San Joaquin Valley
AIR POLLUTION CONTROL DISTRICT

Stockton Community Air Monitoring Report

2023 4th Quarter (October 2023 – December 2023)

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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. The Stockton AB 617 area is a densely populated community within the City of Stockton directly impacted by large freeways, the Port of Stockton, freight locomotives, industrial sources, and emissions traveling downwind from the northern portion of the city. The community of Stockton was prioritized by the Air District and subsequently selected by the California Air Resources Board (CARB) as one of the second-year communities selected.

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 July 2019, including the deployment of various air monitoring platforms within the community as a part of the Stockton 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.

Access to Data from Stockton Community Air Monitoring Network

In addition to these 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) and bilingual weekly updates and real-time air quality information in Stockton, which are both available on the Stockton Air Monitoring webpage. In addition, raw hourly data from the Stockton 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 Stockton CAMP during this period, the following was observed among the pollutants monitored:

- The Stockton community was primarily in the Good to Moderate AQI category throughout quarter 4 of 2023. The highest PM2.5 days were in the Unhealthy for Sensitive Groups AQI category.

- During October through the beginning of November, overnight downslope flow and northwesterly winds directed smoke from wildfires into the Valley from the Sierra Nevada. Stable conditions allowed for continued smoke impacts as residual smoke lingered under the high pressure conditions. PM2.5 concentrations reached the Moderate AQI category. The Residential Wood Burning Curtailment season began on the first day of November.

- PM2.5 concentrations reached the Unhealthy for Sensitive Groups AQI category during December due to high pressure stability, reduced mixing depths, and strong temperature inversions.

- During this period, 2-butanone, acetaldehyde, acetone, ethanol, ethyl acetate, isopropanol, and methanol 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.

- Further analysis including Heat Maps and Charts is included below.

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 Stockton. The following map and table detail the network design for the Stockton CAMP, as well as the status of implementing each specified air monitoring site.

Figure 1 Design of Stockton Community Air Monitoring Network

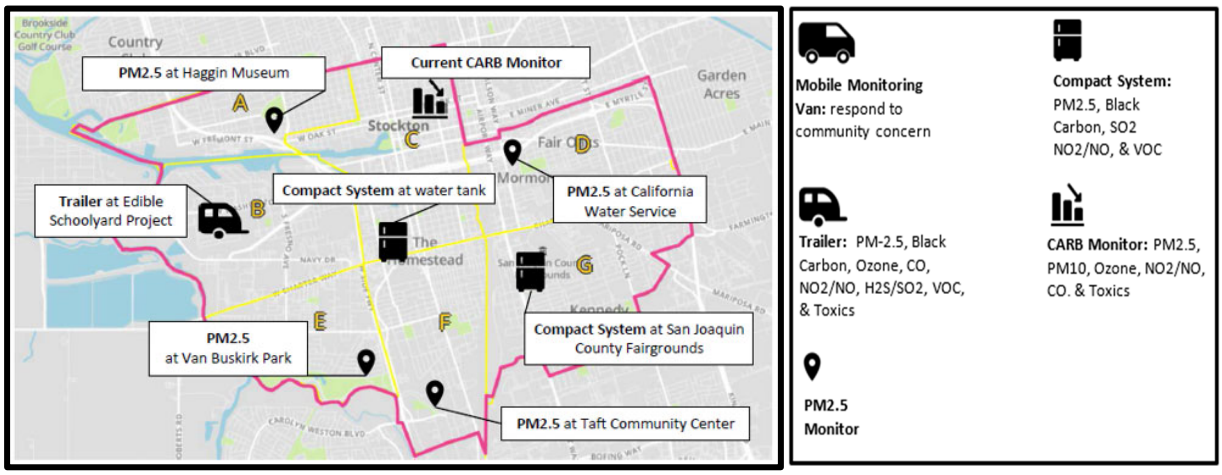


Table 1 Status of Stockton Community Air Monitoring Network

Zone	Location	Installed	Notes
A	Haggin Museum	X	PM2.5 installed on April 4, 2022; VOC sampling from Sept. 2022 to June 2023
B	Edible Schoolyard Project (Boggs Tract Community Farm)	X	Installed on June 26, 2023; VOC sampling commenced July 2023
C	University Park (CARB)	X	CARB installed on October 1, 2021
C	Water Tank (El Dorado St. & E. Clay St.)	X	Installed on March 2, 2022
D	California Water Service Building (E. Lafayette St.)	X	Installed on February 16, 2022
E	Van Buskirk Park		Van Buskirk: Information provided to City of Stockton Public Works who needs time to discuss internally. Awaiting response. Permission denied at Conway Homes (Housing Authority of the County of San Joaquin) and Kipp School.
F	Taft Community Center		Working with Taft Community Center on Lease Agreement
F	Little Manila Center	X	PM2.5 monitor temporarily deployed at Little Manila Center
G	San Joaquin County Fairgrounds	X	Installed on May 3, 2022

