# Update on South Central Fresno Community Air Monitoring

South Central Fresno CSC
Air Monitoring Subcommittee Meeting

May 24, 2021

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# Agenda

**1** Welcome

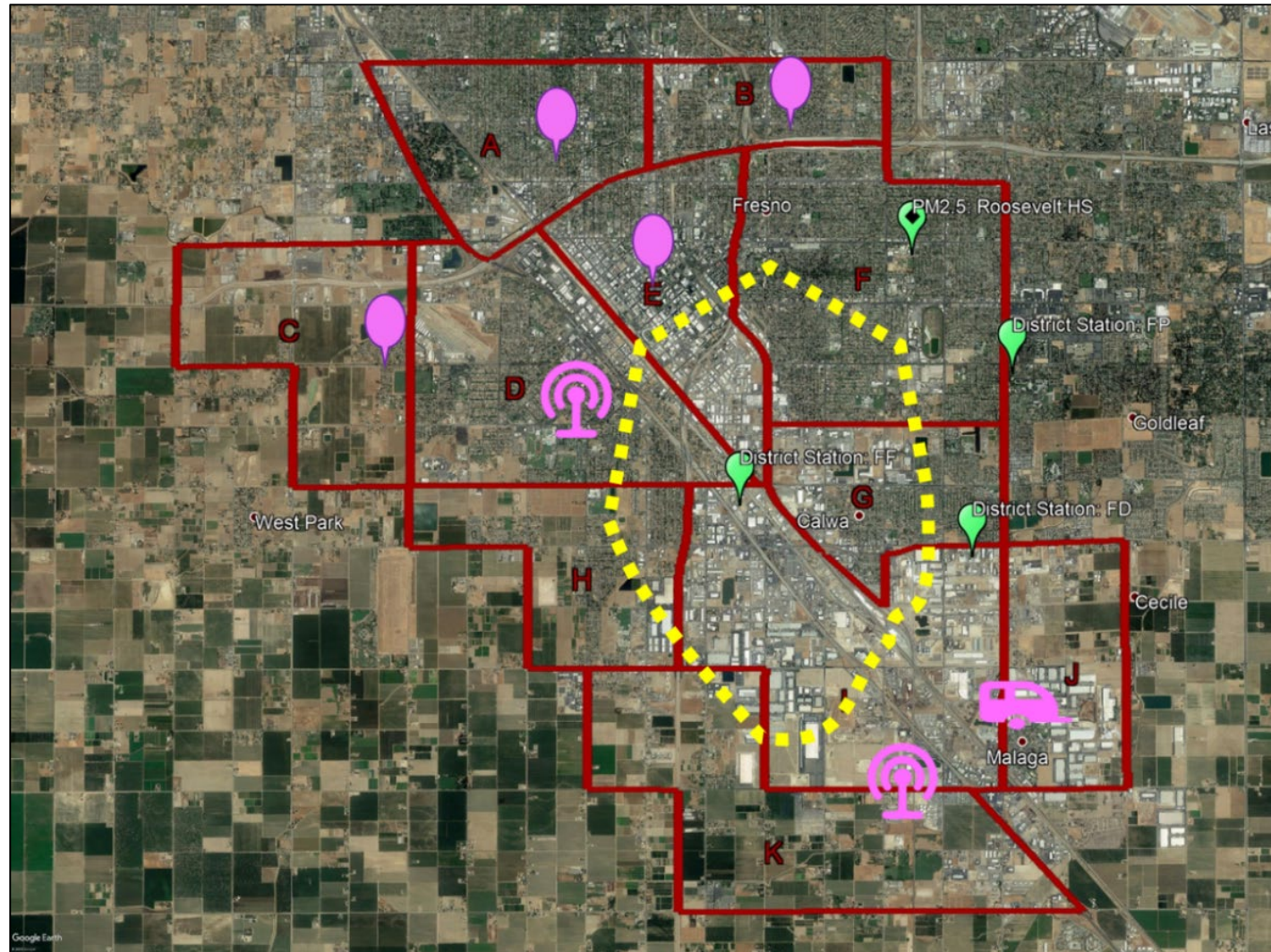**2** Status of Community Air Monitoring Plan (CAMP) Implementation

**3** Review Air Monitoring Data Collected in Community

**4** Discuss Data, What We Have Learned

**5** Next Steps

Adjourn at 6 pm

# South Central Fresno Community Air Monitoring Network Design

# Community Air Monitoring Platforms

# Community Air Monitoring Platforms (cont'd)

# Community Air Monitoring Platforms (cont'd)

# Ongoing Community Air Monitoring

- District continuing to conduct localized air monitoring in the South Central Fresno community
- Working to deploy additional air monitoring platforms across the community, according to Community Steering Committee recommended network design
  - Almost complete except for 1 site
- Air monitoring van actively being used to regularly monitor pollutants in areas of interest of the community and near recommended site locations for network design
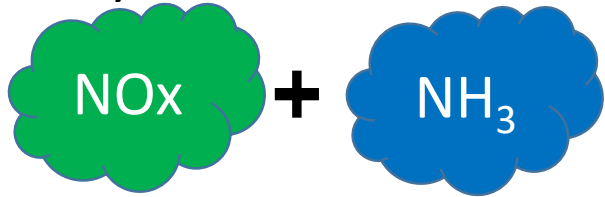- Extensive PM2.5 and VOC speciation sampling and laboratory analysis being conducted since late 2019

