San Joaquin Valley
AIR POLLUTION CONTROL DISTRICT

South Central Fresno Community Air Monitoring Report

2022 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 on June 12, 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 $PM_{2.5}$ 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 now available on CARB's statewide AQView data portal.

II. Summary of Findings for the Quarter

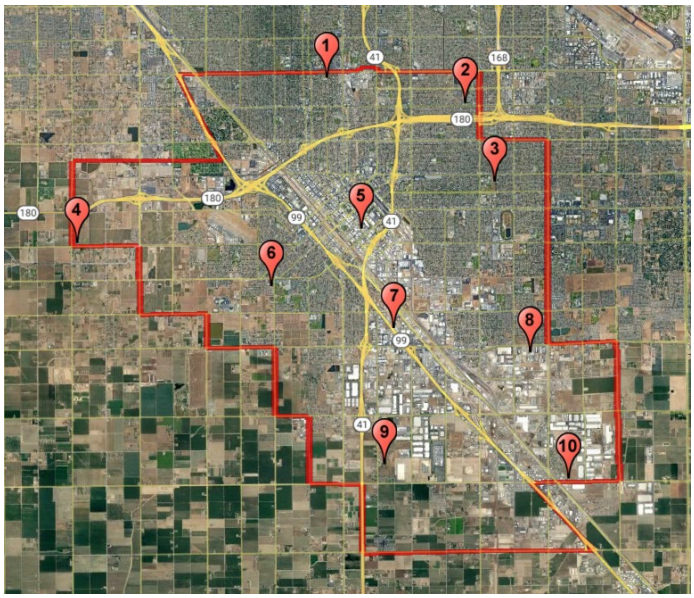
Through the continued implementation of the South Central Fresno CAMP during this period, the following was observed among the pollutants monitored:

- October was dominated by high pressure patterns that caused poor dispersion, trapping pollutants at the surface.
- November was dominated by alternating high and low pressure patterns. The residential wood burning curtailment season began on the first of the month.
- Low pressure patterns were dominant in December. Dispersion conditions improved under the low pressure patterns. December also contained more days of precipitation than the earlier months of the quarter.
- Both November and December experienced multiple days of higher ammonium nitrate levels, which is common in the Valley during the winter season under stable conditions, when pollutants are unable to disperse.
- During this period, acetaldehyde, methanol, ethanol, 2-propanol, and acetone were the primary VOCs detected. Overall, during this monitoring period the concentrations of VOCs that were detected in the samples taken were well below health based thresholds.
- 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 has fully implemented 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

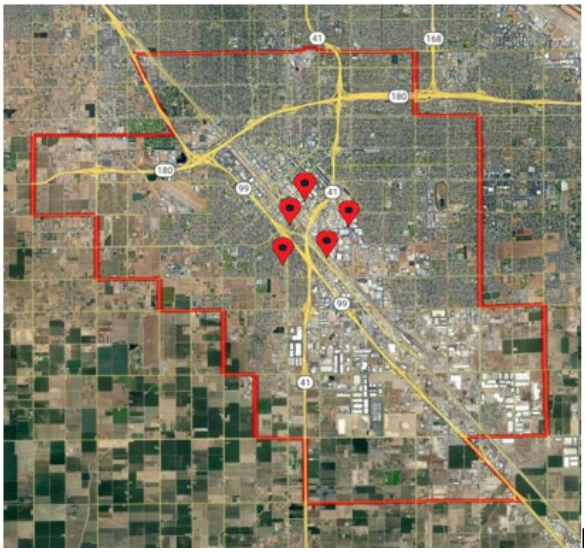


Location	Site Location	Monitoring Platform	Implemented (Y/N)
1	Heaton Elementary School	Real-time $PM_{2.5}$	Y
2	Yosemite Middle School	Real-time $PM_{2.5}$	Y
3	Roosevelt High School	Real-time $PM_{2.5}$	Y
4	Madison Elementary School	Real-time $PM_{2.5}$	Y
5	Bitwise South Stadium	Real-time $PM_{2.5}$	Y
6	Edison High School	Compact Multi-Pollutant	Y
7	Fresno-Foundry Park	Real-time $PM_{2.5}$	Y
8	Fresno-Drummond	Ozone, NO_2, PM_{10}	Y
9	West Fresno Middle School	Compact Multi-Pollutant	Y
10	Malaga Elementary School	Air Monitoring Trailer	Y

