 to be effective.
8	Nearly half of PM2.5 (47%) regionally is secondary PM produced by photochemical processes involving ROG, NOx, SO2, and NH3; measures to reduce this secondary PM also should be considered, in addition to directly emitted primary PM (e.g., from stacks, tailpipes).
9	Community-specific PM source attribution tools are useful in identifying the most important sources; use of such tools should focus initially on the most impacted communities (e.g., West Oakland, Richmond).
10	There are significant differences in PM levels among neighborhoods within West Oakland.
11	Some species of PM may be more dangerous than others; no PM species can be exonerated; better PM speciation is needed, along with more monitoring.
12	Monitoring and other studies for UFP are important and should be continued and expanded; further studies linking UFP and health impacts are needed.
13	Some PM localized hot-spot areas may experience PM levels significantly higher than their community-average level.
14	PM action plans should consider exposure, health vulnerability, and the population of the most sensitive groups (e.g., children, nonwhite, low SES, elderly) among the criteria used in developing those plans.
15	PM action plans should account for regional PM sources, with approximately 80% of PM2.5 in West Oakland coming from regional sources not in West Oakland.
16	PM action plans should consider sources that are regional (Bay Area-wide), local (community-level), and localized hot-spots (block-level).
17	PM action plans should consider emission reduction measures for both primary PM and secondary PM (i.e., precursor ROG, NOx, NH3, and SO2).
18	PM action plans should use source attribution tools to identify the most important sources.
19	Wildfire PM could well be a serious contributor to PM health effects; more research on those effects is needed; following the precautionary principle, significant community protection
20	In developing a PM action plan, there are no single answers; multiple source categories must be addressed; there is no "silver bullet," rather, it is more like "silver buckshot."
21	Source categories once viewed as of lesser importance have increased in importance relative to other sources as PM has been reduced from previously large source categories (e.g., on-road vehicle exhaust).
22	Because of significant reduction in vehicle exhaust PM, tire and brake wear PM emissions are now the most significant contributors to PM from on-road vehicles; they are difficult to address, however, and may require activity reduction measures (e.g., VMT, trip reduction).
23	Newly important PM source categories may not fall within current Air District rules, may be hard to regulate, may need better technical characterization (e.g., emission factors), and may need a more well-defined suite of control measures.
24	Key PM reduction strategies may include cleaner trucks/industry, reduction in vehicle trips and road dust, zero emissions plans (e.g., ports, the Air District's diesel-free in '33 initiative), neighborhood-specific PM action plans, exposure reduction measures, and more enforcement.
25	Techniques for treating PM as an air toxic may be helpful in putting criteria pollutant PM2.5 and air toxics diesel PM on same "balance sheet."

- More than 20 possible findings identified so far
- Based on outside experts, District staff, council expertise





# PM Symposium:

## Evaluation of Potential Actions (DRAFT, For Discussion Only)

Number	Potential Actions
1	Establish goal for PM reductions below current standard (8-10 ug/m3)
2	Set more stringent state PM standards
3	Classify undifferentiated PM as toxic air contaminant
4	Improve emission estimation methods for emerging source categories (e.g., tires & brakes, road dust)
5	Develop Air District PM plan updated with new information
6	Set improved UFP filtration requirements for on-road vehicles
7	Attack PM from all directions, including regional, local, and hyper-local
8	Include sources that have slipped through cracks before in air toxics programs
9	Make air quality data more accessible and closer to real time
10	Reassess need to regulate smaller sources not of regional significance
11	Take aggressive action to reduce PM, additional PM reduction in PM results in additional improvement in public health
12	No single answer, no silver bullet, rather silver buckshot
13	Consider children and low SES groups especially
14	Factor in secondary PM, since nearly half (47%) of PM is secondary, formed in the air by photochemical processes
15	Regulate precursors of secondary PM (NOx, ROG, SO2, NH3), and see them as cumulative with local sources
16	Identify near-term actions, and roll them out early
17	Increase staff to implement/enforce Rule 11-18
18	Devote more staff to risk assessment for air toxics programs like Rule 11-18
19	Identify problematic local sources and deal with them faster
20	Take into account cumulative impact in permitting

- Nearly 50 potential actions identified so far
- Collected from outside experts, District staff, community, other