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# CAMP Implementation Status
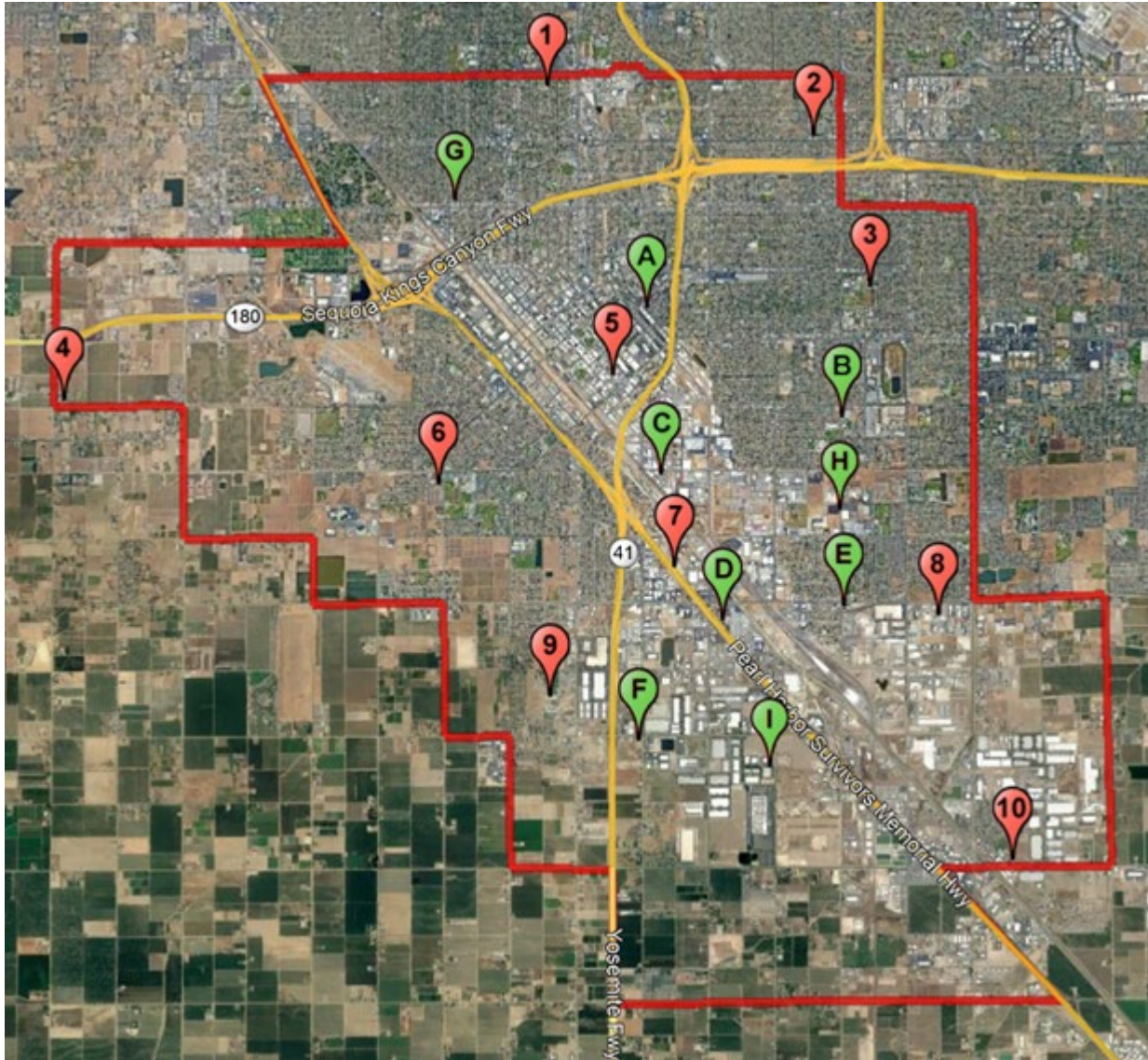


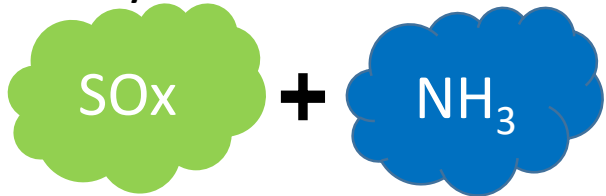| # | Location | Monitoring | Done |
|---|----------|------------|------|
| 1 | Heaton Elementary | PM2.5 | Y |
| 2 | Yosemite Middle School | PM2.5 | Y |
| 3 | Roosevelt High | PM2.5 | Y |
| 4 | Madison Elementary | PM2.5 | Y |
| 5 | Bitwise South Stadium | PM2.5 | Y |
| 6 | Edison High | Multi-Pollutant | N / Van |
| 7 | Fresno-Foundry Park | PM2.5 & Speciation | Y |
| 8 | Fresno-Drummond | Ozone, NO2, PM10 | Y |
| 9 | West Fresno Middle School/Orange Center | Multi-Pollutant | Y |
| 10 | Malaga Elementary | Trailer/ Speciation | Y |
| A | Tulare & 'R' St | Van | Y |
| B | E Butler & S Cedar | Van | Y |
| C | E California & S Van Ness | Van | Y |
| D | 2nd St & Jensen | Van | Y |
| E | E Jensen & S Cedar | Van | Y |
| F | E North & S Cherry | Van | Y |
| G | Ferger & E Belmont | Van | Y |
| H | E Florence & S Cedar | Van | Y |
| I | Orange & Fortune | Van | Y |

# PM2.5

Elevated concentrations of particulate matter < 2.5 micrometers in diameter, or PM2.5, can aggravate or create severe cardiovascular conditions, including premature death

secondary

NOx + NH$_3$

or

secondary

SOx + NH$_3$

or

primary

Dust, Smoke

→ PM$_{2.5}$

HUMAN HAIR
50-70 μm
*(microns)* in diameter

PM$_{2.5}$
Combustion particles, organic compounds, metals, etc.
< 2.5 μm *(microns)* in diameter

PM$_{10}$
Dust, pollen, mold, etc.
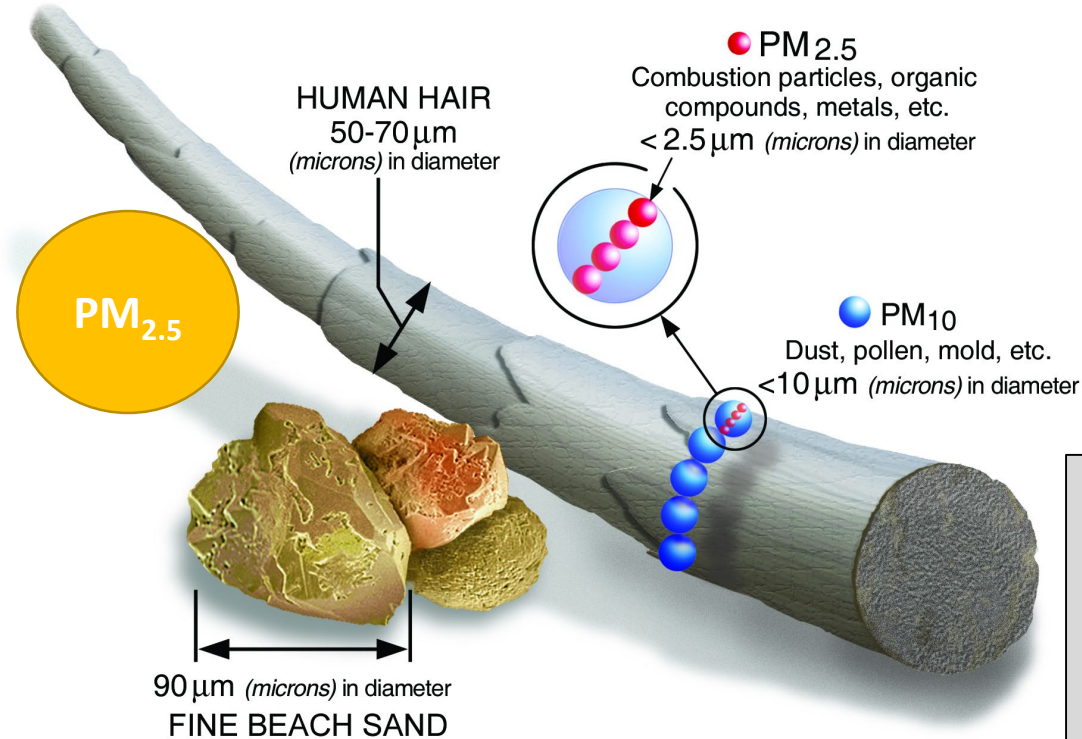<10 μm *(microns)* in diameter