The District continues to work on implementing the Stockton CAMP, as well as making changes as needed based on CSC member comments and other logistical reasons. During this period, the following highlights recent changes or continued work to implement the Stockton CAMP:

- Edible Schoolyard Project: VOC sampling has been moved to the site and an air monitoring trailer has been deployed as of July 2023.
- Van Buskirk Park: Awaiting response from City of Stockton Public Works.
- Taft Community Center: Working on Lease Agreement.

IV. 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 Stockton

community, in February 2022 the District began VOC speciation sampling at the Haggin Museum site near the intersection of N. Pershing Avenue and Picardy Drive. Speciation sampling was moved to the Boggs Tract Community Farm between June 23, 2023 (VOC sampling) and June 29, 2023 (PM2.5 speciation sampling). 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, are below.

PM2.5 Speciation Analysis

High pressure caused dispersion conditions to deteriorate during the fourth quarter of 2023; however the majority of PM2.5 concentrations remained in the Good to Moderate AQI range.

The following figures show the concentration levels and relative comparison of the various PM2.5 species sampled at the Boggs Tract Community Farm air monitoring site. Typically, around 20 PM2.5 speciation samples are collected in a calendar quarter (about 90 days) and results are used to gain a better understanding of the composition of the PM2.5 in the surrounding areas of the Boggs Tract Community Farm air monitoring site.

Analysis of the 23 PM2.5 speciation samples shows that the PM2.5 in the area of the Boggs Tract Community Farm site was primarily made-up of ammonium nitrate, ammonium sulfate, soil, and organic carbon. Noticeably, organic carbon constitutes the majority of the total PM2.5 concentration on days when a sample was collected. Organic carbon can be an indicator of combustion sources such as cooking, industrial processes, mobile source exhaust, and wood burning. Additional details on organic carbon and other PM2.5 species can be found in the Appendix.