# PM Symposium:

## Evaluation of Potential Actions (DRAFT, For Discussion Only)

Number	Category	Potential Actions	Authority
1	Planning	Establish goal for PM reductions below current standard (8-10 ug/m3)	District
2	Regulations	Set more stringent state PM standards	State
3	Planning	Classify undifferentiated PM as toxic air contaminant	State
4	Planning	Improve emission estimation methods for emerging source categories (e.g., tires & brakes, road dust)	State
5	Planning	Develop Air District PM plan updated with new information	District
6	Planning	Set improved UFP filtration requirements for on-road vehicles	Federal
7	Policy	Attack PM from all directions, including regional, local, and hyper-local	District
8	Planning	Include sources that have slipped through cracks before in air toxics programs	District
9	Air Quality	Make air quality data more accessible and closer to real time	District
10	Planning	Reassess need to regulate smaller sources not of regional significance	District
11	Planning	Take aggressive action to reduce PM, additional PM reduction in PM results in additional improvement in public health	District
12	Planning	No single answer, no silver bullet, rather silver buckshot	District
13	Planning	Consider children and low SES groups especially	District
14	Planning	Factor in secondary PM, since nearly half (47%) of PM is secondary, formed in the air by photochemical processes	District
15	Planning	Regulate precursors of secondary PM (NOx, ROG, SO2, NH3), and see them as cumulative with local sources	District
16	Policy	Identify near-term actions, and roll them out early	District
17	Enforcement	Increase staff to implement/enforce Rule 11-18	District
18	Enforcement	Devote more staff to risk assessment for air toxics programs like Rule 11-18	District
19	Planning	Identify problematic local sources and deal with them faster	District
20	Permitting	Take into account cumulative impact in permitting	District







# PM Symposium:

## Evaluation of Potential Actions (DRAFT, For Discussion Only)

Number	Category	Potential Actions	Authority	Council Member [NAME]			
				Impact	Agreement	Timing	Top 5
1	Planning	Establish goal for PM reductions below current standard (8-10 ug/m3)	District	L	Y	<1yr	1
2	Regulations	Set more stringent state PM standards	State	L	Y	<3yr	3
3	Planning	Classify undifferentiated PM as toxic air contaminant	State	L	Y	<3yr	
4	Planning	Improve emission estimation methods for emerging source categories (e.g., tires & brakes, road dust)	State	M	Y	<5yr	
5	Planning	Develop Air District PM plan updated with new information	District	L	Y	<1yr	2
6	Planning	Set improved UFP filtration requirements for on-road vehicles	Federal	M	?	<10yr	
7	Policy	Attack PM from all directions, including regional, local, and hyper-local	District	L	Y	<3yr	
8	Planning	Include sources that have slipped through cracks before in air toxics programs	District	M	Y	<3yr	
9	Air Quality	Make air quality data more accessible and closer to real time	District	M	Y	<1yr	
10	Planning	Reassess need to regulate smaller sources not of regional significance	District	M	Y	<1yr	
11	Planning	Take aggressive action to reduce PM, additional PM reduction in PM results in additional improvement in public health	District	L	Y	<3yr	
12	Planning	No single answer, no silver bullet, rather silver buckshot	District	L	Y	<1yr	
13	Planning	Consider children and low SES groups especially	District	M	Y	<1yr	
14	Planning	Factor in secondary PM, since nearly half (47%) of PM is secondary, formed in the air by photochemical processes	District	L	Y	<3yr	
15	Planning	Regulate precursors of secondary PM (NOx, ROG, SO2, NH3), and see them as cumulative with local sources	District	L	Y	<3yr	
16	Policy	Identify near-term actions, and roll them out early	District	L	Y	<1yr	4
17	Enforcement	Increase staff to implement/enforce Rule 11-18	District	M	?	<3yr	
18	Enforcement	Devote more staff to risk assessment for air toxics programs like Rule 11-18	District	S	?	<1yr	
19	Planning	Identify problematic local sources and deal with them faster	District	L	Y	<1yr	
20	Permitting	Take into account cumulative impact in permitting	District	M	?	<3yr	





## PM Symposium: Next Steps

- Further input from **stakeholders**
- Compilation and analysis of **policy/regulatory options**
- Development of **findings and recommendations**
- **Presentation** to Board and Staff





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**AGENDA: 15**

# **Spare the Air Advertising Campaign Video and Update**

**Board of Directors Meeting  
July 15, 2020**

**Kristine Roselius  
Acting Communications Officer**

# Spare the Air 2020 Campaign



- New advertising & outreach campaign with remote work focus
- Remote work benefits: clean air, cost savings and better work/life balance
- Advertising in multiple languages
- Digital and streaming TV
- Reassess advertising mediums in coming weeks







