San Joaquin Valley
AIR POLLUTION CONTROL DISTRICT

South Central Fresno Community Air Monitoring Report

2021 4th Quarter (October – December)

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I. Background

Assembly Bill (AB) 617, signed into law in July 2017, has resulted in a statewide effort to reduce air pollution and improve public health in communities that experience disproportionate burdens from exposure to air pollutants statewide through new community-focused and community-driven actions. AB 617 provides mechanisms and resources to implement community-specific air quality monitoring networks, develop and implement emission reduction programs; improve availability of data and other technical information; and invest substantial funding in the community through voluntary incentive funding measures. South Central Fresno, a densely populated community within the city of Fresno, was selected as a first year community by CARB in September of 2018.

District staff provided assistance to the Community Steering Committee (CSC) members by helping them to develop their recommended air monitoring priorities. The District worked with CSC members as they reviewed and evaluated a variety of different resources, including maps of stationary sources, area sources, mobile sources, prevailing wind direction data, and sensitive receptor locations relative to sources of air pollution within the community. The CSC adopted their official recommendation in June 2019, including the deployment of various air monitoring platforms within the community as a part of the South Central Fresno Community Air Monitoring Plan (CAMP).

The District has invested an extensive amount of work into implementing the CAMP, including researching, developing, configuring, deploying, trouble-shooting, and maintaining new state-of-the-art high precision air monitoring equipment. This also includes the use of the mobile air monitoring van to take measurements in a variety of locations of interest and to respond to community concerns. The District has also contracted with analytical laboratories to conduct the needed analysis to speciate the VOC and PM2.5 samples being taken in the community. In addition, the District has worked closely with organizations to negotiate leases to authorize the deployment of the equipment on site, followed by logistical, electrical, and site preparation work for the installation of the air monitoring equipment.

Access to Data from South Central Fresno Community Air Monitoring Network

In addition to quarterly reports, the District is continuing its efforts to enhance the availability of air monitoring data and information to ensure that the community is fully apprised of the ongoing air monitoring efforts and are receiving the latest air quality information. This includes continued regular updates to the Community Steering Committee (CSC), continuously posting real-time and all historical air monitoring data, and bilingual weekly updates in South Central Fresno, which are all available on the South Central Fresno Air Monitoring webpage. In addition, raw hourly data from the South Central Fresno community air monitoring network are also being sent to CARB and are expected to become available on CARB's statewide AQView data portal once the website is complete.

II. Summary of Findings for the Quarter

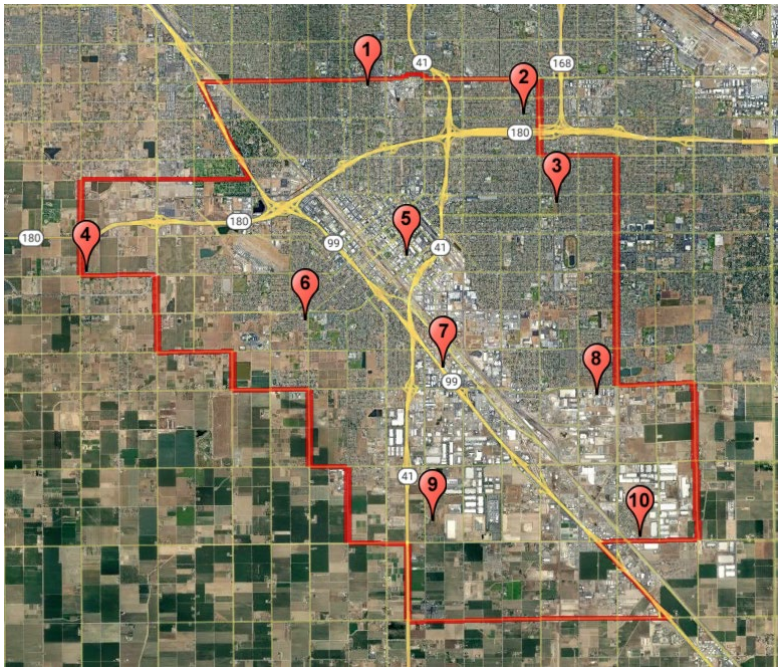
Through the continued implementation of the South Central Fresno CAMP during this period, the following was observed among the pollutants monitored:

- During the fourth quarter of 2021, Wildfire smoke impacts caused elevated concentrations in October. The rest of the quarter was characterized by extended periods of high pressure followed by a few days of low pressure.
- Most of the 24-hour average PM2.5 values and 8-hour average ozone values are below the federal standards except days with impacts from wildfires or during poor dispersion caused by high pressure conditions.
- During this period, acetaldehyde, methanol, ethanol, 2-propanol, and acetone were the primary VOCs detected. Overall, during this monitoring period no concerning concentrations of VOCs were detected in the samples taken.
- November experienced multiple days of higher ammonium nitrate levels, which is common in the Valley during the winter season under stable conditions.
- See Appendix for further analysis including Heat Maps and Charts

III. Status of Community Air Monitoring Network

Consistent with the community recommended air monitoring network design, the District is now implementing the community air monitoring plan for South Central Fresno. The following map and table detail the network design for the South Central Fresno CAMP, as well as the status of implementing each specified air monitoring site.