90 μm *(microns)* in diameter
FINE BEACH SAND
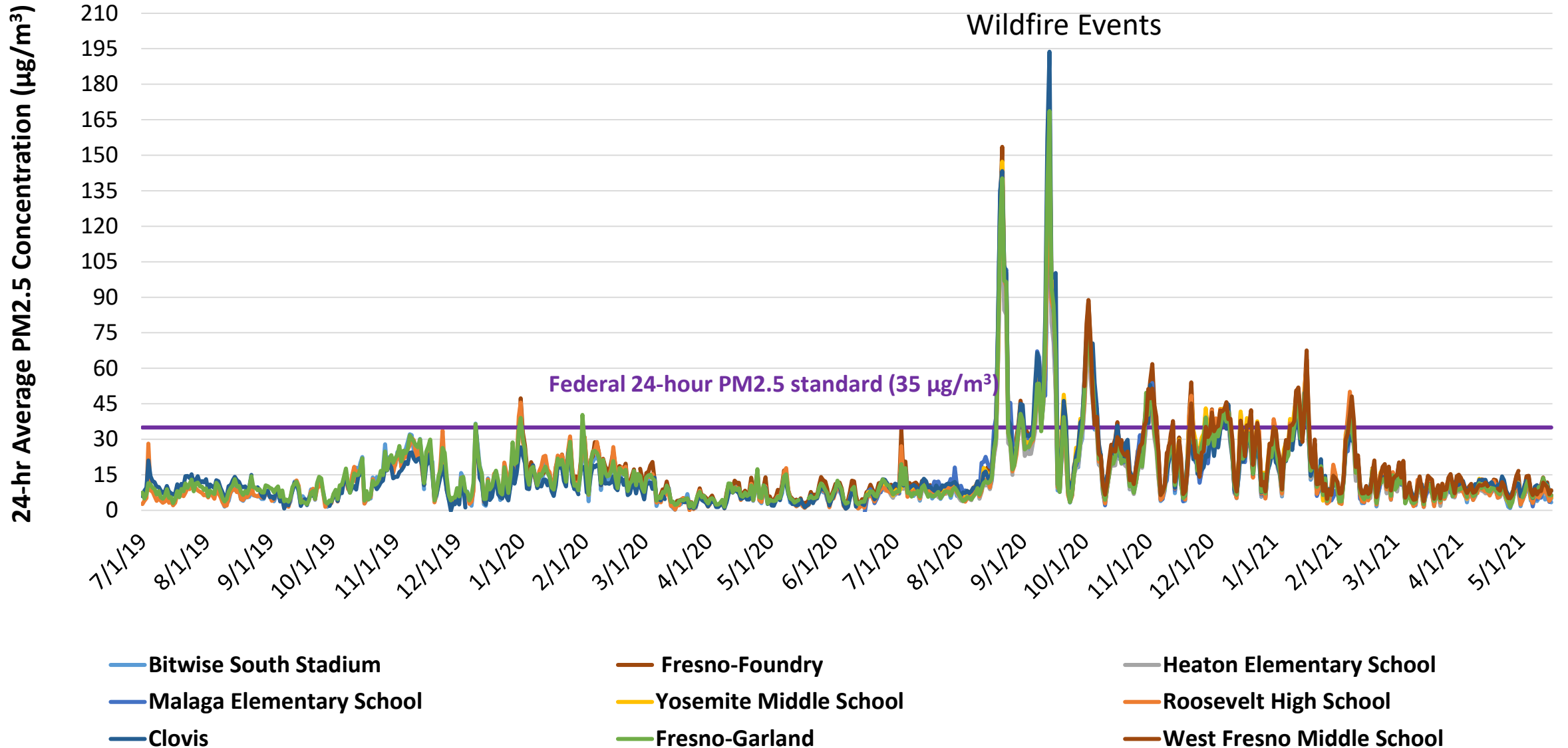
In Valley, elevated PM2.5 concentrations occur on stagnant, cold winter days

# PM2.5 Trends across Fresno/Clovis Urban Area



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# PM2.5 Comparison within Community

*Quarterly 24-Hour Average PM2.5 (µg/m$^3$)*

| Quarter | Roosevelt High School | Bitwise South Stadium | Fresno-Foundry | Heaton Elementary School | Yosemite Middle School | Malaga Elementary School | West Fresno Middle School |
|---------|------------------------|------------------------|----------------|--------------------------|------------------------|---------------------------|----------------------------|
| 2019 Q2 | 6.6 | -- | -- | -- | -- | -- | -- |
| 2019 Q3 | 5.7 | 6.2 | -- | -- | -- | -- | -- |
| 2019 Q4 | 14.2 | 14.3 | -- | -- | -- | -- | -- |
| 2020 Q1 | 13.7 | 12.5 | 14.7 | -- | -- | -- | -- |
| 2020 Q2 | 5.9 | 6.3 | 7.8 | 5.5* | 7.1* | 7.8* | -- |
| 2020 Q3 | 26.3 | 25 | 29.7 | 23.4 | 28.7 | 30.2 | -- |
| 2020 Q4 | 26.1 | 24.3 | 28.1 | 23.8 | 28.2 | 25.1 | 28.8 |
| 2021 Q1 | 16.0 | 14.4 | 17.3 | 14.0 | 16.7 | 14.5 | 17.8 |

*Site was not online for entire quarter*

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# Nitrogen Dioxide (NO2)

- NO2 is one of a group of highly reactive gases known as NOx
- Contribute to formation of PM2.5 and ozone
- From burning of fuel, including cars, trucks, buses, off-road equipment, and power plants
- High concentrations can irritate airways in human respiratory system