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**AGENDA: 16**

# **Air Quality During Shelter-in-Place**

**Board of Directors Meeting  
July 15, 2020**

**Michael Flagg  
Principal Air Quality Specialist**

# Overview



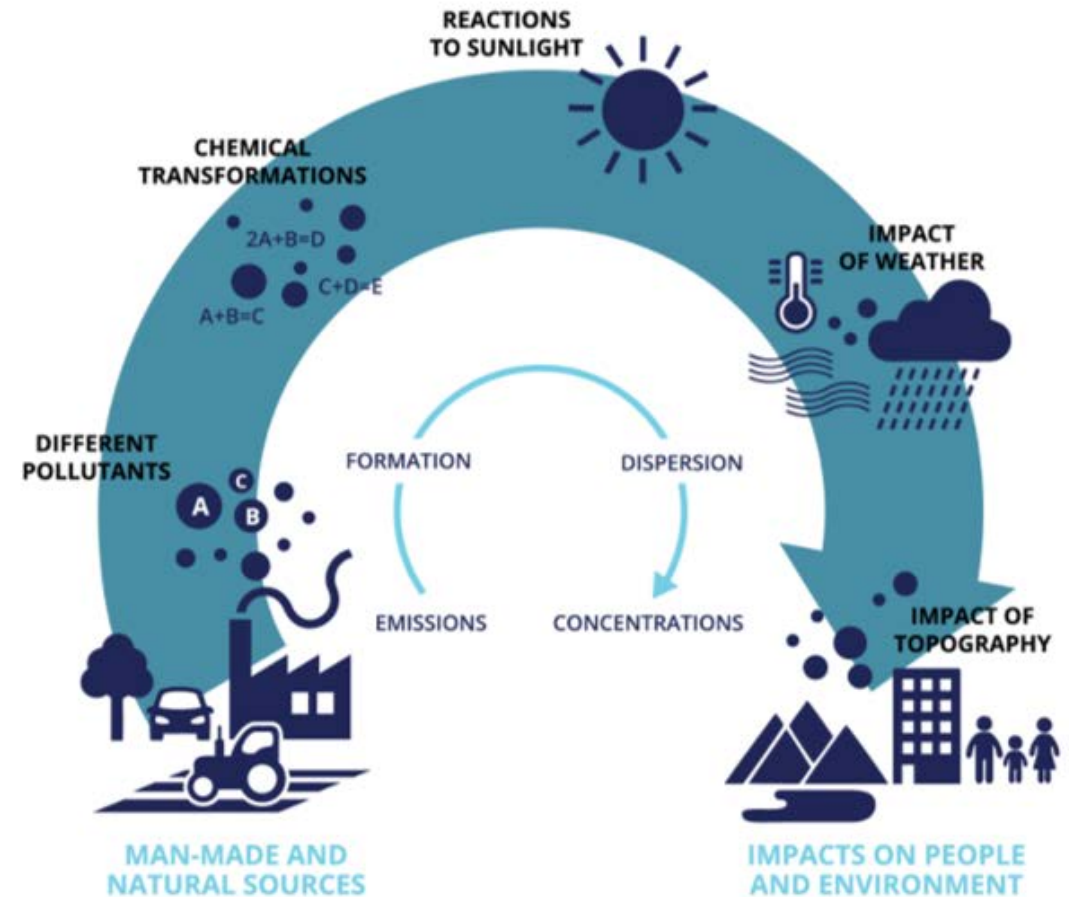
- Factors Affecting Air Quality
- Estimates of Emission Reductions
- Overview of Particulate Matter<sub>2.5</sub> (PM<sub>2.5</sub>) Network
- Analysis of PM<sub>2.5</sub> During Shelter-in-Place Compared to Spring Months in Previous Years
- Challenges



# Factors Affecting Air Quality



- Pollutant concentrations vary in time and space due to:
  - Natural background sources
  - Nearby emissions ←
  - Transport from other areas
  - Meteorology
  - Chemical reactions
  - Topography



