San Joaquin Valley
AIR POLLUTION CONTROL DISTRICT

South Central Fresno Community Air Monitoring Report

2023 1st Quarter (January – March)

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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 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 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

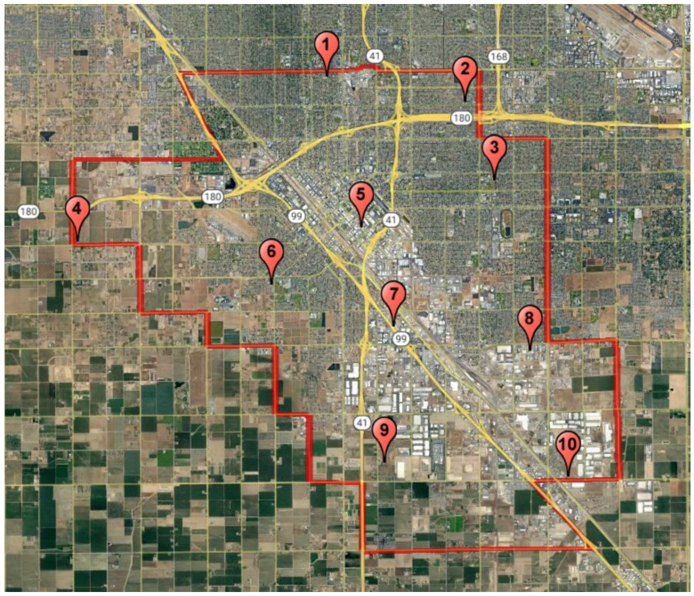
Through the continued implementation of the South Central Fresno CAMP during this period, the following was observed among the pollutants monitored:

- Pollutant concentrations were low during early January due to superior dispersion conditions and widespread precipitation. Mid to late January there was weak high pressure, causing PM concentrations to increase.
- February there were alternating high and low pressure systems. The residential wood burning curtailment season ended on the last day of February.
- Low pressure patterns were dominant in March resulting in improved dispersion conditions. March also experienced widespread precipitation across the Valley, similar to conditions at the start of the quarter.
- Stable meteorological conditions led to three days in January where at least two sites exceeded the federal 24-hour PM2.5 standard of 35 µg/m^3.
- During this period, Acetaldehyde, methanol, ethanol, 2-proponal, and acetone were the primary VOCs detected. Overall, during this monitoring period the concentrations of VOCs 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 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, NO2, PM10	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 mobile air monitoring van data was not available; however, the District plans to continue to utilize the mobile air monitoring vans for the AB617 South Central Fresno community in the future. For reference, a detailed table of all community air monitoring data collected with the mobile air monitoring van is available on the Fresno community air-monitoring website.

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. On March 11, 2022, PM2.5 speciation was relocated to Edison High School to help assess potential sources contributing to elevated PM2.5 in the area. 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 Edison High School air-monitoring site. Twenty-two samples were collected over a three-month period during the timeframe of this report to gain a better understanding of the composition of the PM2.5 in the surrounding areas of Edison High School.

Low temperatures, wet conditions, and superior dispersion conditions were common at the start of the first quarter of 2023, allowing for PM2.5 concentrations to remain low. Temperatures remained low, but weak high pressure dominated the middle of the first quarter, causing ammonium nitrate and organic carbon concentrations to increase. At the end of the first quarter of 2023, temperatures continued to be low, but more dispersive conditions and precipitation brought PM2.5 concentrations back down.

This analysis shows that during this quarter, the highest concentrations of PM2.5 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 PM2.5 measurements this quarter. The higher ammonium nitrate levels this quarter are a common occurrence during the winter months in the Valley under stable, low temperature, and high humidity wintertime conditions. 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 Edison High School