Figure 2 Speciated PM2.5 Concentrations at Boggs Tract Community Farm

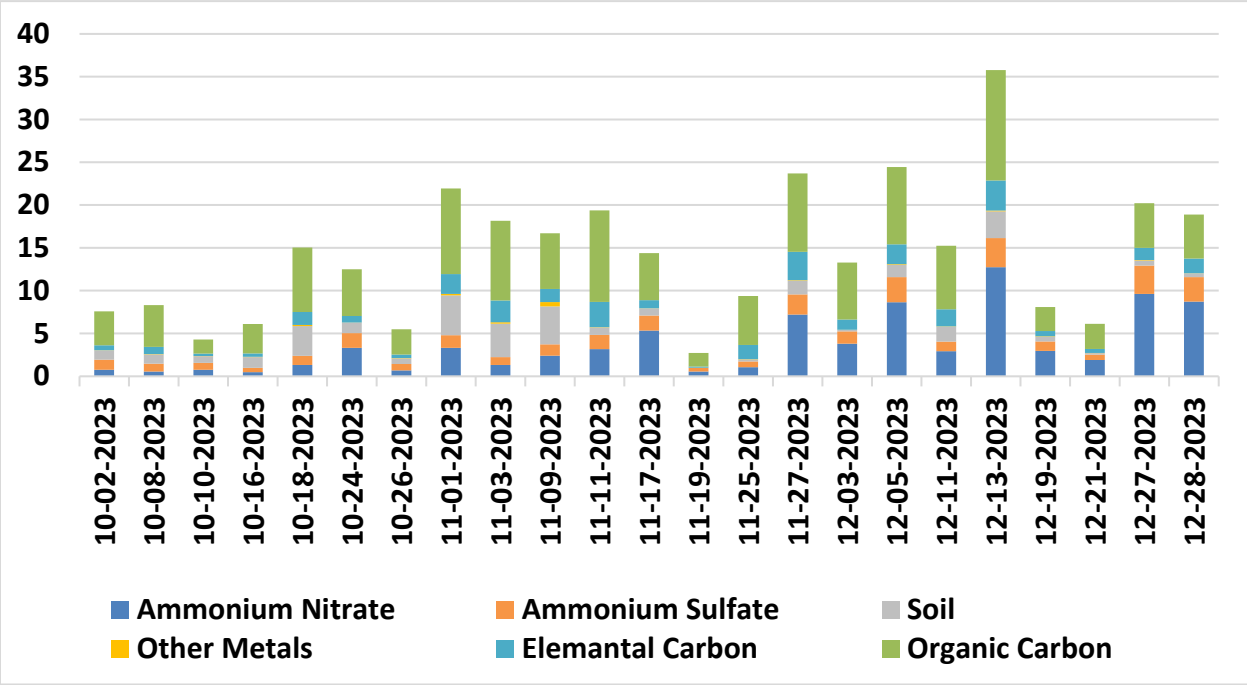