Source: EEA, 2015, Air Quality in Europe, 2015 Report

# Estimates of Emission Reductions



## Traffic (VMT)



50% to 85%  
*(per traffic counts  
and cell phone  
tracking data)*



## Total Emissions



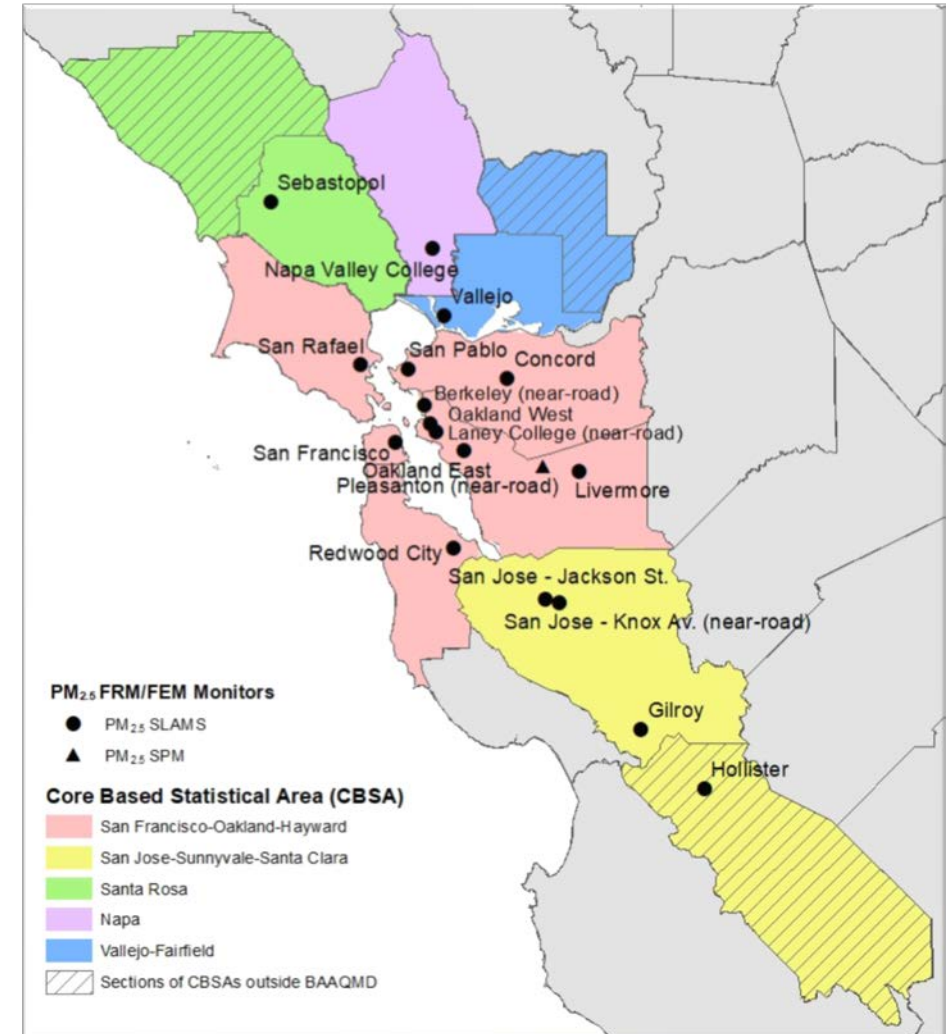
Carbon Dioxide  
(CO<sub>2</sub>): 20% to 30%  
PM<sub>2.5</sub>: 15% to 25%  
Oxides of Nitrogen  
(NO<sub>x</sub>): 30% to 45%



