Shafter Community Air Monitoring Report

2022 4th Quarter (October 2022 – December 2022)

Table of Contents

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. Shafter, a rural community in Kern County, 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 July 2019, including the deployment of various air monitoring platforms within the community as a part of the Shafter 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.

<u>Access to Data from Shafter Community Air Monitoring Network</u>

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 Shafter, which are both available on the Shafter Air Monitoring webpage. In addition, raw hourly data from the Shafter 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

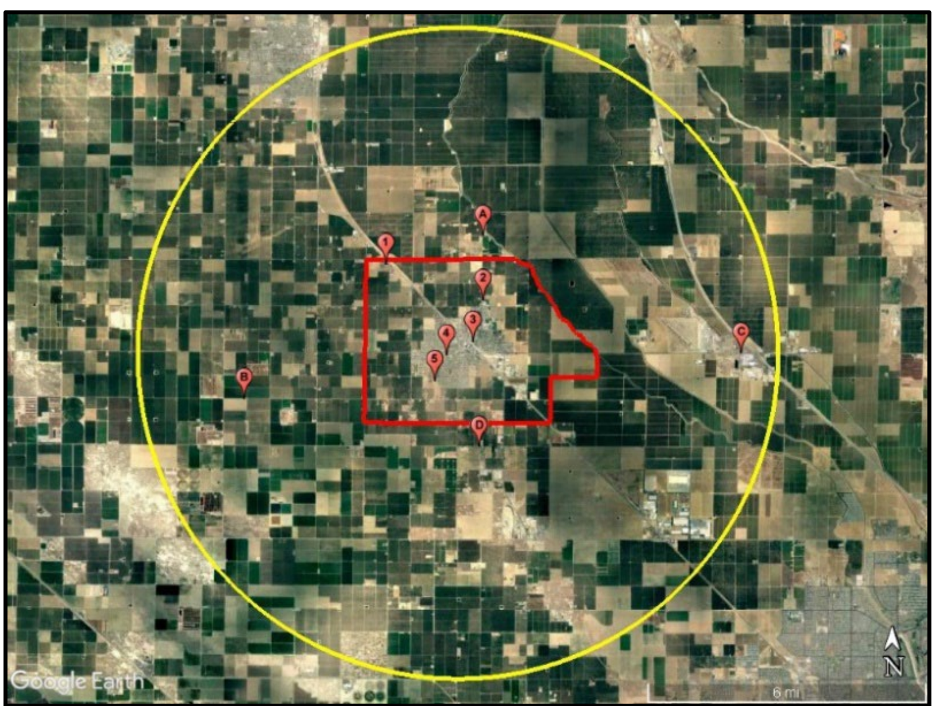
Through the continued implementation of the Shafter CAMP during this period, the following was observed among the pollutants monitored:

- The fourth quarter of 2022 was dominated by high pressure in October and low pressure during December. The high pressure patterns produced poor dispersion, trapping particulates from wood-burning fireplaces and other sources.
- During this period, acetaldehyde, methanol, ethanol, 2-propanol, and acetone were the primary VOCs detected. Overall, during this monitoring period the concentrations of VOCs detected in the samples were well below health-based thresholds.
- Low temperatures and dry conditions were present for most of the quarter reflected by days of higher organic carbon throughout the period as emissions were unable to disperse. December contained more days of precipitation than the rest of the quarter which improved pollutant concentrations.
- 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 implementing the community air monitoring plan for Shafter. The following map and table detail the network design for the Shafter CAMP, as well as the status of implementing each specified air monitoring site.

Figure 1 Design and Status of Shafter Community Air Monitoring Network



Location	Site Location	Monitoring Platform	Implemented (Y/N)
1	Shafter Farm Labor Center	Air Monitoring Trailer	Y
2	Sequoia Elementary School	Compact Multi-Pollutant	Y
3	Shafter DMV	Real-time $PM_{2.5}$ and PM10	Y
4	Golden Oak Elementary	Real-time $PM_{2.5}$	Y
5	Grimmway Academy	Real-time $PM_{2.5}$	Y
A	North of Shafter in agriculture area	Air Monitoring Van	Y
B	West of Shafter near dairy operations	Air Monitoring Van	Y
C	East of Shafter near industrial/airport area near Highway 99 and Lerdo Highway	Air Monitoring Van	Y
D	La Colonia	Real-time $PM_{2.5}$	N, Interim use of Air Monitoring Van