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
$PM_{2.5}$*	51.0 µg/m³*	35 µg/m³ (24-hr average)
Ozone*	70.1 ppb*	70 ppb (8-hr average)
CO	0.4 ppm	35 ppm (1-hr average)
NO2	33.4 ppb	100 ppb (1-hr average)
SO2	5.6 ppb	75 ppb (1-hr average)
Benzene	0.0 ppb	8 ppb (Acute Risk Exposure Level) 1 ppb (Chronic Risk Exposure Level)
Toluene	0.0 ppb	9,818 ppb (Acute Risk Exposure Level) 80 ppb (Chronic Risk Exposure Level)
Ethylbenzene	0.0 ppb	461 ppb (Chronic Risk Exposure Level)
Xylene	0.0 ppb	5,067 ppb (Acute Risk Exposure Level) 161 ppb (Chronic Risk Exposure Level)
H_2S	13.1 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 $PM_{2.5}$ and Volatile Organic Compound (VOC) concentrations in the South Central Fresno community, in November 2019 the District began operating $PM_{2.5}$ and VOC speciation sampling at the Fresno-Foundry site near the intersection of Jensen Avenue and Highway 99. On June 23, 2020, VOC and $PM_{2.5}$ speciation air monitoring efforts were shifted to the air monitoring trailer at Malaga Elementary School. On March 11, 2022, $PM_{2.5}$ speciation was relocated to Edison High School to help assess potential sources contributing to elevated $PM_{2.5}$ in the area. The collected samples were sent to a third-party laboratory for analysis to determine the contribution of various species of $PM_{2.5}$, 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.

$PM_{2.5}$ Speciation Analysis

The following figures show the $PM_{2.5}$ speciation concentrations and relative comparison of the various $PM_{2.5}$ species sampled at the Edison High School air monitoring site. Samples were taken over a 3 month period during the timeframe of this report. Twenty samples were collected at the Edison High School air monitoring site and one special project sampling took place for one day, on 11/17/2022, at the Vitro Architectural Glass site to gain a better understanding of the composition of the $PM_{2.5}$ in the surrounding areas.

High temperatures and dry conditions were common at the start of the fourth quarter of 2022. Low temperatures and dry conditions were present for the middle of the fourth quarter. At the end of the fourth quarter of 2022, temperatures remained low, but more precipitation alleviated the dry conditions that were observed previously. The dry conditions may account for the large portion of soil present in the $PM_{2.5}$ speciation results at the start of the fourth quarter.

This analysis shows that during this quarter, the highest concentrations of $PM_{2.5}$ were primarily driven by ammonium nitrate and organic carbon. Combustion emissions are a source of organic carbon. Noticeably, organic carbon constitutes a large portion of the total speciation results, which can be an indicator of combustion emissions impacts on $PM_{2.5}$ measurements this quarter. The higher ammonium nitrate levels this quarter 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 $PM_{2.5}$ pollution.

Analysis of the special project sampling, taken at the Vitro Architectural Glass site, shows that ammonium nitrate, organic carbon, and soil contribute to a large portion of the composition of $PM_{2.5}$ at the site, which is typical during the winter months.

Figure 3 Speciated $PM_{2.5}$ Concentrations at Edison High School and Vitro Architectural Glass