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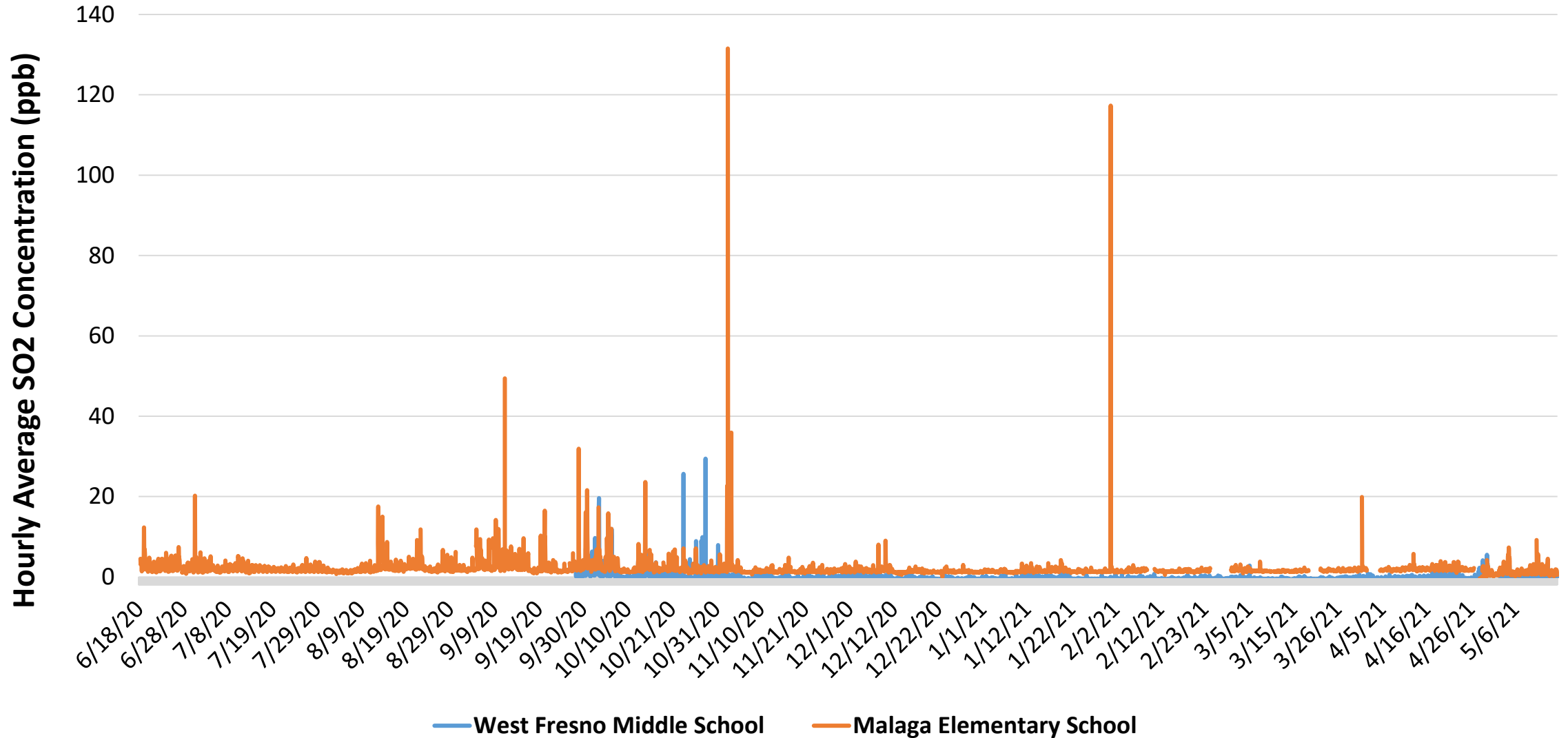AIR POLLUTION CONTROL DISTRICT