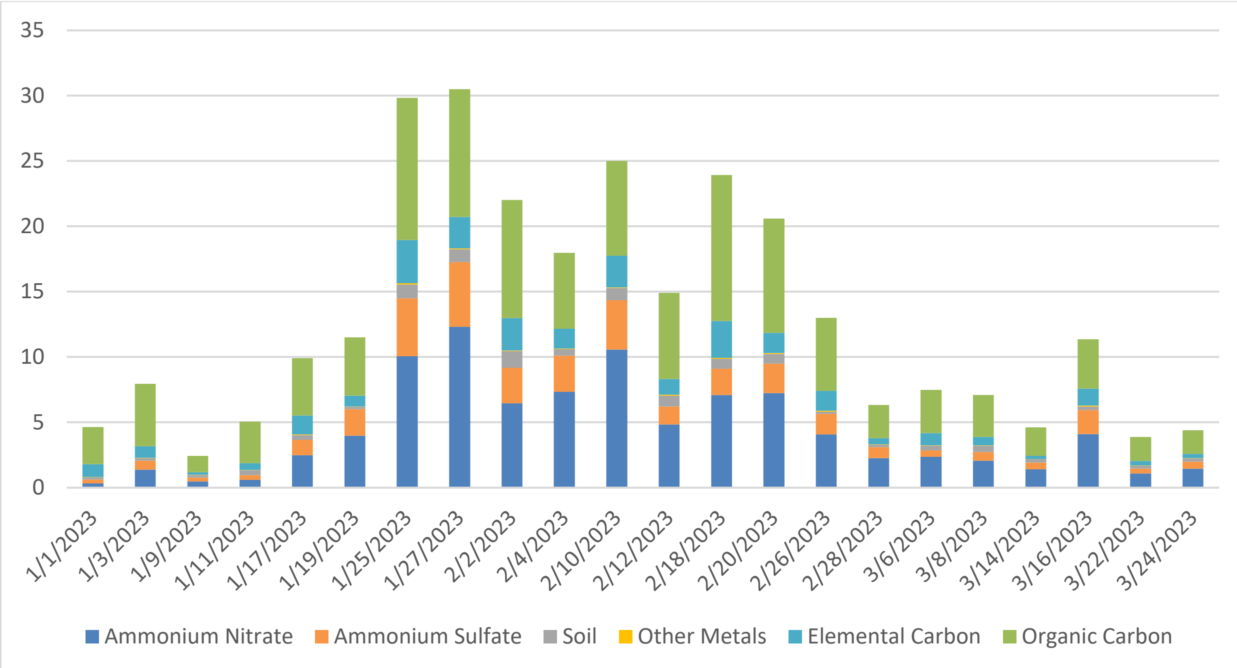


Figure 4 Relative Comparison of PM2.5 Species Measured at