Figure 1 Design and Status of South Central Fresno Community Air Monitoring Network



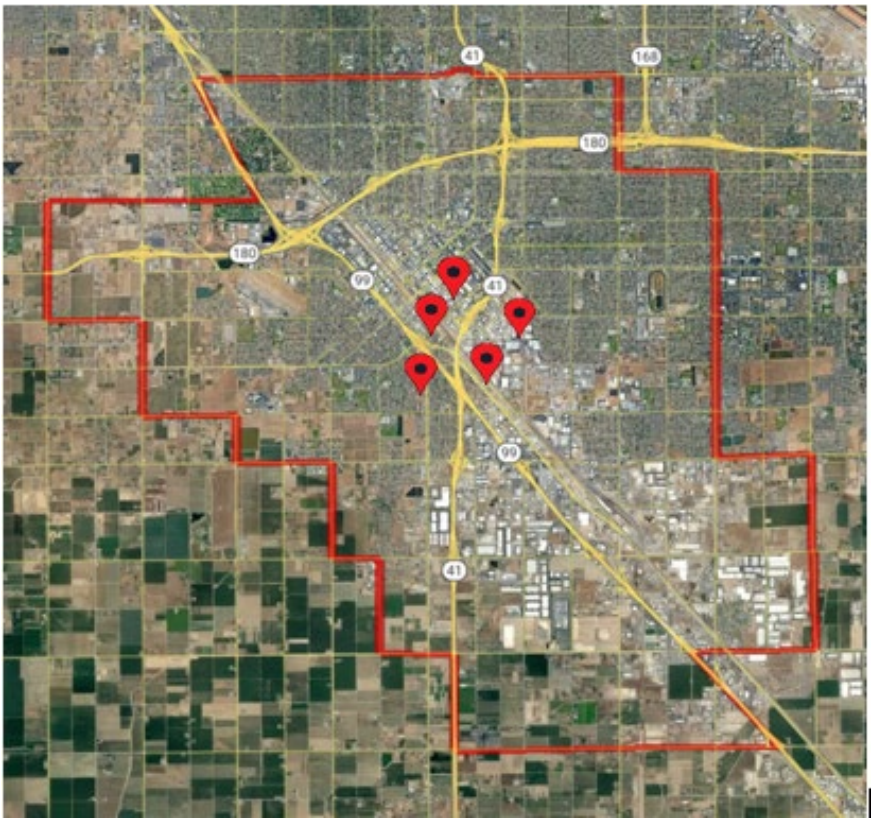
Location	Site Location	Monitoring Platform	Implemented (Y/N)
1	Heaton Elementary School	Real-time PM2.5	Y
2	Yosemite Middle School	Real-time PM2.5	Y
3	Roosevelt High School	Real-time PM2.5	Y
4	Madison Elementary School	Real-time PM2.5	Y
5	Bitwise South Stadium	Real-time PM2.5	Y
6	Edison High School	Compact Multi-Pollutant	Y
7	Fresno-Foundry Park	Real-time PM2.5	Y
8	Fresno-Drummond	Ozone, NO_2, PM10	Y
9	West Fresno Middle School	Compact Multi-Pollutant	Y
10	Malaga Elementary School	Air Monitoring Trailer	Y

The District continues to work on implementing the South Central Fresno CAMP, as well as making changes as needed based on CSC member comments and other logistical reasons.

IV. Mobile Air Monitoring Van Activities

During this quarterly air monitoring period, the District used the mobile air monitoring van to measure air quality at the following locations:

Figure 2 Mobile Air Monitoring Locations



The following table provides a summary of the results of the air quality data collected with the air monitoring van during this period. Green colored values represent pollutant concentrations that are below the applicable health standard or Reference Exposure Level (REL), while orange colored values represent elevated values or values above the applicable health standard or REL. For reference, a detailed table of all community air monitoring data collected with the mobile air monitoring van is available on the South Central Fresno community air monitoring website.