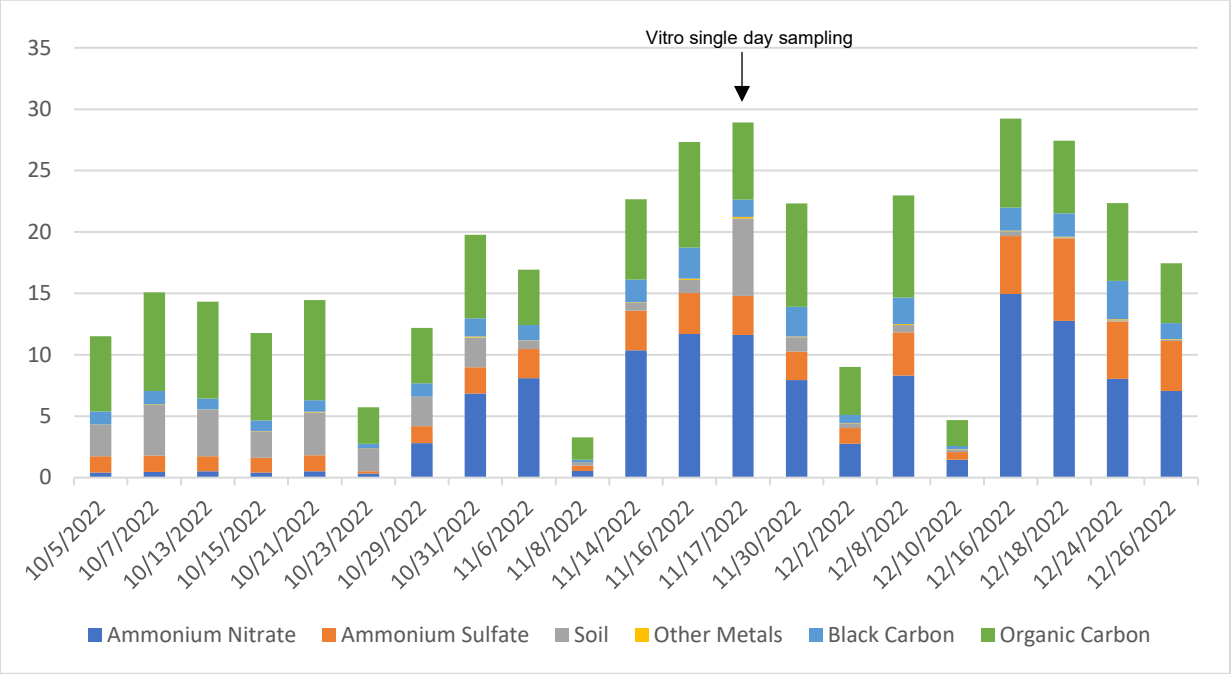


Figure 4 Relative Comparison of $PM_{2.5}$ Species Measured at Edison High School and Vitro Architectural Glass