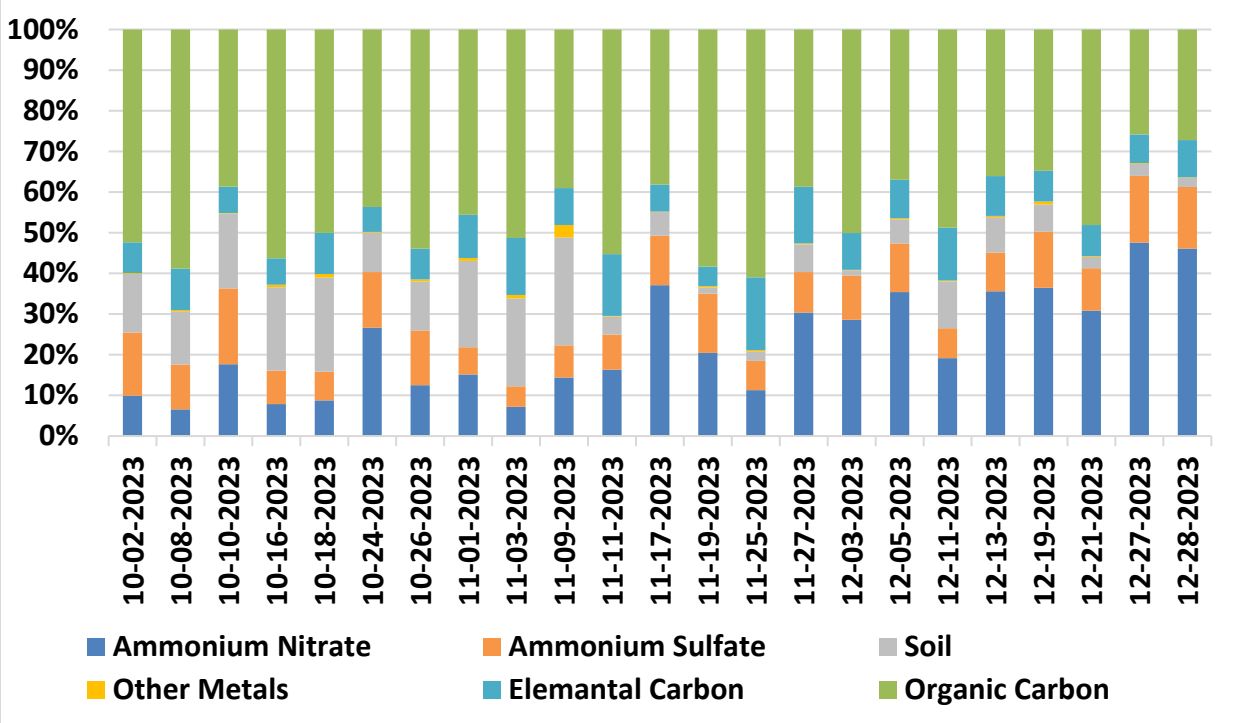
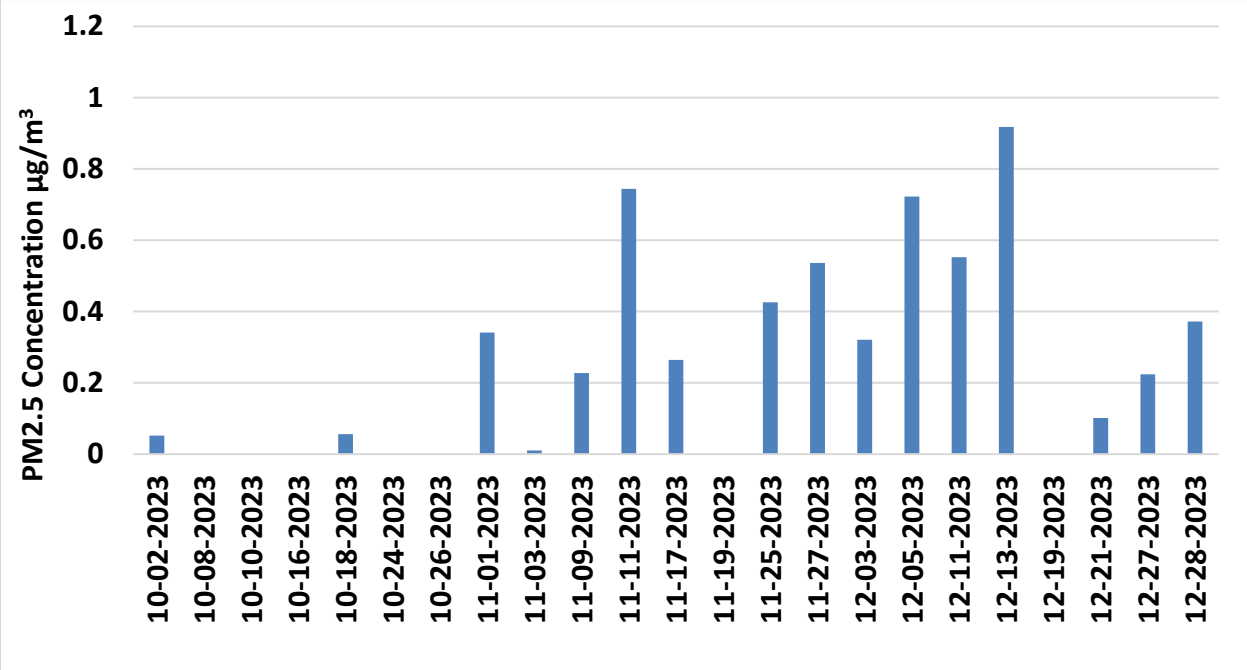