Table 1 Summary of Data Collected with Mobile Air Monitoring Van

Pollutant	Peak 1-hour Average Value	Applicable Standard
PM2.5*	56.0 µg/m^3*	35 µg/m^3 (24-hr average)
Ozone*	58.9 ppb*	70 ppb (8-hr average)
CO	0.5 ppm	35 ppm (1-hr average)
NO2	37.5 ppb	100 ppb (1-hr average)
SO2	2.0 ppb	75 ppb (1-hr average)
Benzene	1.3 ppb	8 ppb (Acute Risk Exposure Level) 1 ppb (Chronic Risk Exposure Level)
Toluene	2.3 ppb	9,818 ppb (Acute Risk Exposure Level) 80 ppb (Chronic Risk Exposure Level)
Ethylbenzene	1.7 ppb	461 ppb (Chronic Risk Exposure Level)
Xylene	4.8 ppb	5,067 ppb (Acute Risk Exposure Level) 161 ppb (Chronic Risk Exposure Level)
H2S	3.4 ppb	30 ppb (Acute Risk Exposure Level) 7 ppb (Chronic Risk Exposure Level)

*Peak 1-hour values not directly comparable to 24-hour and 8-hour average standards for PM2.5 and ozone, respectively

V. Summary of PM2.5 and VOC Speciation Analysis

To build a better understanding of the various constituents that compose the overall PM2.5 and Volatile Organic Compound (VOC) concentrations in the South Central Fresno community, in November 2019 the District began operating PM2.5 and VOC speciation sampling at the Fresno-Foundry site near the intersection of Jensen Avenue and Highway 99. On June 23, 2020, VOC and PM2.5 speciation air monitoring efforts were shifted to the air monitoring trailer at Malaga Elementary School. The collected samples were sent to a third-party laboratory for analysis to determine the contribution of various species of PM2.5, as well as the various species of VOCs in the air sampled in the community.

Details on the types of species measured through this analysis, and potential activities, can be found in the appendix to this report.

PM2.5 Speciation Analysis

The following figures show the PM2.5 speciation concentrations and relative comparison of the various PM2.5 species sampled at the Malaga Elementary School air monitoring site. Samples were taken over a 3 month period during the timeframe of this report.

This analysis shows that during this quarter, the highest concentrations of PM2.5 were primarily driven by ammonium nitrate and organic carbon. Wildfire smoke impacts were experienced throughout the quarter, which can significantly contribute to the organic carbon concentrations in the PM2.5 samples. The higher ammonium nitrate levels in November are a common occurrence during the winter months in the Valley under stable conditions, where NOx emissions from mobile sources and other fuel combustion processes contribute to chemical reactions to form this type of PM2.5 pollution.