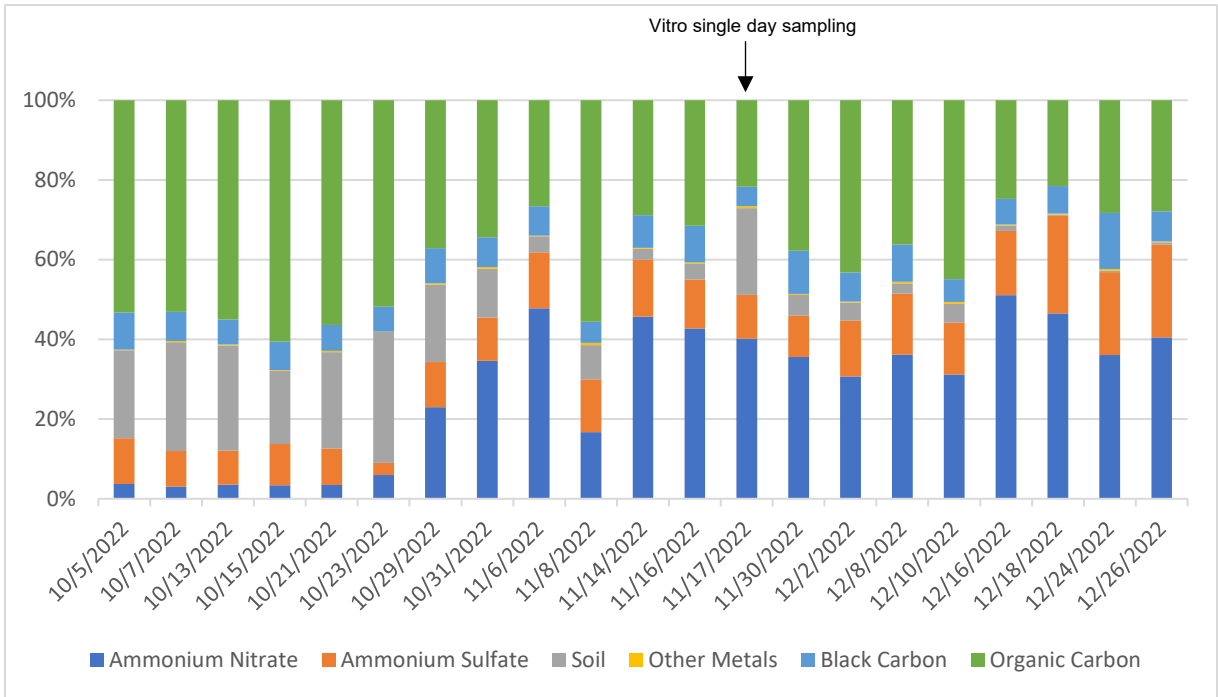
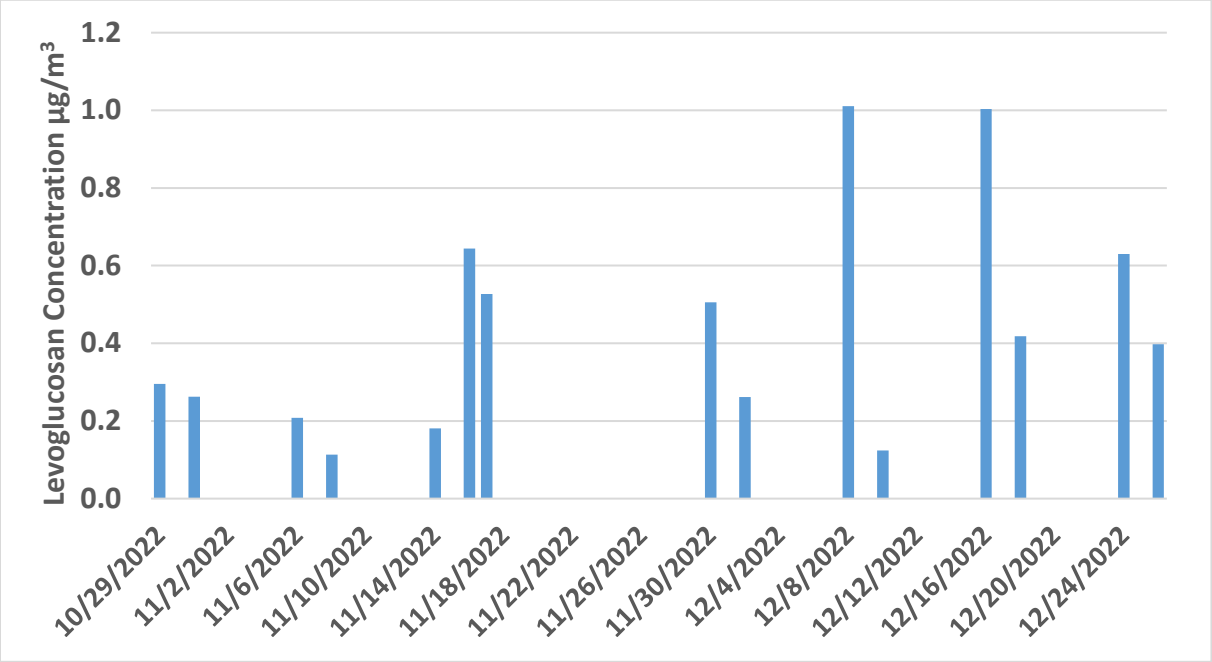


Figure 5 Wood Burning Tracer Levoglucosan Concentrations at Edison High School and Vitro Architectural Glass



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 18 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 three, 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

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

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 for Malaga Elementary School

Pollutant	Potential Sources of Emission	Short Term Impact		Long Term Impact	
		Max Measured [24-hour] (ppb)	OEHHA Acute REL [1-hour] (ppb)	Average Measured [Annual] (ppb)	OEHHA Chronic REL [Annual] (ppb)
Methanol	Automobile exhaust, solvent use, and naturally from vegetation and microbes	30.0	21,367	13.2	3,052
Acetaldehyde	Wood combustion in fireplaces and woodstoves, coffee roasting, burning of tobacco, vehicle exhaust fumes, and coal refining and waste processing	4.6	261	9.7	78

VI. Appendix of Pollutant Species and Comparative Analysis

Overview of $PM_{2.5}$ Species

The nature and formation of $PM_{2.5}$ 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. $PM_{2.5}$ can be emitted directly as primary $PM_{2.5}$ from various sources or formed secondarily through chemical reactions in the atmosphere. The resulting ambient $PM_{2.5}$ 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.