Edison High School

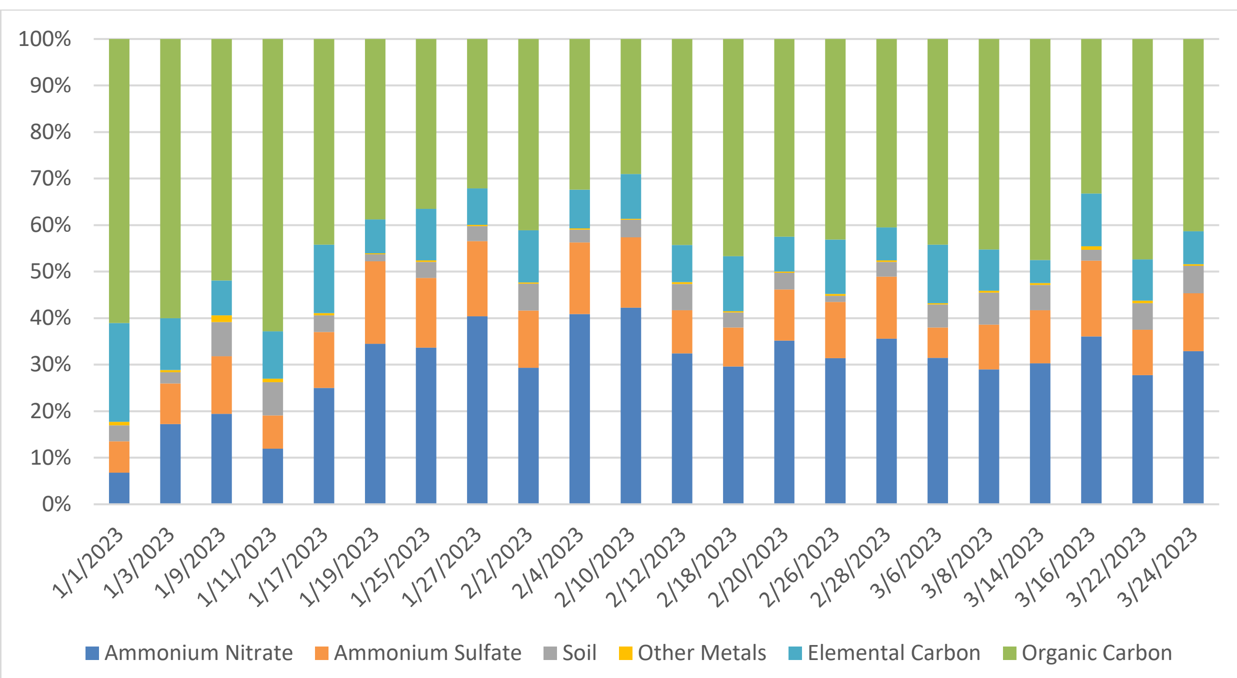
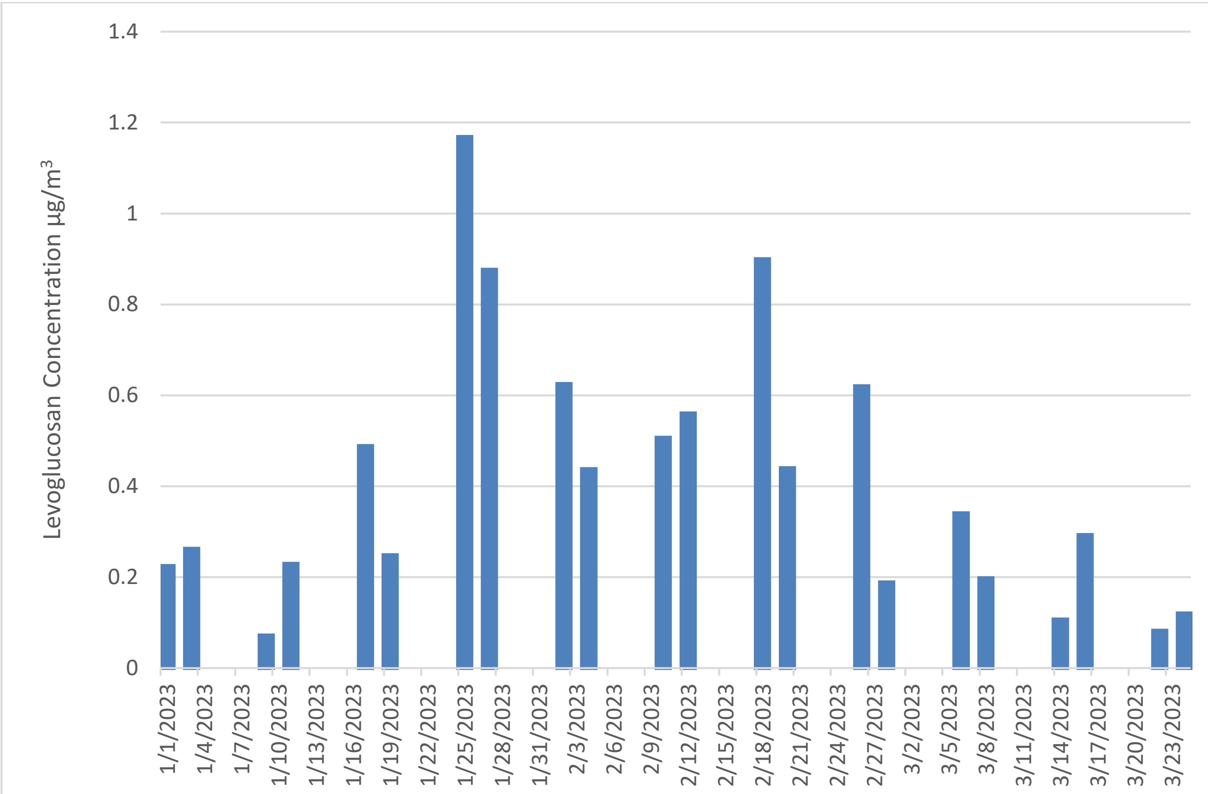