Figure 3 Speciated PM2.5 Concentrations at Malaga Elementary School

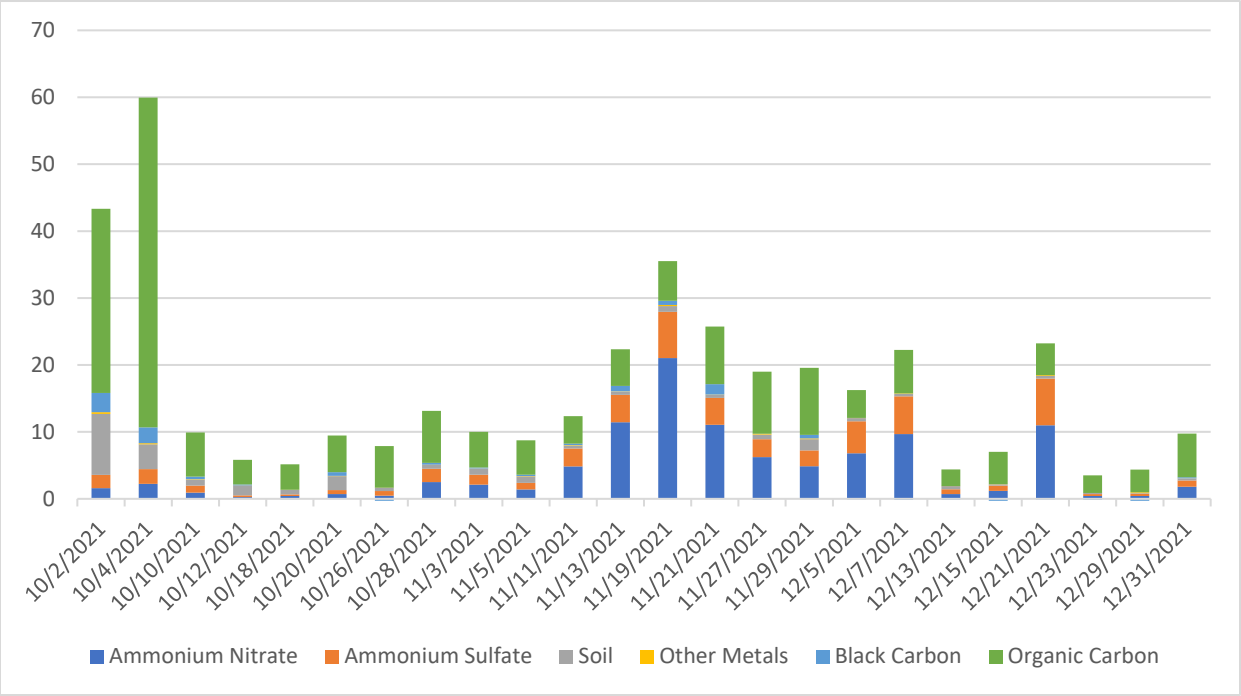
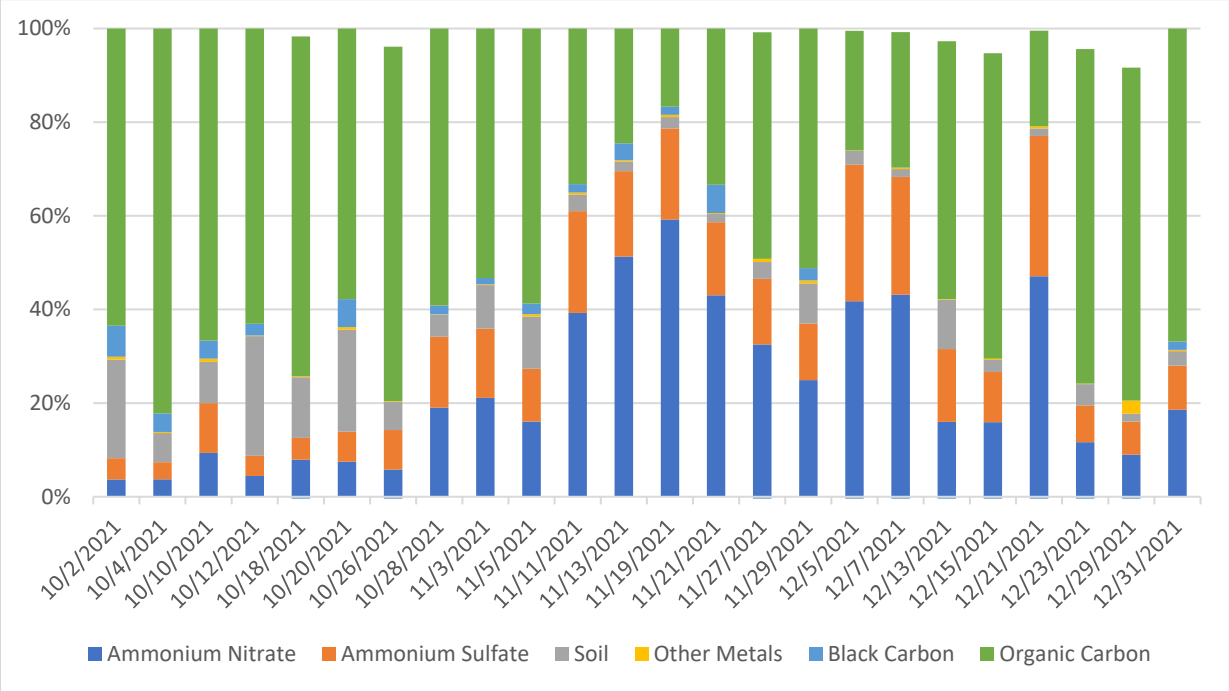


Figure 4 Relative Comparison of PM2.5 Species Measured at Malaga Elementary School



VOC Speciation Analysis

VOCs are carbon chained compounds that vaporize in ambient conditions. Among these compounds are BTEX, 1,3-butadiene, PAH, aldehydes, naphthalene, and diethanolamine. These compounds are typically emitted from products such as paints, inks, organic solvents, petroleum products, and vehicle exhaust. The health effects of these compounds vary but, long term exposure can have lasting adverse health effects. A more detailed list of possible VOCs and the associated health effects is provided by the California Office of Environmental Health Hazard Assessment (OEHHA)[1].

During this period, the District collected 24 air samples for laboratory analysis. The VOC laboratory analysis is capable of isolating concentrations of 83 VOC species, however during this period most VOCs were not detected in the atmosphere.

Acetaldehyde, methanol, ethanol, 2-proponal, and acetone were the primary VOCs detected. Of these, only acetaldehyde and methanol have an associated Reference Exposure Level (REL), a health risk metric established by the Office of Environmental Health Hazard Assessment (OEHHA). Below is a summary of the potential sources and a comparison of the peak concentration with the associated OEHHA REL. Green colored values represent pollutant concentrations that are below the applicable REL, while orange colored values represent elevated values or values above the applicable REL. All shaded values in the table below are colored green and no concerning concentrations of VOCs were detected in the samples taken.