$PM_{2.5}$ in the Valley is comprised of many species that contribute to the total $PM_{2.5}$ 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 $PM_{2.5}$ 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.

- **Wood Burning Tracers:** Levoglucosan is an example of a hydrocarbon formed from the combustion of cellulose and hemicellulose, or wood burning. Levoglucosan can be used as a tracer to understand if $PM_{2.5}$ is coming from wood burning.

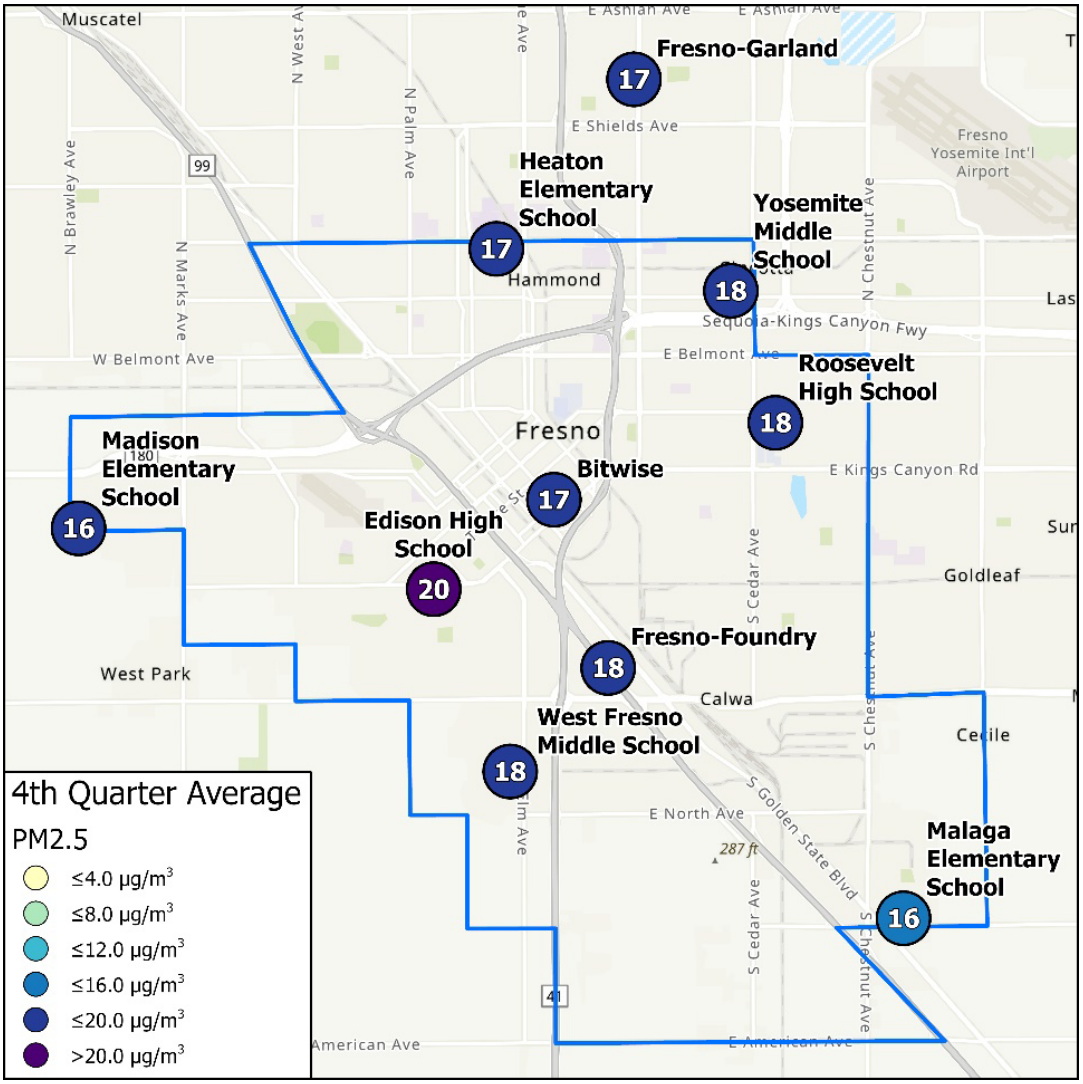
Comparative Analysis of Measured Pollutants

The following spatial comparison map depicts the quarterly $PM_{2.5}$ averages and locations of each site within the community. Good air quality is represented in the map by the light yellow, light green, and light blue colors. Moderate air quality and above is represented by darker blues and purples based on how high the quarterly average is for that site.