NO2 Concentration Trends
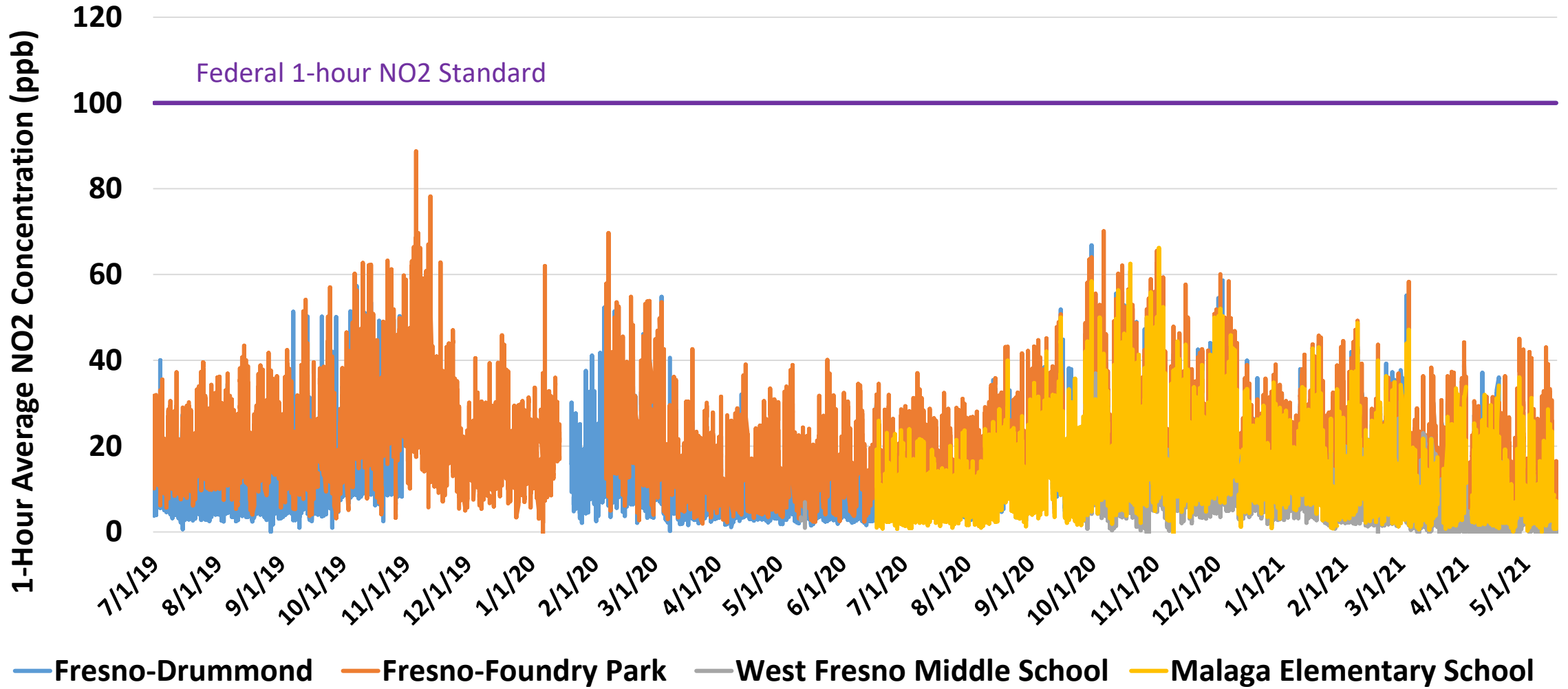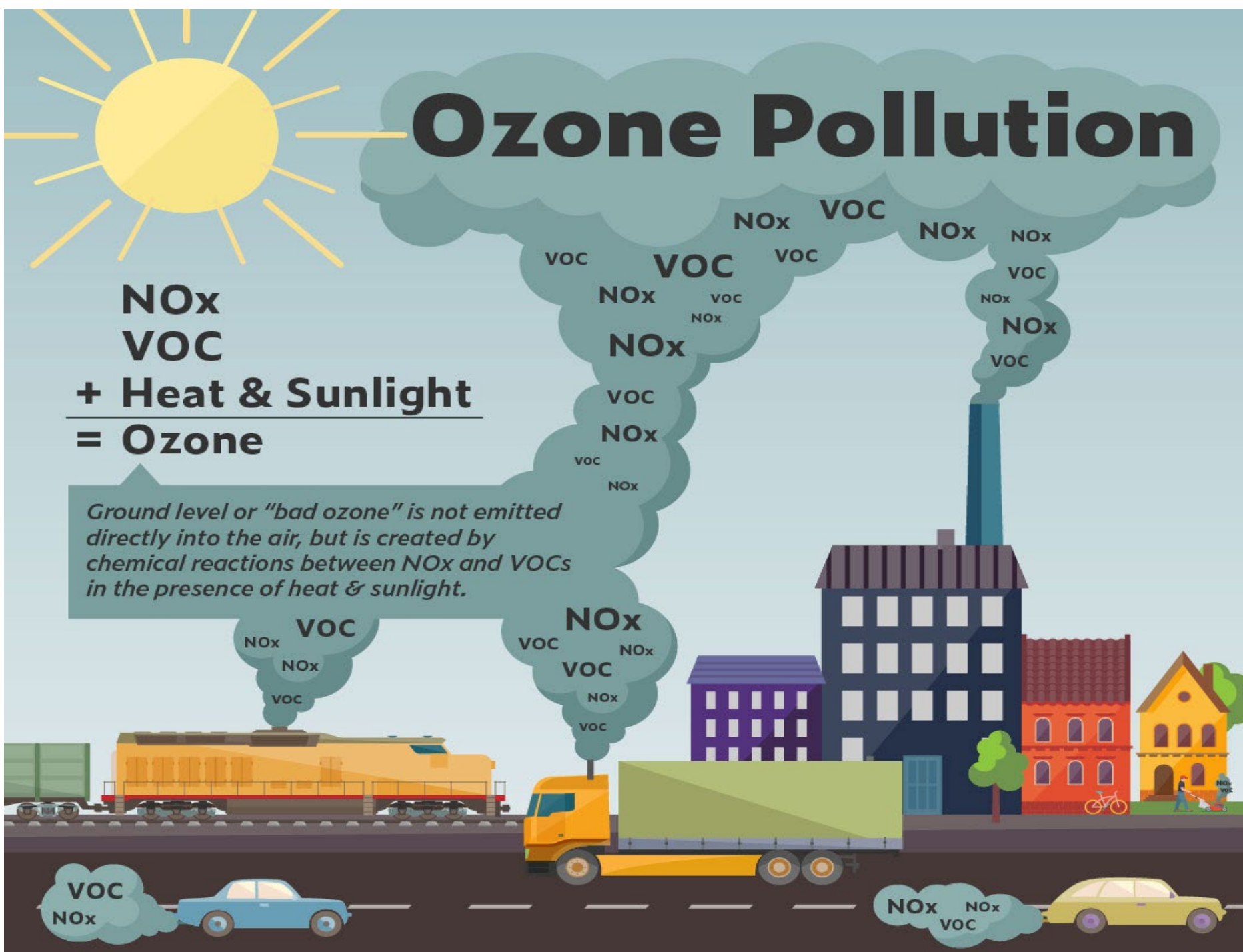
# Sulfur Dioxide (SO2)

- From wildfires, power plants, locomotives, and other vehicles and heavy equipment that burn fuel with high sulfur content
- Short-term exposures can harm the human respiratory system and make breathing difficult
- SO2 can lead to formation of particulate matter that may penetrate deeply into lungs and contribute to health problems

# SO2 Concentration Trends



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# Ozone Concentration Trends



Federal 8-hour Ozone Standard (70 ppb)

8-hour Average Ozone Concentrations (ppb)