Table 2 Summary of VOC Speciation Analysis

Pollutant	Potential Sources of Emission	Highest 24-hour Average Concentration Detected (ppb)	OEHHA Acute REL (ppb)	OEHHA Chronic REL (ppb)
Methanol	Automobile exhaust, solvent use, and naturally from vegetation and microbes	636.0	21,367	3052
Acetaldehyde	Wood combustion in fireplaces and woodstoves, coffee roasting, burning of tobacco, vehicle exhaust fumes, and coal refining and waste processing	15.6	261	78

[1] https://oehha.ca.gov/air/general-info/oehha-acute-8-hour-and-chronic-reference-exposure-level-rel-summary

VI. Appendix of Pollutant Species and Comparative Analysis

Overview of PM2.5 Species

The nature and formation of PM2.5 in the San Joaquin Valley is highly complex as it can be composed of any material that has a diameter of 2.5 microns or less. PM2.5 can be emitted directly as primary PM2.5 from various sources or formed secondarily through chemical reactions in the atmosphere. The resulting ambient PM2.5 mixture can include aerosols (fine airborne solid particles and liquid droplets) consisting of components of nitrates, sulfates, organic carbon, black carbon, soil, trace metals, and more.

PM2.5 in the Valley is comprised of many species that contribute to the total PM2.5 mass. This complex mixture is attributable to emissions from stationary, mobile, and area-wide sources, as well as naturally occurring emissions. Although the list of species contributing to PM2.5 in the Valley is lengthy, it can be grouped into larger representative categories. The following is a brief description of each of these larger species categories:

- **Ammonium Nitrate:** Ammonium nitrate is formed from the reaction of ammonia and nitric acid, where the nitric acid is formed from emissions of nitrogen oxides.

- **Ammonium Sulfate:** Ammonium sulfate is form from the reaction of ammonia and sulfuric acid, where the sulfuric acid is formed primarily from emissions of sulfur oxide, with smaller amounts forming from direct emissions of sulfur.

- **Organic carbon:** Organic carbon (OC) are generated as primary organic aerosol, predominantly through the combustion of hydrocarbons. Key sources include cooking, industrial processes, mobile source exhaust, tire wear, and wood burning. Secondary organic aerosols are formed from the oxidation of motor vehicle hydrocarbons, wood burning, solvent use, and industrial processes.

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

- **Soil:** This category consists of road dust and soil dust that are entrained in the air from activity, such as soil disturbance or airflow from traffic.

- **Other Metals:** Identified as components from soil emissions or found in other particulates having been emitted in connection with combustion from engine wear, brake wear, and similar processes. Certain metals are also emitted from the use of fireworks.

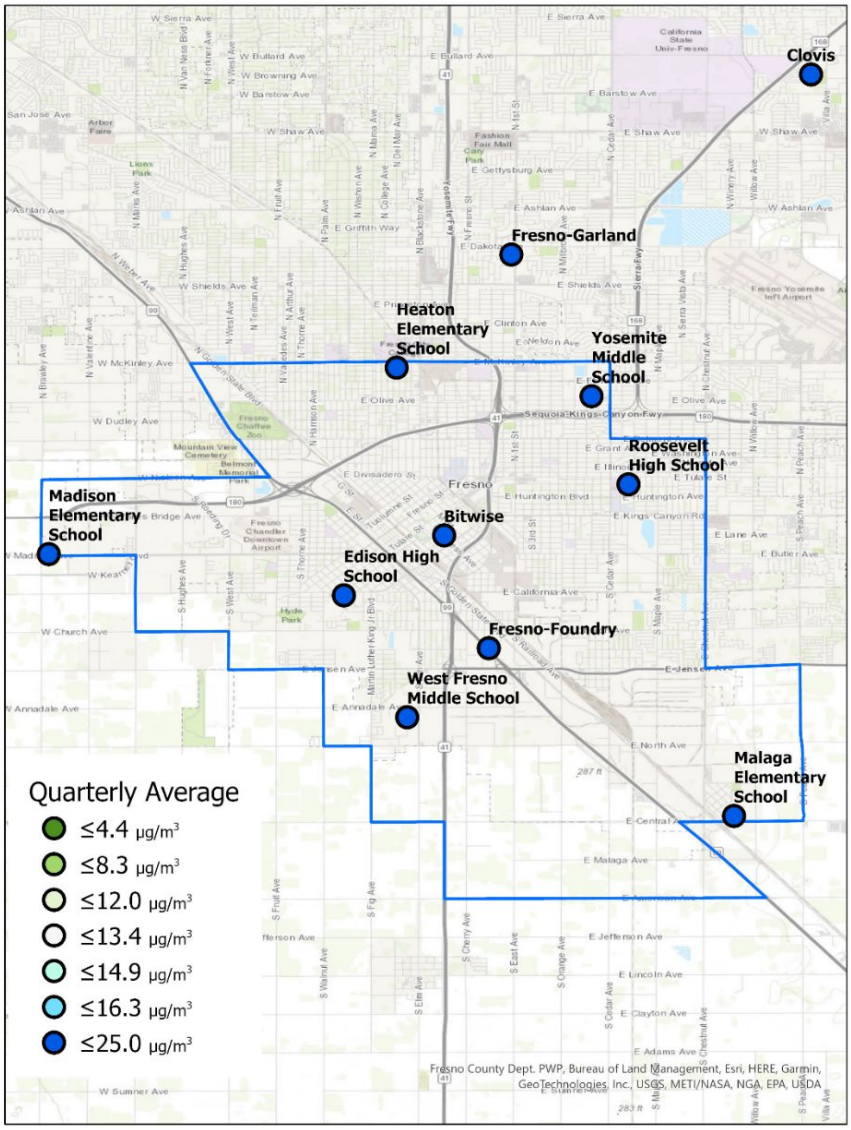
Comparative Analysis of Measured Pollutants