# PM<sub>2.5</sub> Fixed Site Network



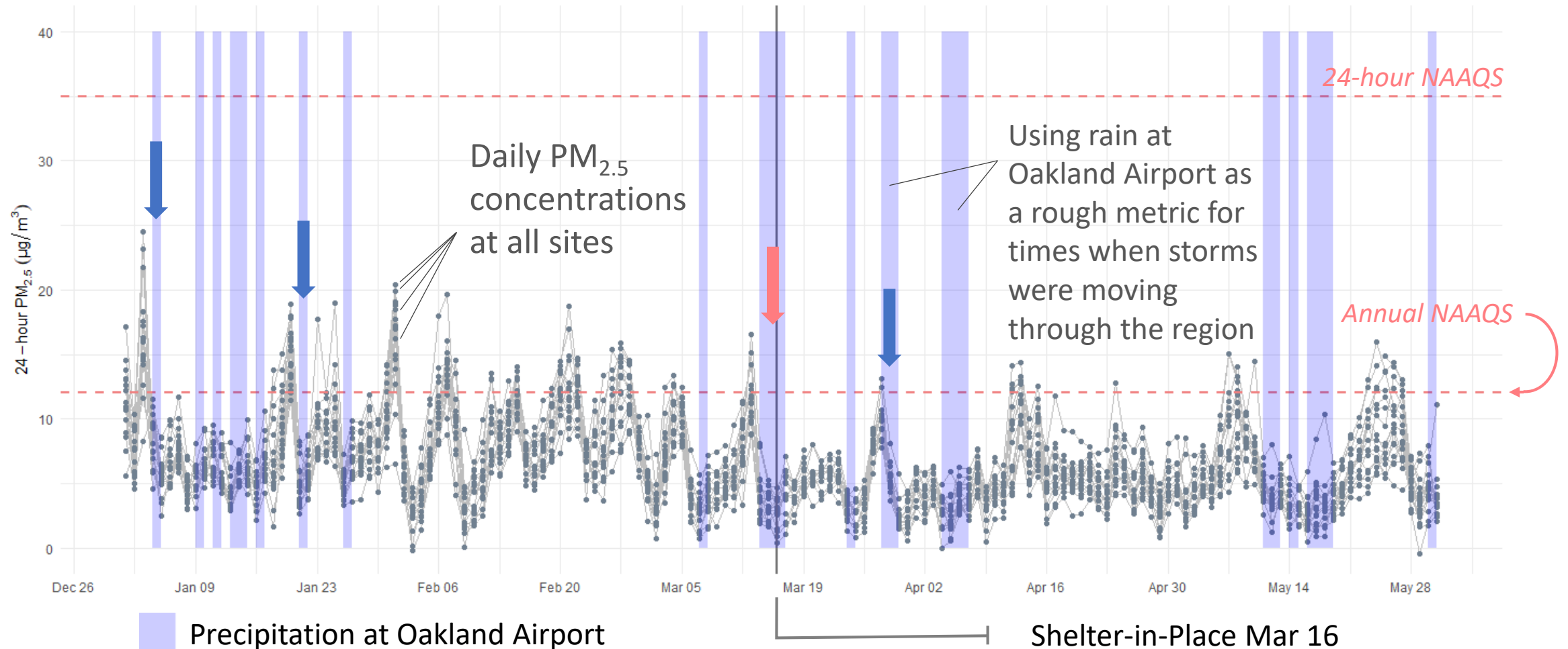
- PM<sub>2.5</sub> network is designed to meet Environmental Protection Agency (EPA) federal monitoring requirements and other local objectives
- Currently, the Air District operates 17 PM<sub>2.5</sub> monitoring sites throughout the region
- The network includes four (4) near-road sites



# 2020 Daily (24-hour) PM<sub>2.5</sub> Timeseries



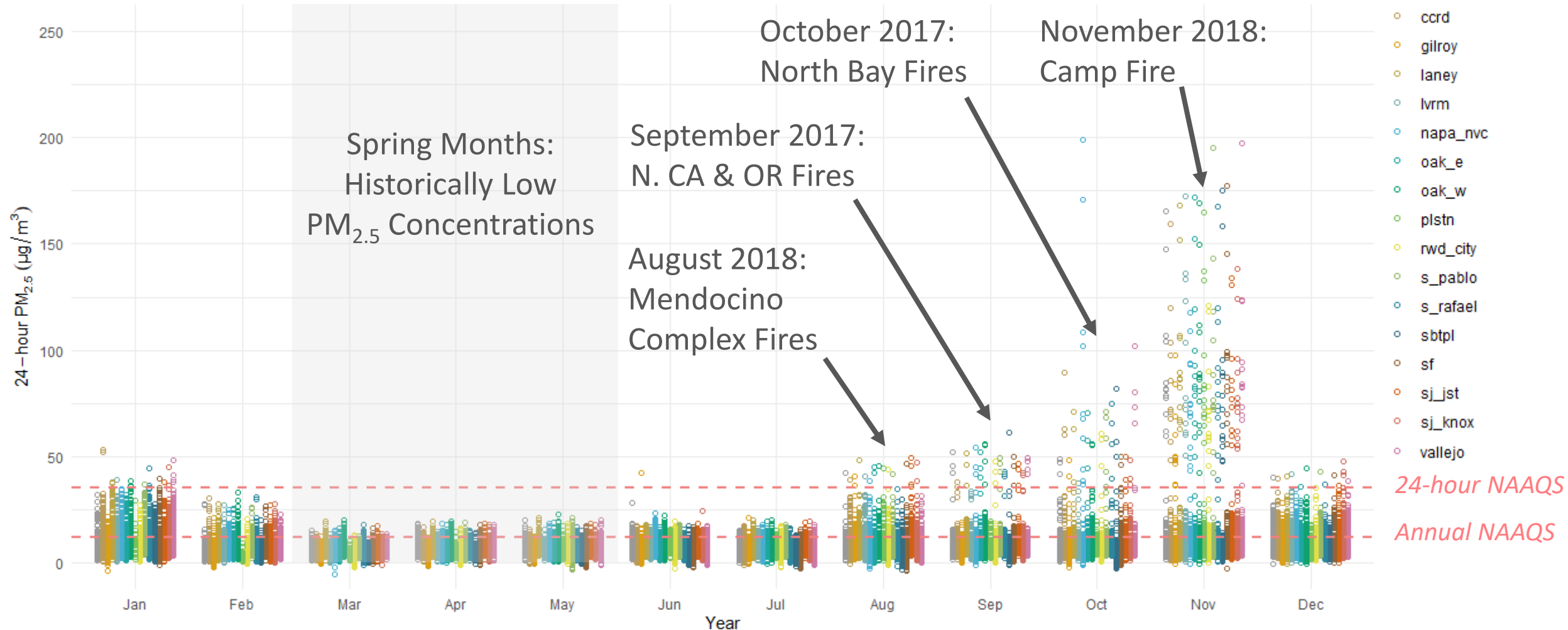
Bay Area PM<sub>2.5</sub> Jan – May 2020