— Fresno-Drummond   — Malaga Elementary School   — West Fresno Middle School

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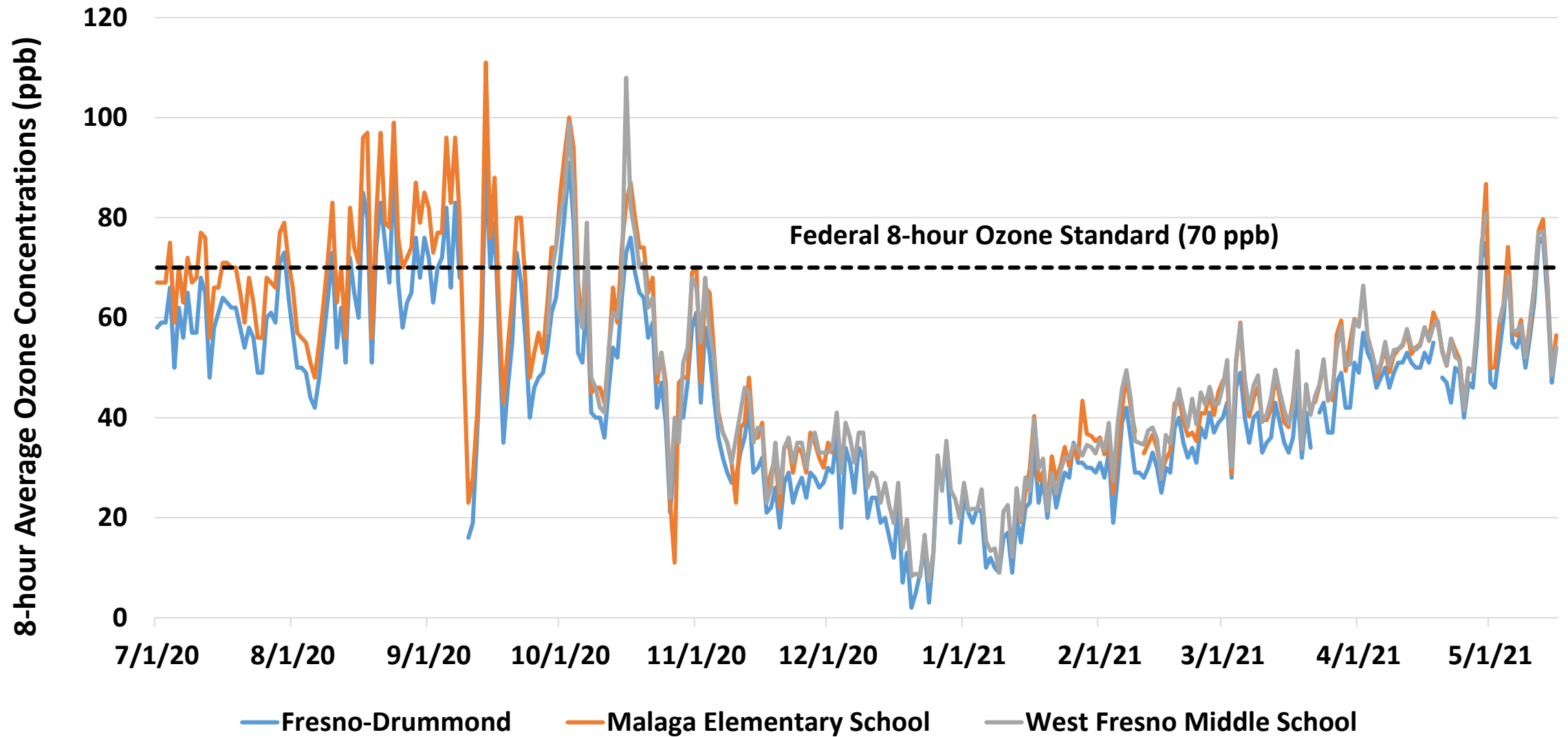
# Benzene, Toluene, Ethylbenzene, Xylenes (BTEX)

- BTEX are volatile organic compounds
  - Sources include motor vehicle exhaust, gasoline, industrial emissions and tobacco smoke
- Health effects include throat and eye irritation, dizziness, and headaches
- Department of Health and Human Services has determined that exposure to high concentrations of benzene can cause cancer

# Summary of BTEX Data Measured at Malaga Elementary School
## (*June 2020 – May 2021*)

| Pollutant | Annual Average Concentration (ppb) | Peak 1-hr Average Concentration (ppb) | OEHHA Reference Exposure Level |
|---|---|---|---|
| Benzene | 0.0 | 1.0 | 1 ppb (annual average) 8.5 ppb (1-hr average) |
| Toluene | 0.0 | 5.9 | 111 ppb (annual average) 1,326 ppb (1-hr average) |
| Ethylbenzene | 0.0 | 11.5 | 461 ppb (annual average) |
| Xylene | 0.2 | 1.1 | 161 ppb (annual average) 5,066 ppb (1-hr average) |

# Summary of Air Monitoring Van Data
## *January 2020 – Present*
### *(Intermittent Data at Various Locations)*

| Pollutant | Average Hourly Value | Peak Value | Applicable Standard |
|---|---|---|---|
| Toluene* | 0.0 | 9.6 ppb (1-hr avg) | 111 ppb (annual average) 1,326 ppb (1-hr average) |
| PM2.5 | 13.6 μg/m³ | 160.6 μg/m³ (1-hr avg, wildfire) | 35 μg/m³ (24-hr average) |
| Ozone | 34.9 ppb | 47.0 ppb (8-hr avg) | 70 ppb (8-hr average) |
| CO | 0.3 ppm | 1.3 ppm (1-hr avg) | 35 ppm (1-hr average) |
| NO2 | 9.9 ppb | 69.1 ppb (1-hr avg) | 100 ppb (1-hr average) |
| SO2 | 1.4 ppb | 19.6 ppb (1-hr avg) | 75 ppb (1-hr average) |

*did not detect any benzene, ethylbenzene, or xylene during this period

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# PM2.5 Speciation Sampling and Laboratory Analysis

- June 2020, PM2.5 speciation sampling began at Malaga Elementary School
  - Requires intensive operation of special air monitoring equipment
- Collected samples sent to third-party laboratory for analysis to determine contribution of various species to overall measured PM2.5 concentration
  - Speciation results can help determine which sources may be contributing to overall PM2.5 pollution
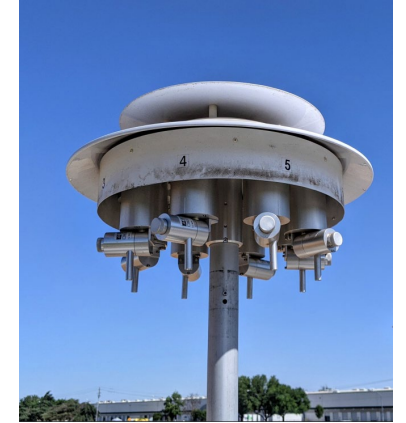
# Components of PM2.5

- **Ammonium Nitrate:** Formed from reaction of ammonia and nitric acid, where nitric acid is formed from nitrogen oxides. Key sources of nitrogen oxides is from burning of fuel.

- **Ammonium Sulfate:** Form from reaction of ammonia and sulfuric acid, where sulfuric acid is formed primarily from sulfur oxide, with smaller amounts forming from direct sulfur. Key sources of sulfur oxides is burning of fuel.

- **Organic carbon:** Organic carbon (OC) are generated as primary organic aerosol, predominantly through combustion of fuel. Key sources include cooking, industrial processes, mobile source exhaust, tire wear, and wood burning.

# Components of PM2.5 (cont'd)

- **Black Carbon:** Known as soot or elemental carbon, and is formed during incomplete combustion in fuels, including mobile exhaust (mainly diesel) and wood burning.

- **Soil:** Road dust and soil dust entrained in air from activity, such as soil disturbance or airflow from traffic.

- **Other Metals:** Particulates having been emitted in connection with combustion from engine wear, brake wear, and similar processes. Certain metals are also emitted from use of fireworks.