The following table and spatial comparison map depicts the quarterly PM2.5 averages and locations of each site within the community, and other nearby air monitoring sites. Good air quality is represented by a dark green color and lightens as quarterly averages rise. Moderate air quality and above is represented by a blue color which continues to darken based on how high the quarterly average is for that site. During this period, the Fresno-Foundry, West Fresno Middle School, and Edison High School monitors recorded the highest average PM2.5 across the community. Note that much of the data during this period was impacted by wildfires, and does not represent normal ambient air quality conditions across the urban area. In response to the higher concentrations measured at Edison High School, in Spring 2022 the District began to measure speciated PM2.5 at this location to better understand the sources that could be contributing to the measurements in this area of the South Central Fresno community.

Quarter	Clovis	Fresno-Garland	Roosevelt High School	Bitwise South Stadium	Fresno-Foundry
2021 Q4	19.4	21.2	20.8	21.9	23.1

Quarter	Heaton Elementary School	Yosemite Middle School	Malaga Elementary School	West Fresno Middle School	Madison Elementary School	Edison High School
2021 Q4	20.1	19.6	19.5	24.8	21.1	25.0

Spatial Comparison of PM2.5 Quarterly Averages

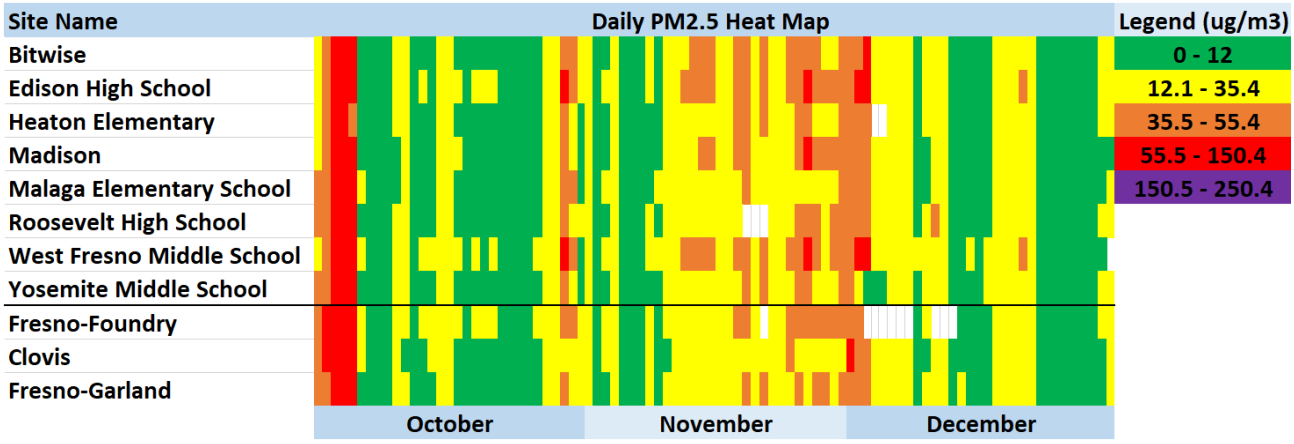


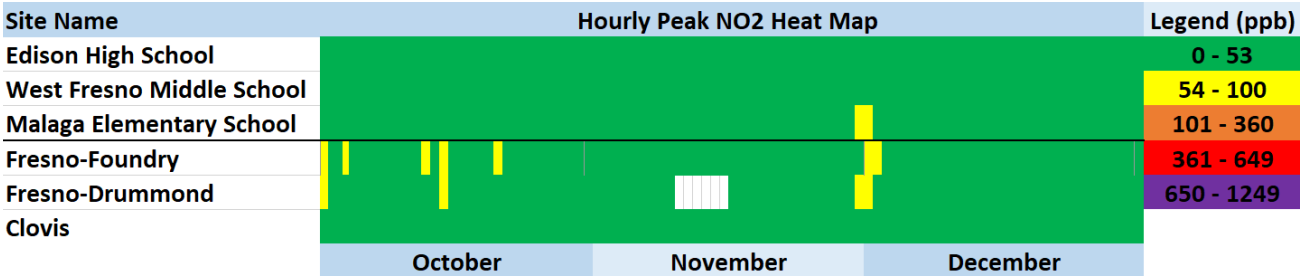