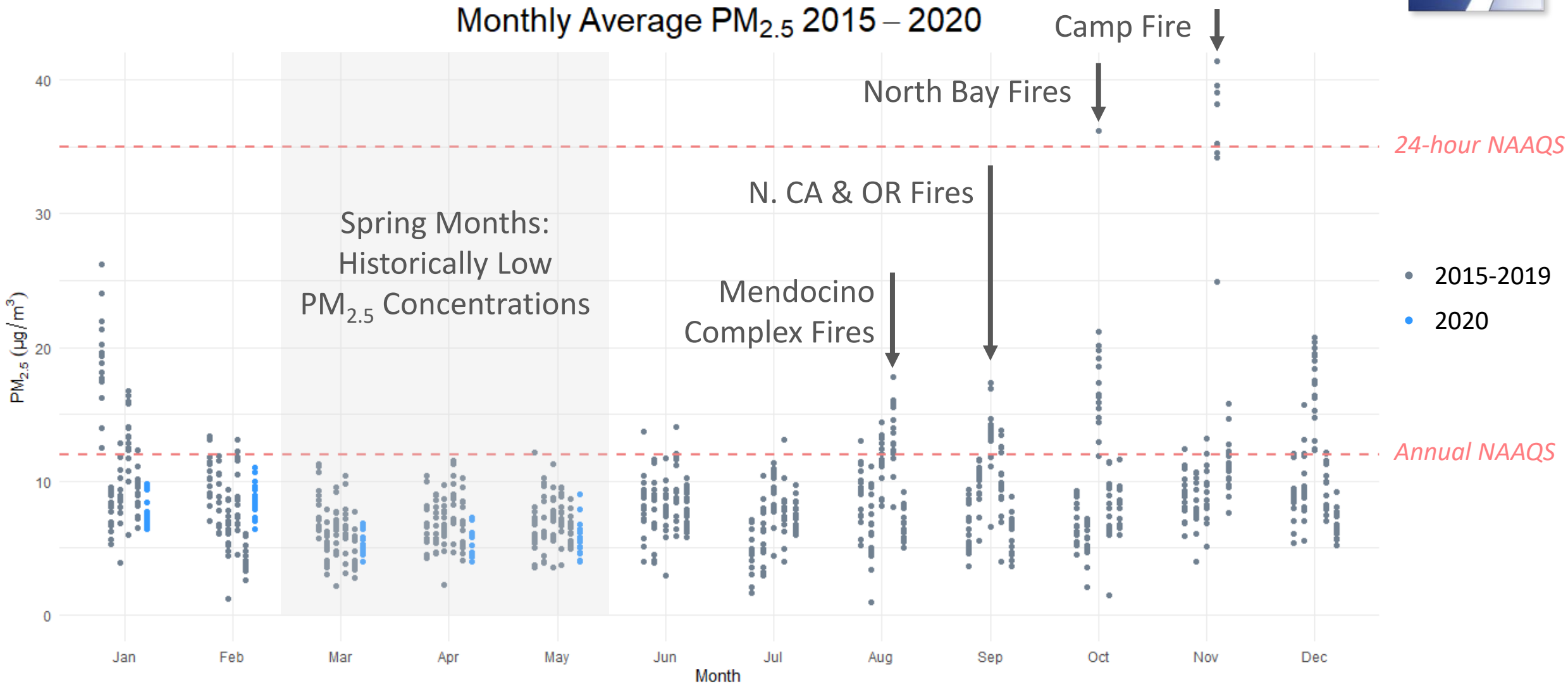
# Historical Variation in Daily PM<sub>2.5</sub>