Trend of PM2.5 and Species at Malaga Elementary School (June 2020 – Mar 2021)
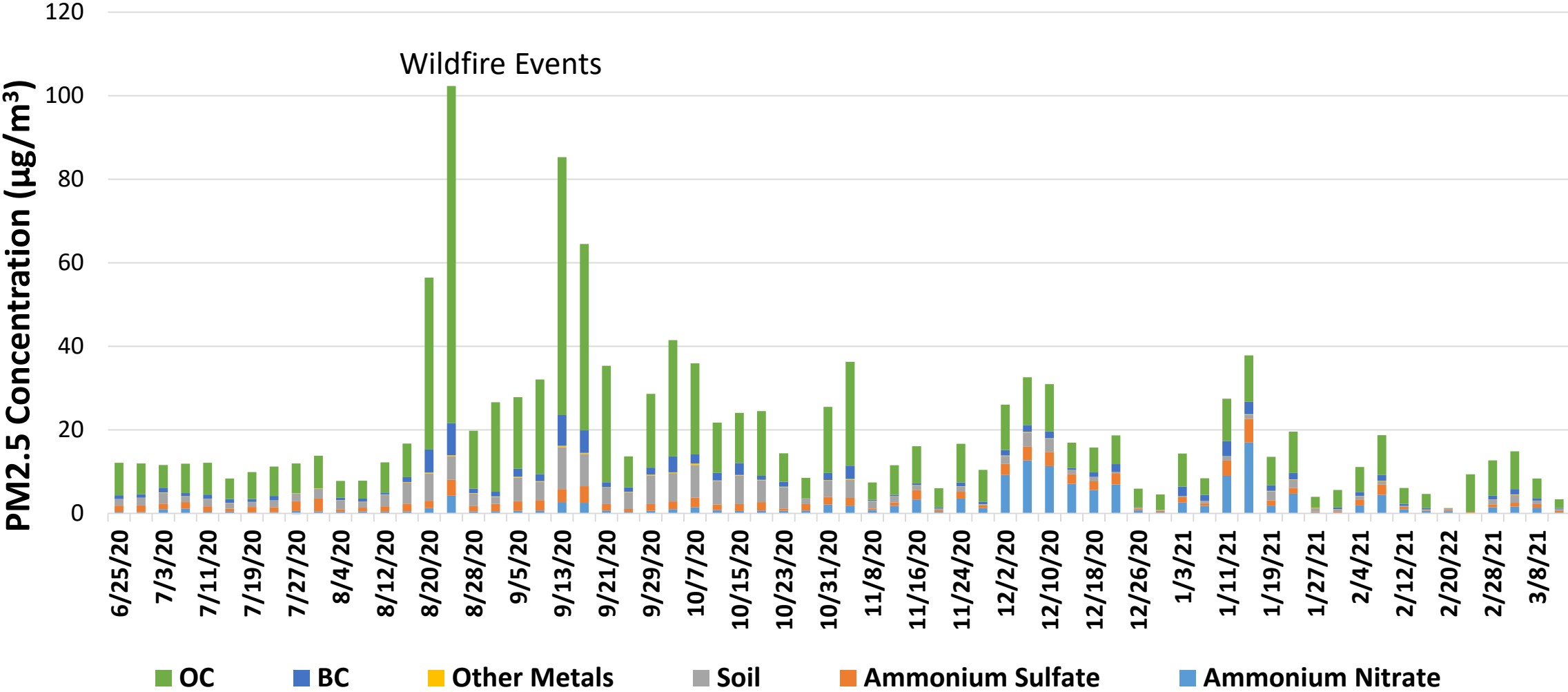
# VOC Speciation Sampling and Laboratory Analysis

- June 2020, VOC speciation sampling began at Malaga Elementary School
  - Requires intensive operation and handling of special canister based air monitoring equipment
- Collected samples sent to third-party laboratory for analysis to determine various specific VOC detected in atmosphere
  - Capable of isolating 86 different VOCs from each air sample
- To date, VOC analysis has detected primarily acetaldehyde, methanol, ethanol, and acetone
  - Only acetaldehyde and methanol have associated Reference Exposure Level (REL), a health risk metric established by the California Office of Environmental Health Hazard Assessment (OEHHA)

# VOCs: Methanol and Acetaldehyde Measurements

- Methanol
  - Sources include solvent uses, automobile exhaust, and biological decomposition of biological wastes, sewage, and sludge
  - Health impacts include blurred vision, headache, dizziness, and nausea
- Acetaldehyde
  - Sources include wood combustion (fireplaces and woodstoves), vehicle exhaust, tobacco smoke, and waste processing
  - Can cause irritation of the eyes, skin, and respiratory tract
  - At higher exposure levels, can cause erythema (reddening of skin), coughing, pulmonary edema (excess fluid in lungs), and necrosis (body tissue damage)