Figure 5 Wood Burning Tracer (Levoglucosan) Concentrations at Edison High School



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 23 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 five, only acetaldehyde and methanol have an associated Reference Exposure Level (REL), a health risk metric established by the Office of

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

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 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	2,700	21,367	380.6	3,052
Acetaldehyde	Wood combustion in fireplaces and woodstoves, coffee roasting, burning of tobacco, vehicle exhaust fumes, and coal refining and waste processing	59	261	3.7	78

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.

- **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 PM2.5 is coming from wood burning.

Comparative Analysis of Measured Pollutants

The following spatial comparison map depicts the quarterly PM2.5 averages and locations of each site within the community. 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.

Table 3 PM2.5 Quarterly Averages

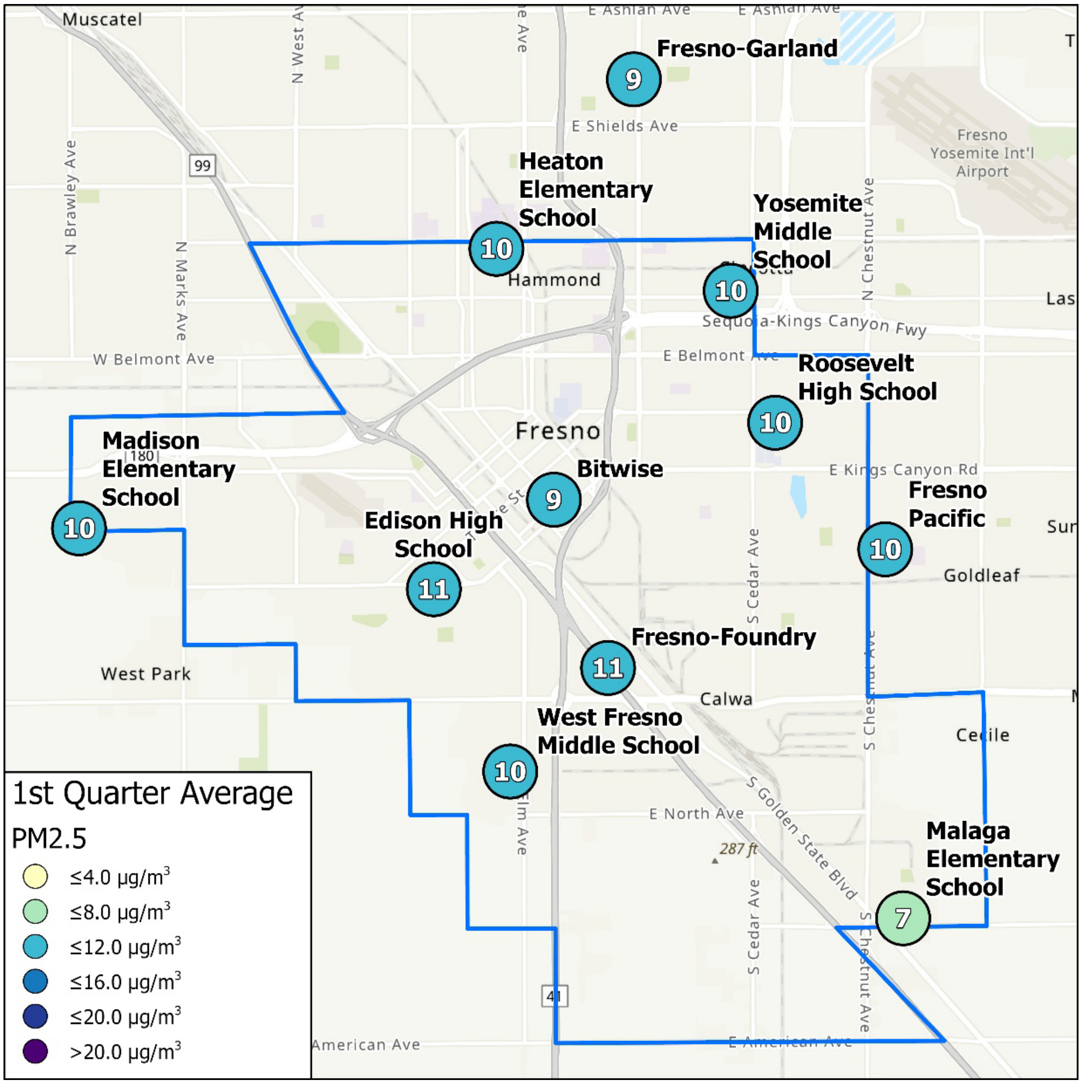
a) Quarterly average PM2.5 concentrations