24 – hour PM<sub>2.5</sub> by Month 2015 – 2019



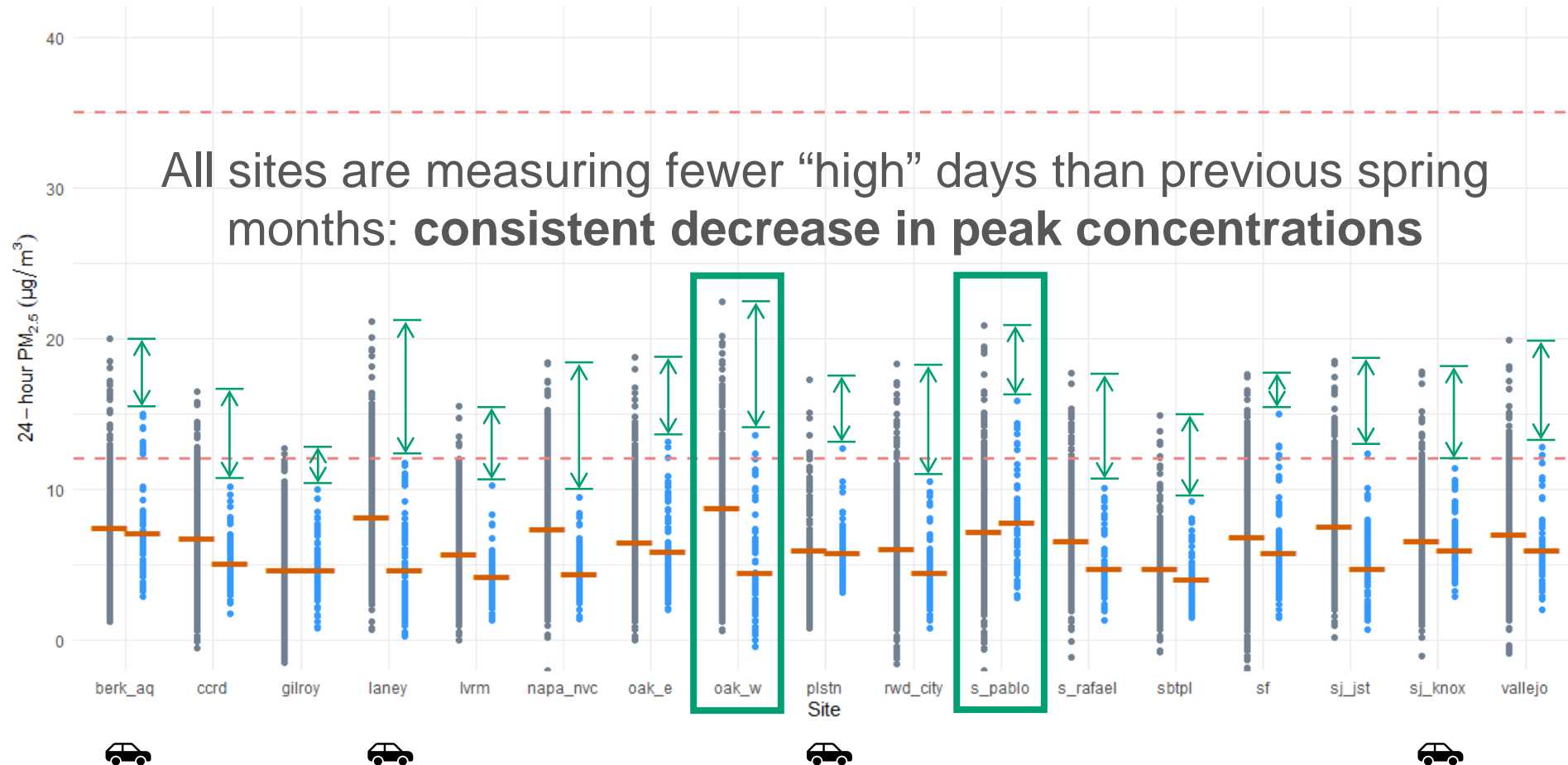
# Historical Variation in Monthly Averages



# Comparison to Previous Spring Months



Bay Area PM<sub>2.5</sub> (March – May) 2015 – 2020





# Summary of Observations



- Concentrations during shelter-in-place have been **low**, but also occurring during the **lowest time of year**
- Changes in mobile source emissions and PM<sub>2.5</sub> concentrations are **not uniform throughout the region**
- Reductions in mobile source emissions may have **greater benefit at some locations**