Methanol Detected at Malaga Elementary School
(June 2020 – March 2021)
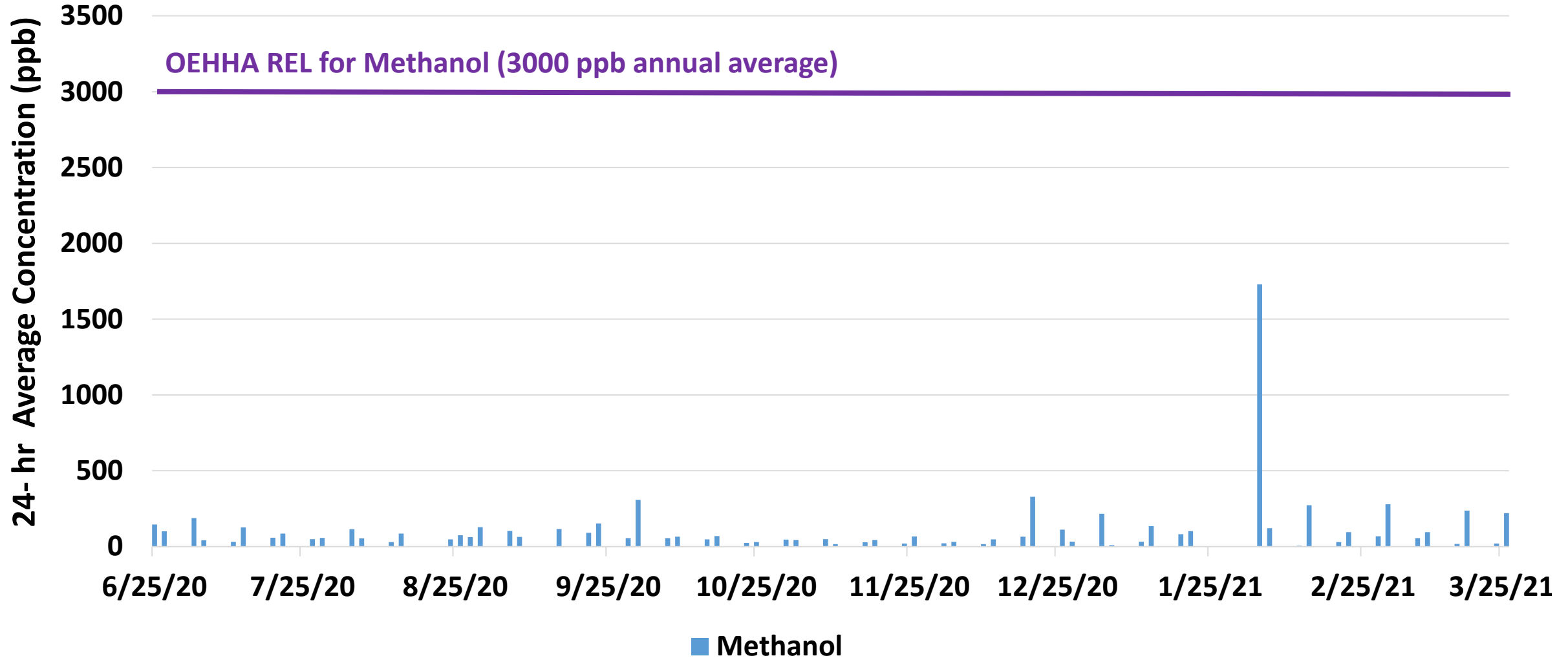
Acetaldehyde Detected at Malaga Elementary School (June 2020 – March 2021)
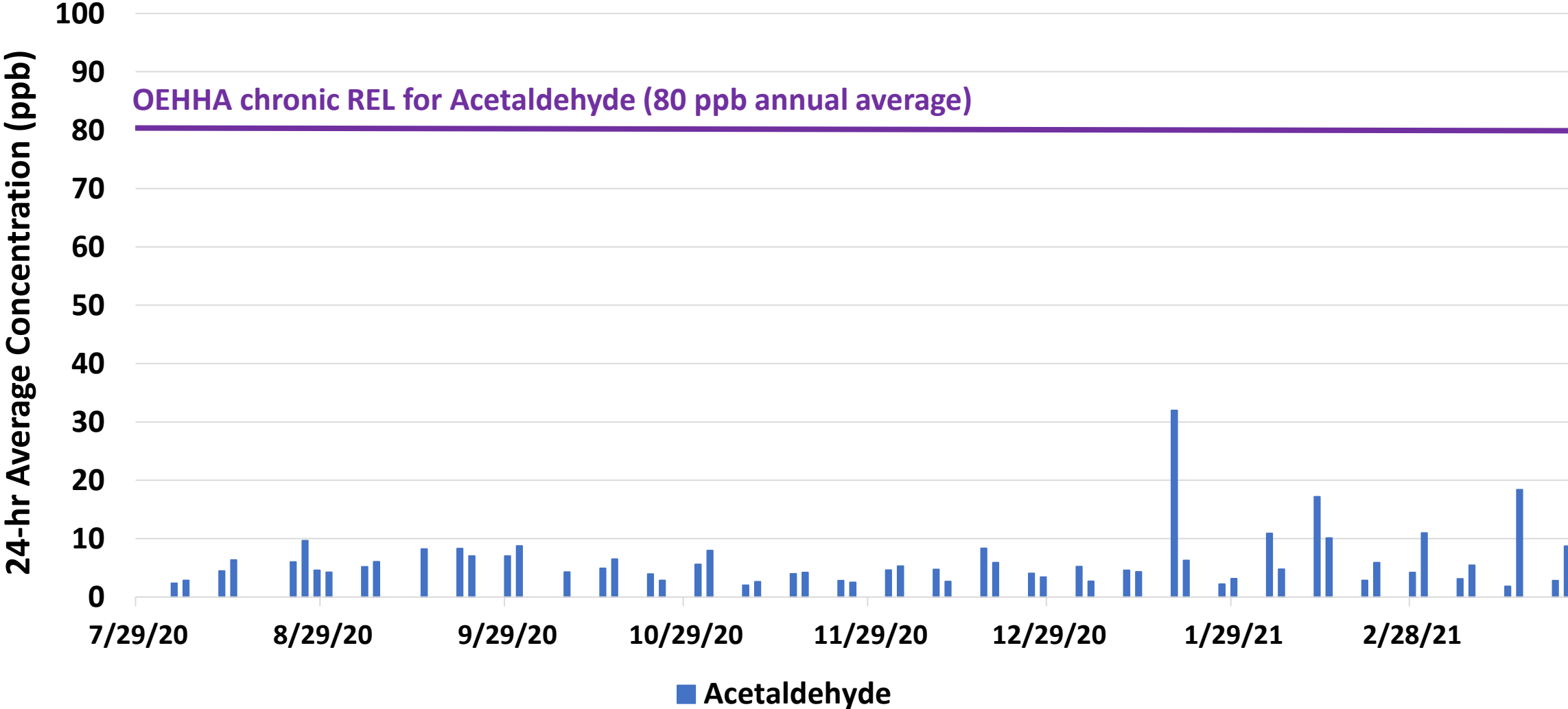
# Summary of Air Monitoring Results "Lessons Learned"

- Real-time community monitors
  - Pollutant concentrations tracking consistently with each other and nearby regulatory monitors outside of community
  - Ongoing data collection will be needed to capture full understanding, including spikes and variations among locations
- PM2.5 speciation: Spikes in organic carbon from wildfire smoke impacts in the summer/fall, with increased ammonium nitrate contribution during winter season as expected
- VOC speciation: Species detected were well below OEHHA reference exposure levels but more data and further investigation needed to better understand potential sources
- Overall, more data needed to capture seasonal changes and account for impacts from COVID-19

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# Next Steps

- Continue with current air monitoring efforts with stationary sites, speciation analysis, and air monitoring vans, responding to community needs and concerns
- Continue to work with Fresno Unified School District to implement air monitoring at final location: Edison High School
- Triggers established for timely action to investigate spikes in emissions
  - Deploy staff to site to determine potential causes
  - Reviewing data to ensure validity and that equipment operating optimally

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# Community Air Quality Data

- District AB 617 webpage at: http://community.valleyair.org/community-air-monitoring
  - Real-time community air monitoring data
  - Raw BTEX data for Malaga
  - Air monitoring data from vans
  - Quarterly reports
  - Weekly air monitoring updates
- CARB's statewide air quality data portal (AQview) displays and provides community air monitoring data from AB 617 communities
  - AQview website located at: https://ww2.arb.ca.gov/es/community-air-quality-portal
  - Air quality data from Valley AB 617 communities available at this website
  - Development ongoing, new features to be added

# Comments/Questions?