Figure 3 Relative Comparison of PM2.5 Species Measured at Boggs Tract Community Farm



For the Stockton community, additional lab analysis of the PM2.5 speciation samples is performed to help identify the possible amount of the PM2.5 concentration that is from wood burning. Levoglucosan is an organic compound that can be used to identify emissions from smoke from sources such as forest, grassland, agricultural, and residential wood burning. Of the 23 speciation samples from the October-December period, 16 samples indicated detectable levoglucosan levels. The results from remaining seven samples indicate that the levels of the levoglucosan wood burning tracer were too low to be detected in the lab analysis.

Figure 4 Wood Burning Tracer (Levoglucosan) Concentrations at Boggs Tract Community Farm



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 as well as 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 their health effects is provided by the California Office of Environmental Health Hazard Assessment (OEHHA)[1].

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

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.

2-butanone, acetaldehyde, acetone, ethanol, ethyl acetate, isopropanol, and methanol were the primary VOCs detected. Of these six, 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	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	7.8	3,052
Acetaldehyde	Wood combustion in fireplaces and woodstoves, coffee roasting, burning of tobacco, vehicle exhaust fumes, and coal refining and waste processing	11.0	261	2.5	78

V. 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.

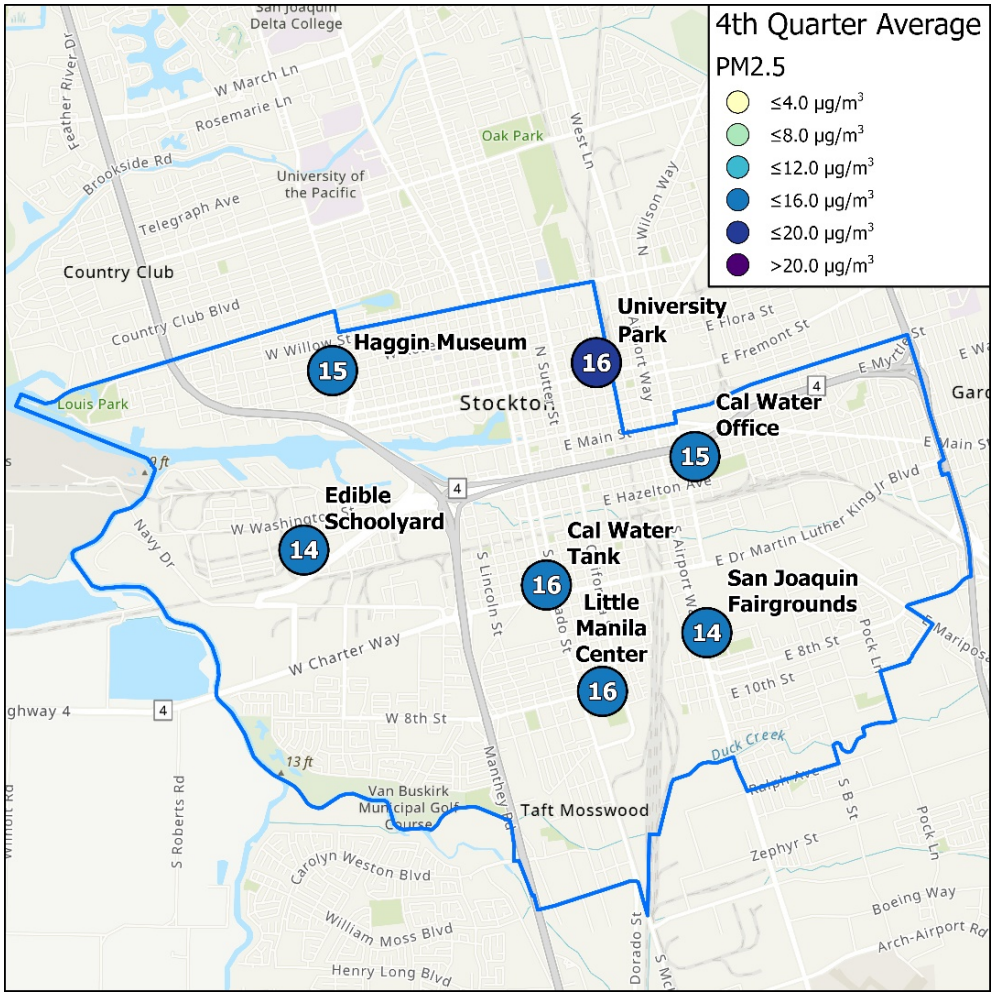
Comparative Analysis of Measured Pollutants

The following spatial comparison map depicts the quarterly PM2.5 average and location for 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 PM2.5 is for each site.

Table 3 PM2.5 Quarterly Averages

Quarter	University Park	Little Manilla Center	Cal Water Office	Cal Water Tank	Haggin Museum	San Joaquin Fairgrounds	Edible Schoolyard
2023 Q4	16.4	15.9	15.3	15.6	14.5	14.3	13.5

Figure 5 Spatial Comparison of PM2.5 Quarterly Averages



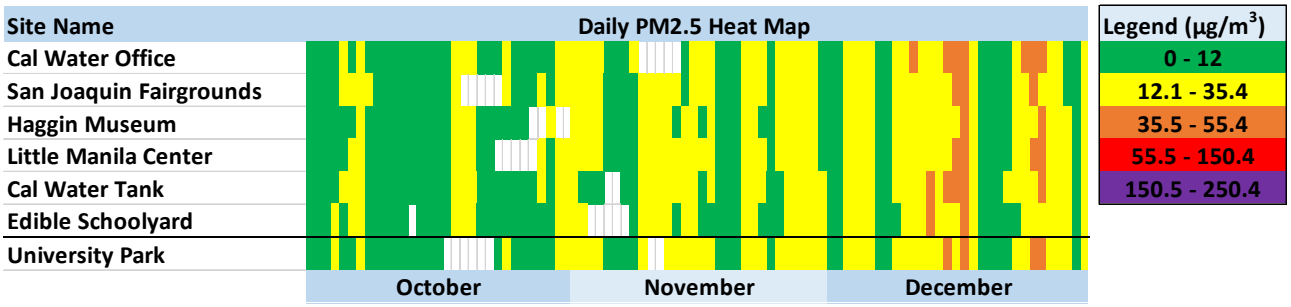
Pollutant Concentration Heat Maps

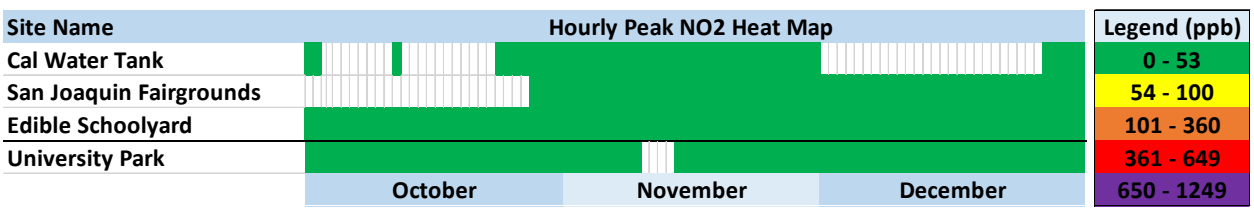
The following Heat Maps provide a comparative analysis of various pollutants being measured at the air monitoring sites as a part of the community air monitoring network. The color scales for each table are based on the Air Quality Index (AQI) or the associated Reference Exposure Level (REL).