Quarter	Clovis	Fresno-Garland	Roosevelt High School	Bitwise South Stadium	Fresno-Foundry
2022 Q4	13.2	17.0	18.4	16.8	18.4

Quarter	Heaton Elementary School	Yosemite Middle School	Malaga Elementary School	West Fresno Middle School	Madison Elementary School	Edison High School
2022 Q4	17.1	17.9	15.7	17.9	16.1	20.2

Figure 6 Spatial Comparison of $PM_{2.5}$ Quarterly Averages



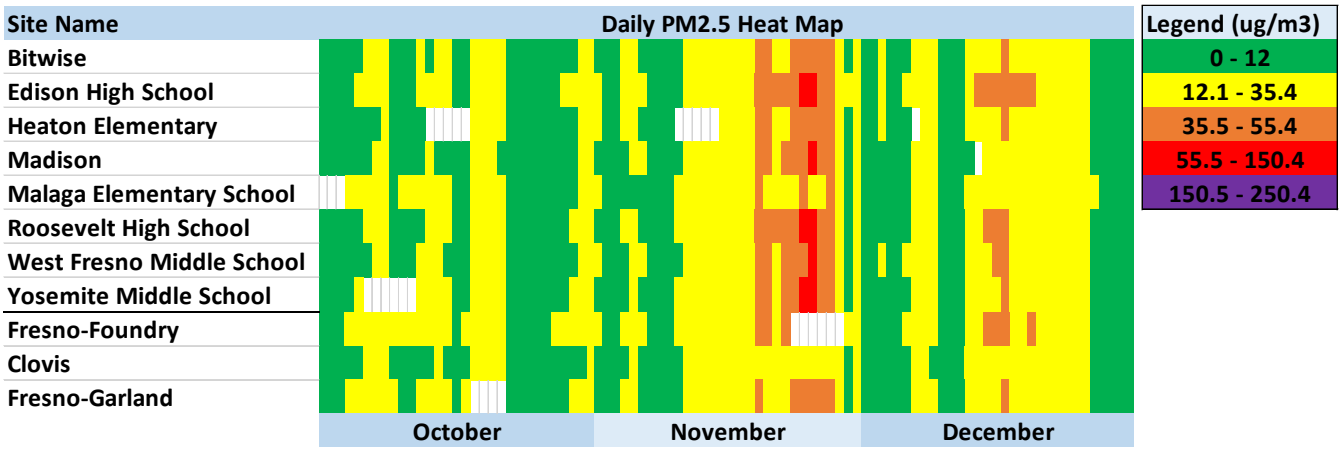
Pollutant Concentration Heat Maps

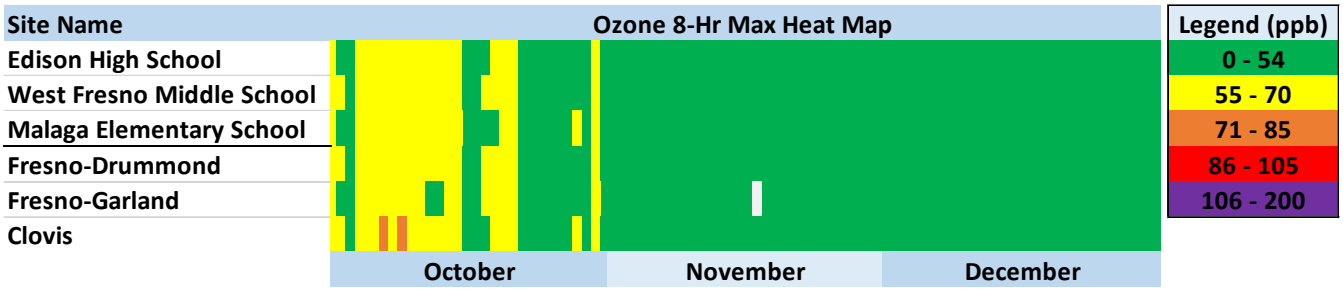
The following Heat Maps provide a comparative analysis of various pollutants being measured at the air monitoring sites as a part of the community air monitoring network. The color scales for each table are based on the Air Quality Index (AQI) or the associated Reference Exposure Level (REL).