# Summary of Observations (Cont'd)



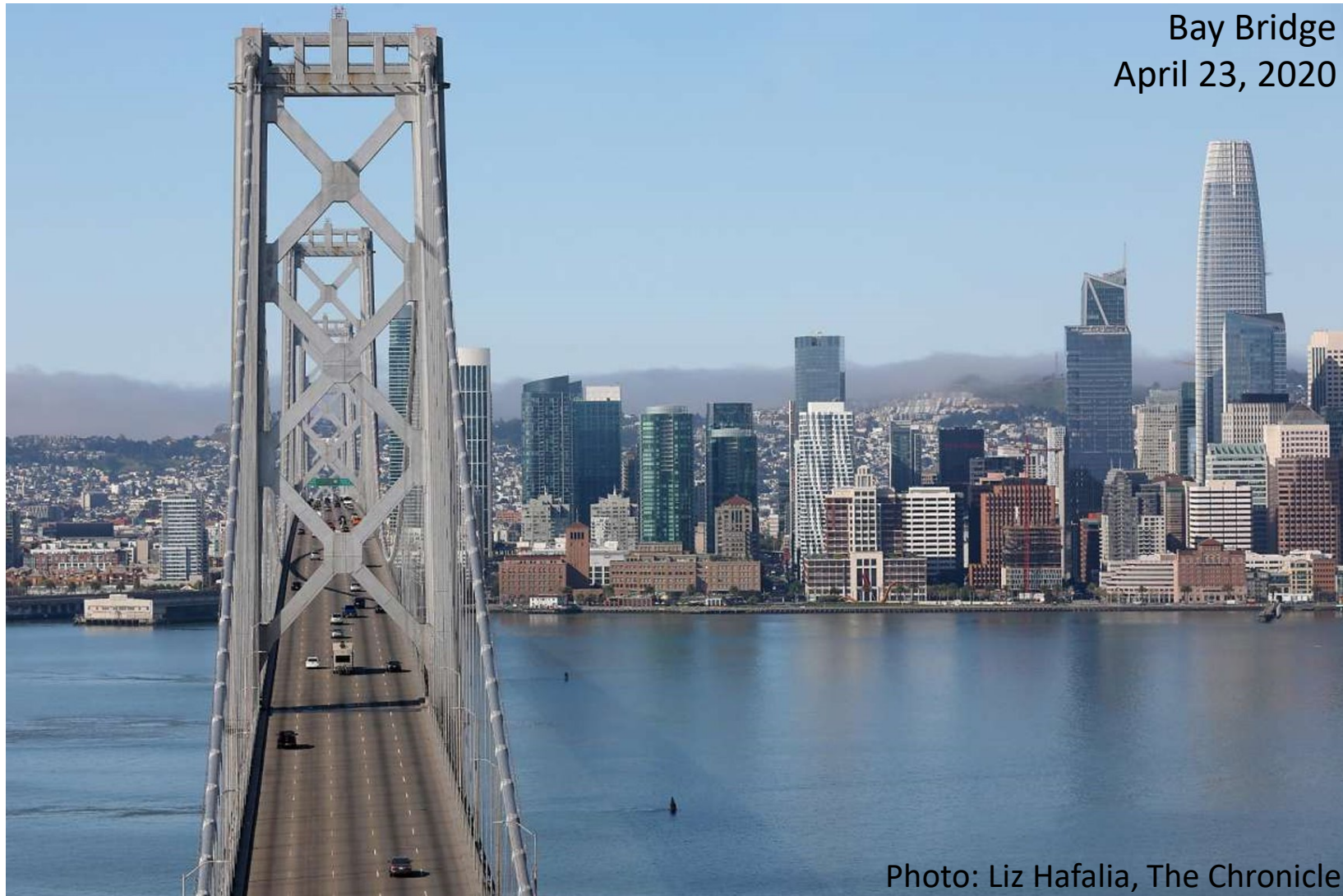
- Some sites measuring **lower average concentrations** compared to previous spring months, others measuring **similar concentrations**
- All sites are measuring fewer “high” days than previous spring months... so, there is a **consistent decrease in peak concentrations**
- How PM<sub>2.5</sub> concentrations are changing is **site specific**: diurnal profiles and day-of-week patterns

# Challenges



- Assessing causality remains difficult due to a number of confounding factors:
  - Seasonally
  - Favorable meteorology for low concentrations during spring months
  - Year-to-year variability
  - Measurement uncertainty at low concentrations

# Questions



Bay Bridge  
April 23, 2020

Photo: Liz Hafalia, The Chronicle