Quarter	Heaton Elementary School	Yosemite Middle School	Malaga Elementary School	West Fresno Middle School	Madison Elementary School	Edison High School
2023 Q1	9.6	9.8	7.0	9.9	9.9	11.3

b) Quarterly average PM2.5 concentrations (continued)

Quarter	Roosevelt High School	Bitwise South Stadium	Clovis	Fresno-Garland	Fresno-Foundry	Fresno Pacific University
2023 Q1	10.1	8.8	4.9	8.9	11.1	9.5

Figure 6 Spatial Comparison of PM2.5 Quarterly Averages

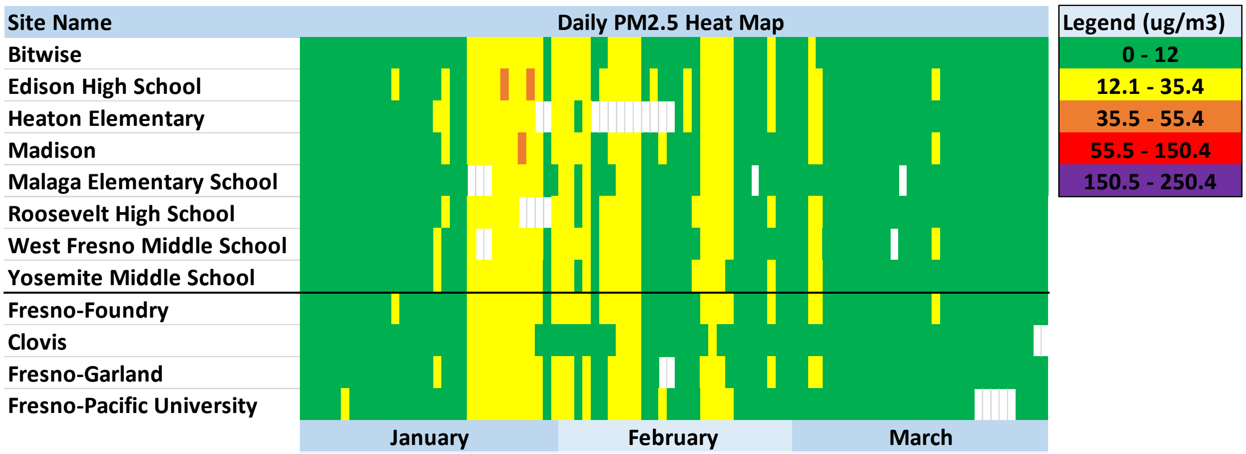


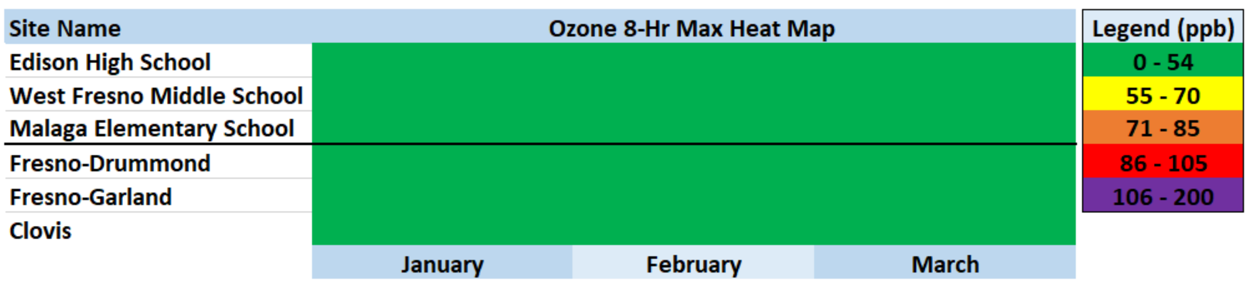
Pollutant Concentration Heat Maps

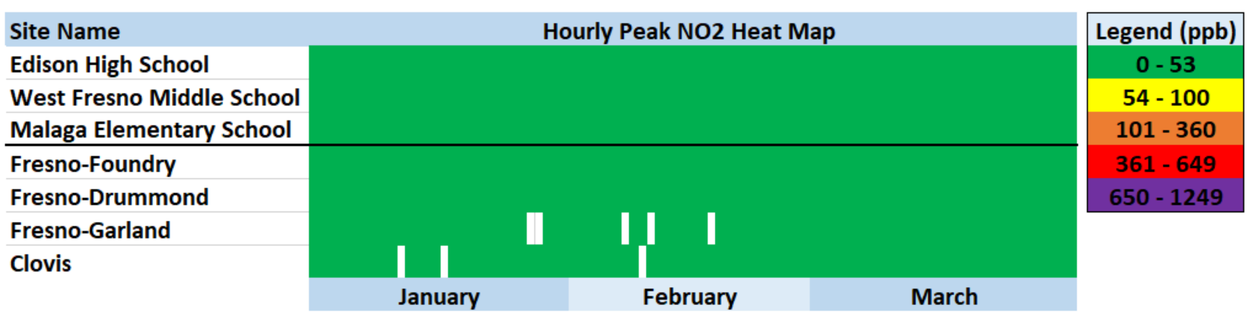
The following Heat Maps provide a comparative analysis of various pollutants being measured at the air monitoring sites as a part of the community air-monitoring network. The color scales for each table are based on the Air Quality Index (AQI) or the associated Reference Exposure Level (REL).

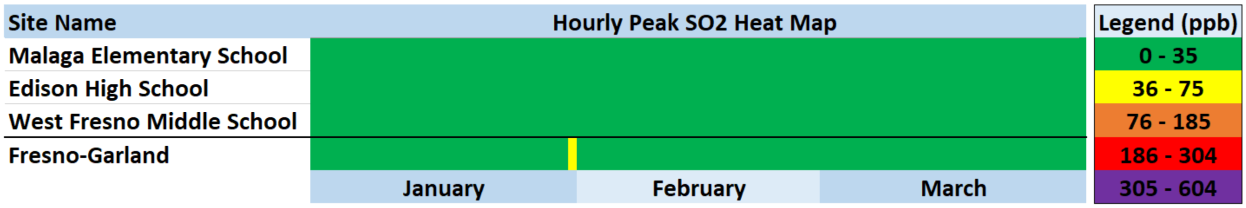