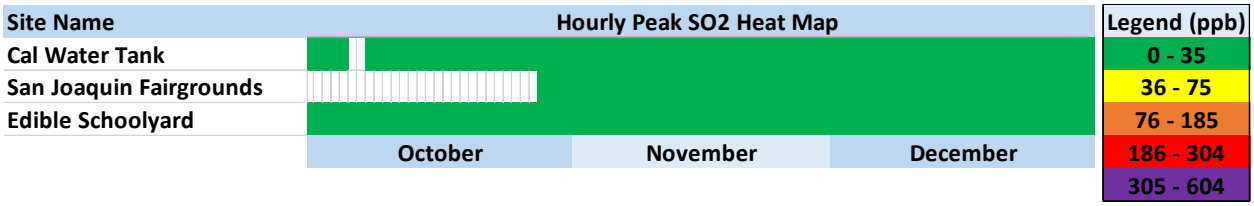
October experienced multiple storms that transported through the region and brought good dispersion conditions throughout the Valley, resulting in it being the month with the most Good AQI category days in the fourth quarter of 2023. Days with air quality in the Moderate AQI category during the month of October are largely the result of high pressure building over and remaining present over the region providing increased stability, increased temperature, stronger temperature inversions, and deteriorating dispersion conditions. Smoke from wildfires burning in the Sierra Nevada was also transported into the Valley, impacting receptors and contributing to elevated PM2.5 and Ozone concentrations. Under these conditions PM2.5 and Ozone concentrations elevated into the moderate AQI category at multiple sites within the community. Low pressure systems were the primary sources of good dispersion conditions and helped reduce pollutant concentrations.

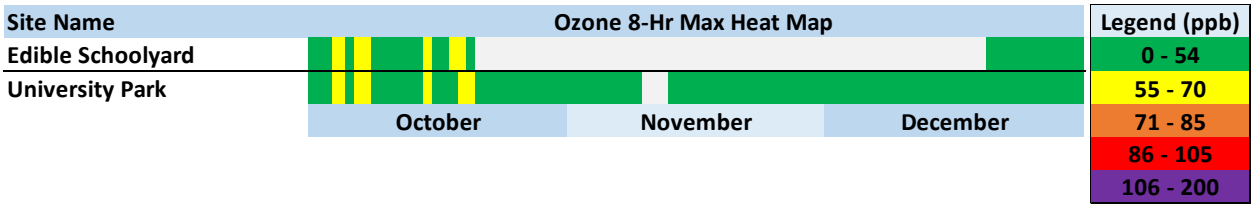
In November, high pressure continued to produce stable conditions with deteriorating air quality for the majority of the month. Reduced mixing depths during the afternoons and cooler seasonal temperatures, allowed for stable conditions and temperature inversions to further deteriorate the air quality. Residual smoke from the wildfires in the Sierra Nevada Mountains also remained trapped at the surface at the start of the month under high pressure conditions. As a result, the majority of days in November were in the Moderate AQI category due to PM2.5. Multiple storms and low pressure systems did bring some relief and provide some days in the Good AQI category.

December was similar to November, with poor to marginal dispersion present across the community for the majority of the month due to high pressure and shallow mixing depths. On the start of the week of December 10th, high pressure began to steadily build over the region bringing deteriorating dispersion conditions to the Valley. Conditions remained stable throughout the week with PM2.5 concentrations significantly elevating under a less dispersive atmosphere leading to air quality in the Moderate to USG AQI categories. High pressure began to build over the region again beginning on December 21st. Stability strengthened, dispersion conditions deteriorated, and particulate matter concentrations increased leading to Moderate to USG air quality due to PM2.5.






Site Name
Hourly Peak SO2 Heat Map
Legend (ppb)
Cal Water Tank
San Joaquin Fairgrounds
Edible Schoolyard
October
November
December
0 - 35
36 - 75
76 - 185
186 - 304
305 - 604


Site Name
Ozone 8-Hr Max Heat Map
Legend (ppb)
Edible Schoolyard
University Park
October
November
December
0 - 54
55 - 70
71 - 85
86 - 105
106 - 200