Pollutant Concentration Heat Maps

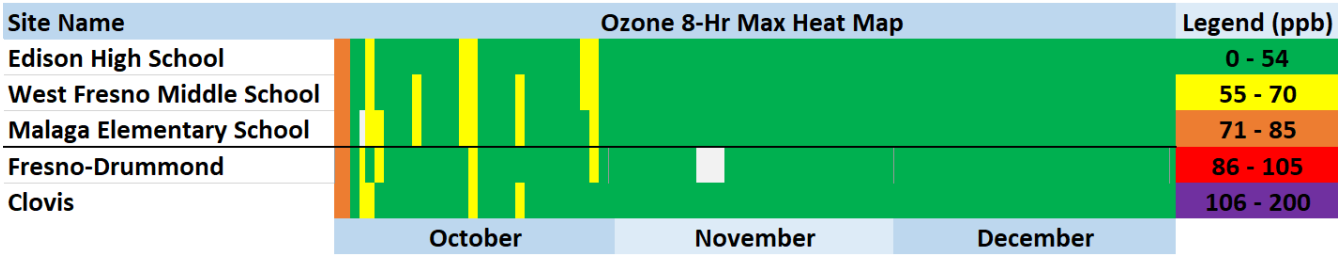
The following Heat Maps provide a comparative analysis of various pollutants being measured at the air monitoring sites as a part of the community air monitoring network. The color scales for each table are based on the Air Quality Index (AQI) or the associated Reference Exposure Level (REL).

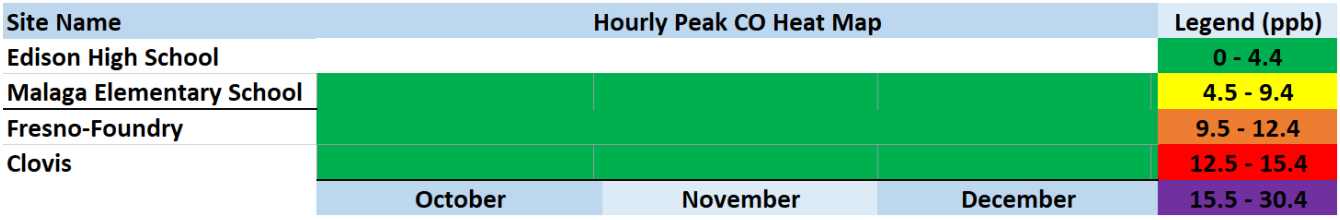
October was influenced by wildfires causing elevated PM2.5 and Ozone concentrations. Generally, California's weather pattern is characterized by high pressure systems and low pressure systems that move through the region every two to four days in alternating fashion however the high pressure systems that built over the region in November 2021 remained in place for longer durations of time. Much of November was characterized by

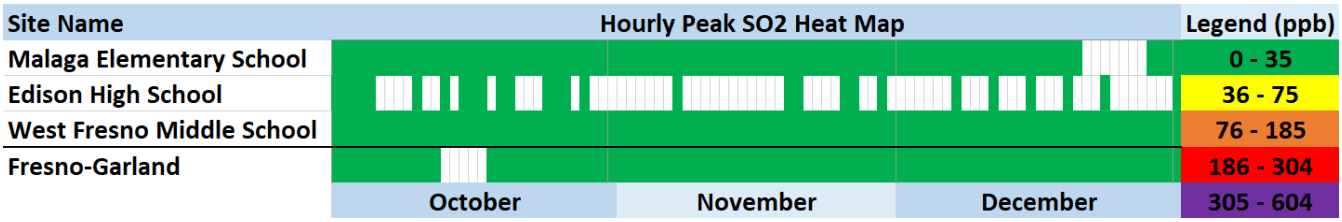
elevated PM2.5 and spikes in NO_2 levels due to the combination of extended periods of strong stability. Wildfire activity subsided by the beginning of October 2021 and PM2.5 concentrations were able to decrease through parts of the month. An alternating pattern of high and low pressures systems moved through region during December, however, the trajectories of most of the low pressure systems that passed through were such that they did not provide good dispersion for the Valley. Thus the majority of December was governed by stability and elevated PM2.5 levels.