The first quarter of 2023 was characterized by multiple dispersive weather systems passing through the region bringing good air quality for the majority of the period. January was dominated by multiple winter storms associated with superior dispersion conditions and heavy precipitation. Brief periods of stable weather conditions led to an increase in particulate matter concentrations during the end of January and February. Specifically, the end of January into the beginning of February, a high pressure ridge pattern was firmly centered over California causing less air movement and deteriorating dispersion conditions. These stable conditions led to higher PM2.5 concentrations with some sites experiencing an exceedance of the federal 24-hour standard of 35 µg/m^3.

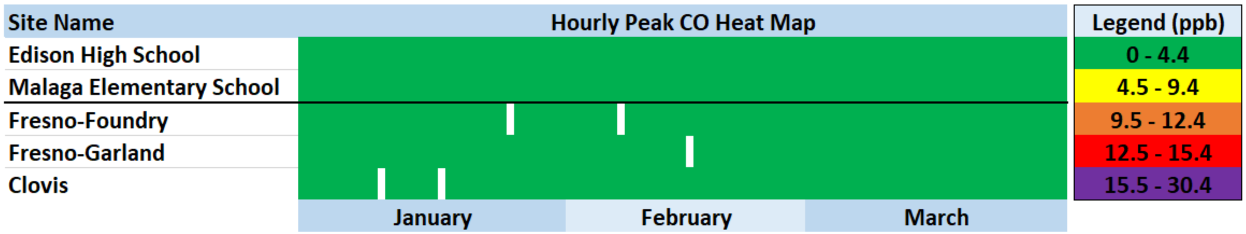
March was similar to the beginning of the quarter with a cycle of short periods of high pressure followed by extended periods of low pressure weather systems and good dispersion conditions. The Heaton PM2.5 monitor was not operating for 10 days in February.