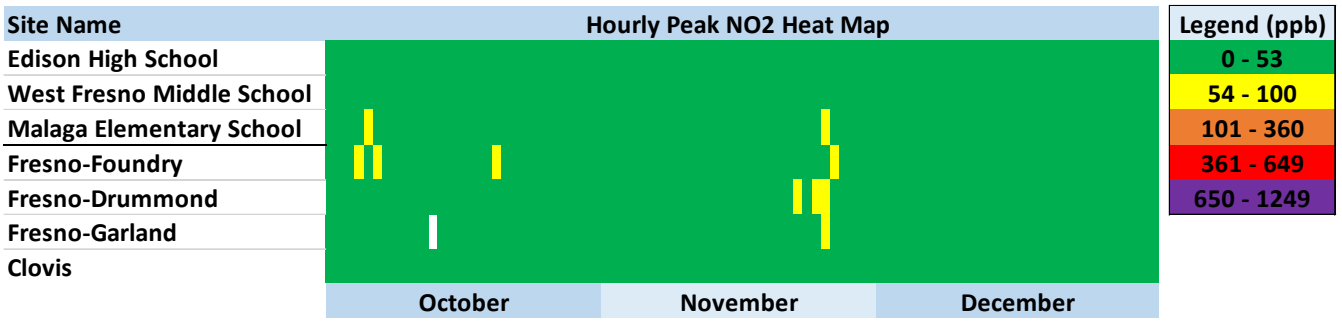
Initially the 4th quarter of 2022 was dominated by high pressure systems that produced near triple digit heat and poor dispersion across the Valley. The strong temperature inversions and stable conditions associated with the high pressure systems prevented particulates from being carried out of the region.

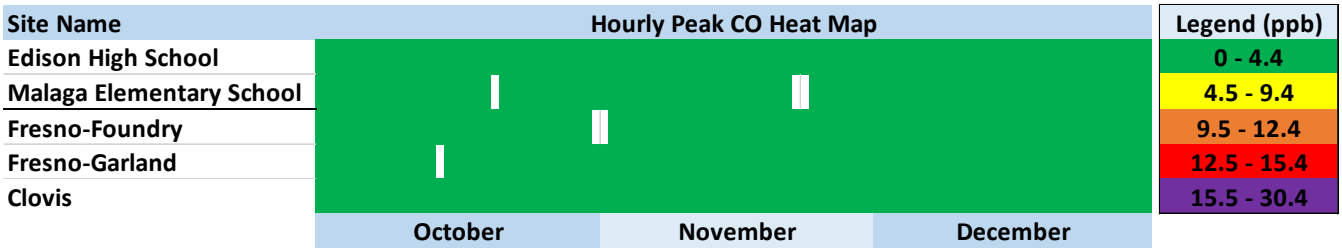
As the quarter progressed, high and low pressure patterns began to alternate and temperatures began to drop. Increased particulate concentrations were observed in the evening and early morning hours due to the strong temperature inversions.

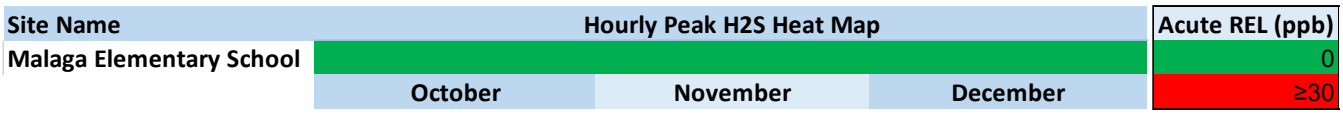
Weak high pressure systems briefly passed through the region periodically in December, allowing for particulates to accumulate overnight and dense morning fog to form; however, the end of the 4th quarter was dominated by low pressure systems that brought in precipitation and allowed for improved dispersion across the Valley. The improved dispersion conditions were sufficient enough to clean out the Valley floor of pollutants on some days.