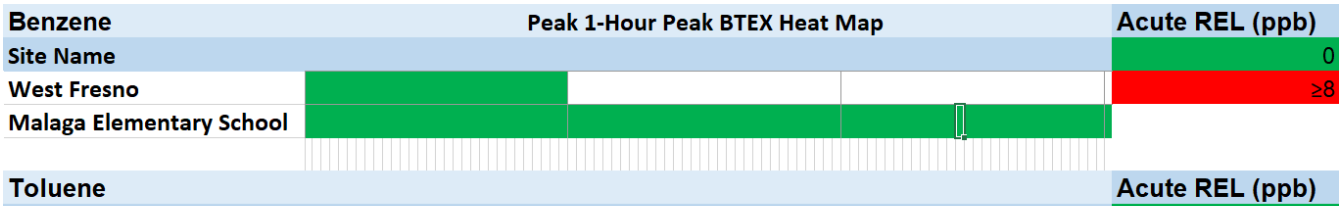


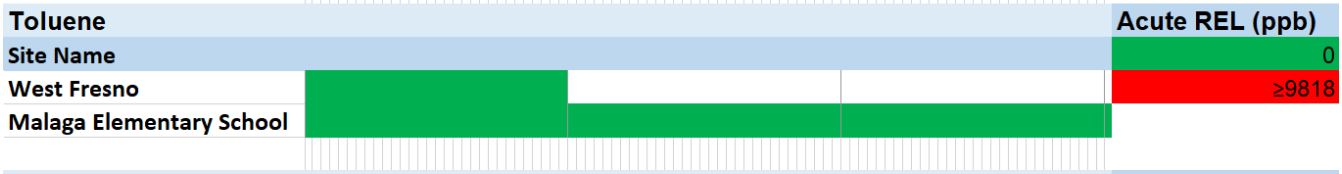


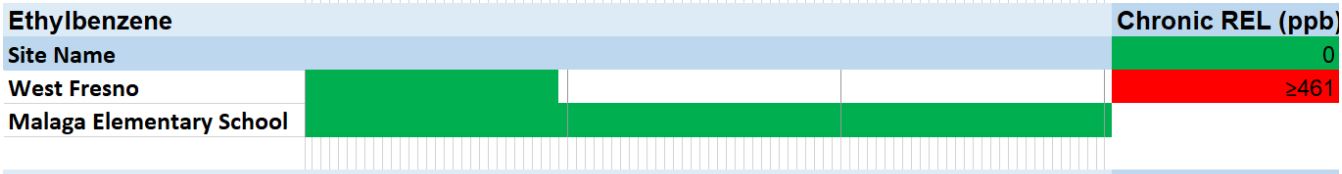


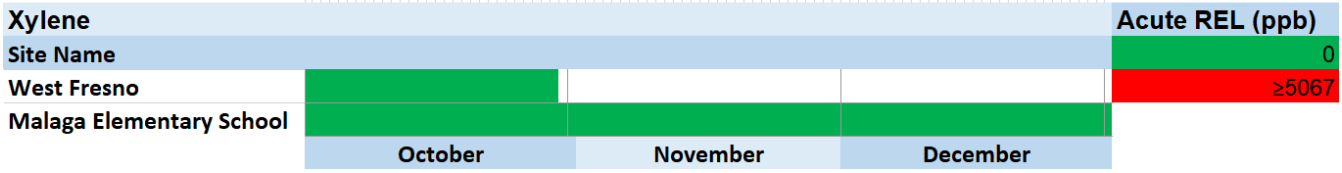



Site Name
Hourly Peak SO2 Heat Map
Legend (ppb)
Malaga Elementary School
Edison High School
West Fresno Middle School
Fresno-Garland
0 - 35
36 - 75
76 - 185
186 - 304
305 - 604
October
November
December


Benzene
Peak 1-Hour Peak BTEX Heat Map
Acute REL (ppb)
Site Name
0
West Fresno
≥8
Malaga Elementary School


Toluene
Acute REL (ppb)
Site Name
0
West Fresno
≥9818
Malaga Elementary School


Ethylbenzene
Chronic REL (ppb)
Site Name
0
West Fresno
≥461
Malaga Elementary School


Xylene
Acute REL (ppb)
Site Name
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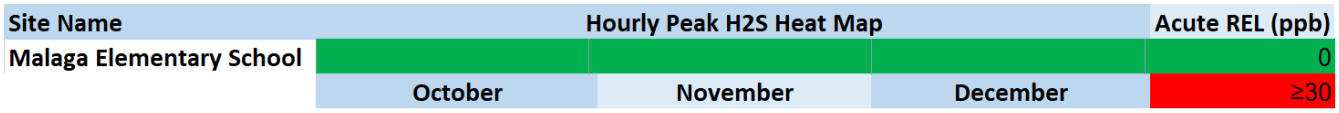
West Fresno
≥5067
Malaga Elementary School
October
November
December


Site Name
Hourly Peak H2S Heat Map
Acute REL (ppb)
Malaga Elementary School
0
October
November
December
≥30