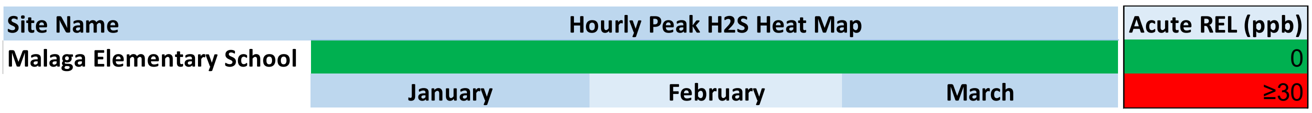


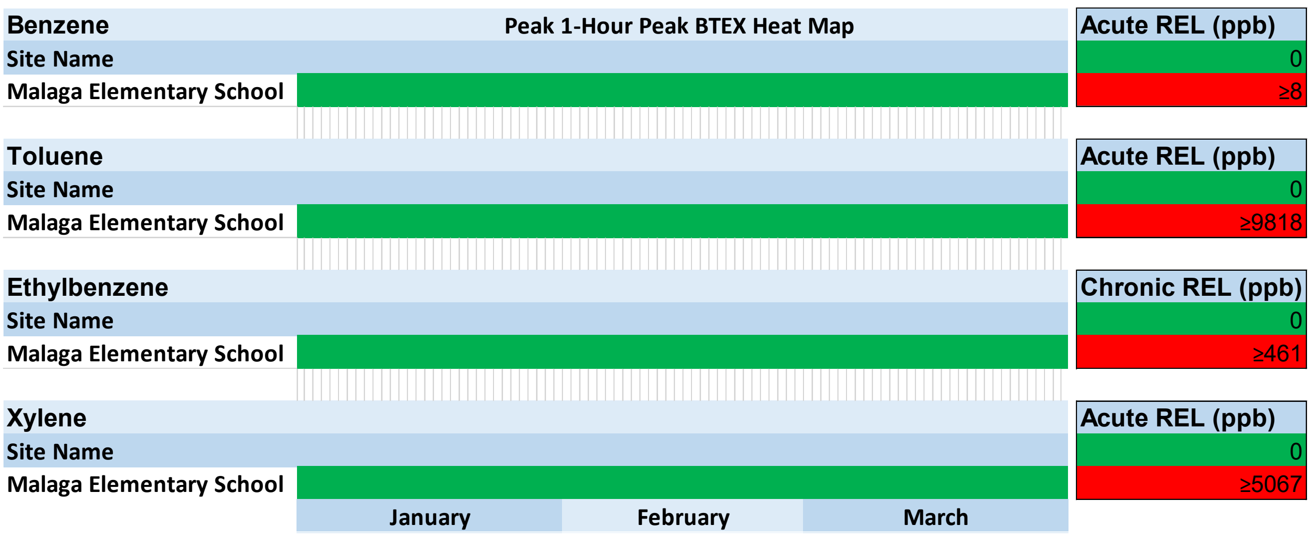





Site Name
Hourly Peak SO2 Heat Map
Legend (ppb)
Malaga Elementary School
Edison High School
West Fresno Middle School
Fresno-Garland
January
February
March
0 - 35
36 - 75
76 - 185
186 - 304
305 - 604


Site Name
Hourly Peak CO Heat Map
Legend (ppb)
Edison High School
Malaga Elementary School
Fresno-Foundry
Fresno-Garland
Clovis
January
February
March
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
Acute REL (ppb)
Malaga Elementary School
January
February
March
0
≥30


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