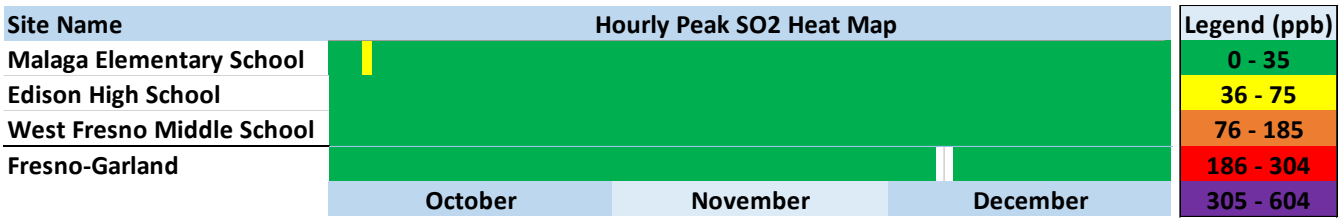


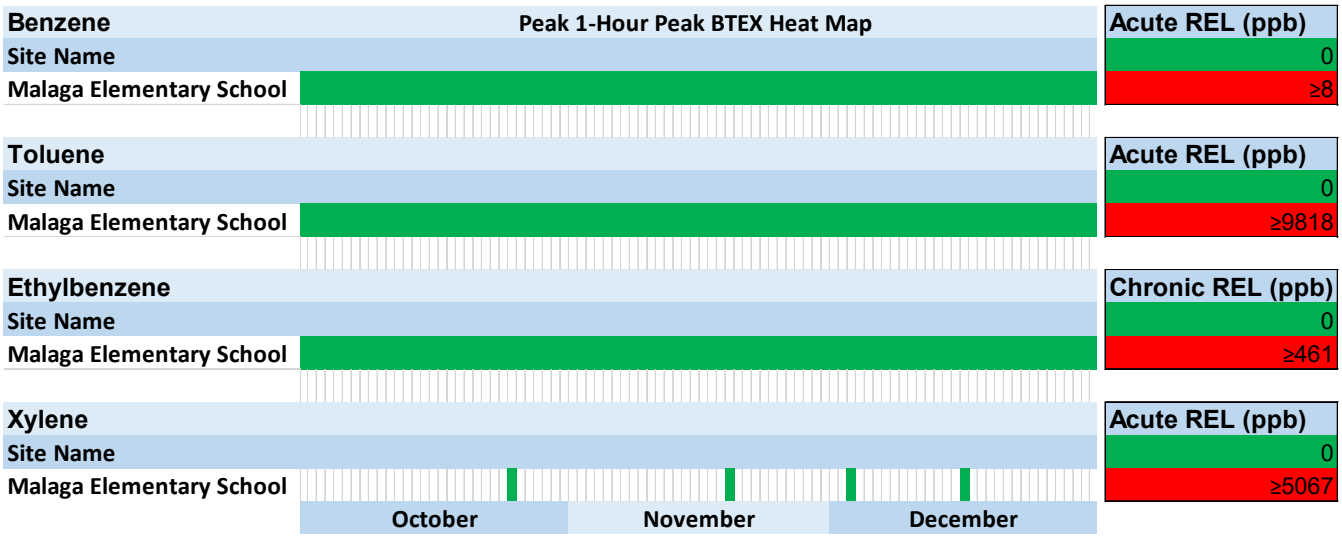



Site Name
Hourly Peak NO2 Heat Map
Edison High School
West Fresno Middle School
Malaga Elementary School
Fresno-Foundry
Fresno-Drummond
Fresno-Garland
Clovis
October
November
December
Legend (ppb)
0 - 53
54 - 100
101 - 360
361 - 649
650 - 1249


Site Name
Hourly Peak CO Heat Map
Edison High School
Malaga Elementary School
Fresno-Foundry
Fresno-Garland
Clovis
October
November
December
Legend (ppb)
0 - 4.4
4.5 - 9.4
9.5 - 12.4
12.5 - 15.4
15.5 - 30.4


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


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


Benzene
Peak 1-Hour Peak BTEX Heat Map
Site Name
Malaga Elementary School
Acute REL (ppb)
0
≥8
Toluene
Site Name
Malaga Elementary School
Acute REL (ppb)
0
≥9818
Ethylbenzene
Site Name
Malaga Elementary School
Chronic REL (ppb)
0
≥461
Xylene
Site Name
Malaga Elementary School
Acute REL (ppb)
0
≥5067
October
November
December