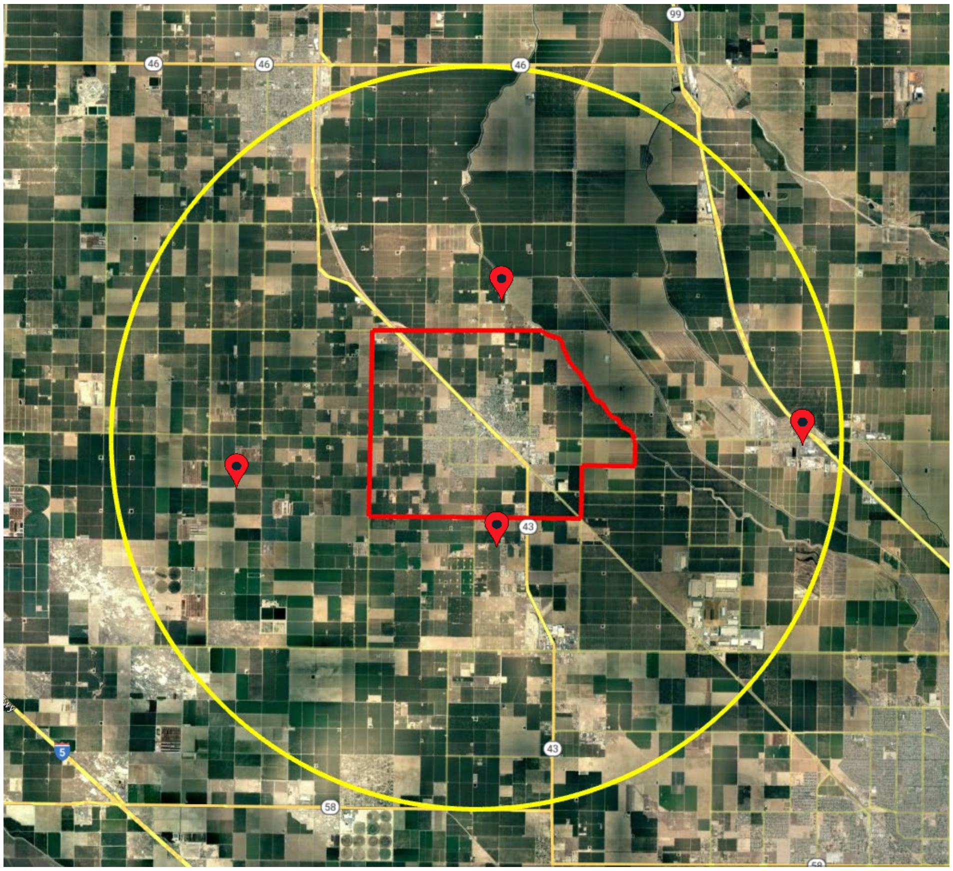
The District continues to work on implementing the Shafter CAMP, as well as making changes as needed based on CSC member comments and other logistical reasons. During this period, the following highlights recent changes or continued work to implement the Shafter CAMP:

- Air Monitoring in La Colonia: The District continued to move forward in deploying the last remaining air monitor to La Colonia. The District is working with Kern County to place a monitor at a future community park on Martinez Street. Concurrently, the District is also working with the property owner of an alternative site on Rodriguez Street, located just north of the future community park.

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 Shafter community air monitoring website.

Table 1 Summary of Data Collected with Mobile Air Monitoring Van

Pollutant	Peak 1-hour Average Value	Applicable Standard
$PM_{2.5}$	58.0 µg/m³*	35 µg/m³ (24-hr average)
Ozone	84.7 ppb*	70 ppb (8-hr average)
CO	2.2 ppm	35 ppm (1-hr average)
NO_2	17.7 ppb	100 ppb (1-hr average)
SO_2	5.2 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	8.1 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 PM2.5 and Volatile Organic Compound (VOC) concentrations in the Shafter community, in January 2020 the District began operating $PM_{2.5}$ and VOC speciation sampling at the Shafter-DMV site near the intersection of Walker Street and Pacific Avenues. 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.

<u>$PM_{2.5}$ Speciation Analysis</u>

The following figures show the concentration levels and relative comparison of the various $PM_{2.5}$ species sampled at the Shafter-DMV air monitoring site.

This analysis shows that during this quarter, the highest concentrations of $PM_{2.5}$ were primarily driven by Organic Carbon and Ammonium Nitrate. Residential wood burning generated increased $PM_{2.5}$ concentrations throughout the quarter. Cold temperatures and high humidity dominated most of Quarter 4.

Figure 3 Speciated $PM_{2.5}$ Concentrations at Shafter DMV Site

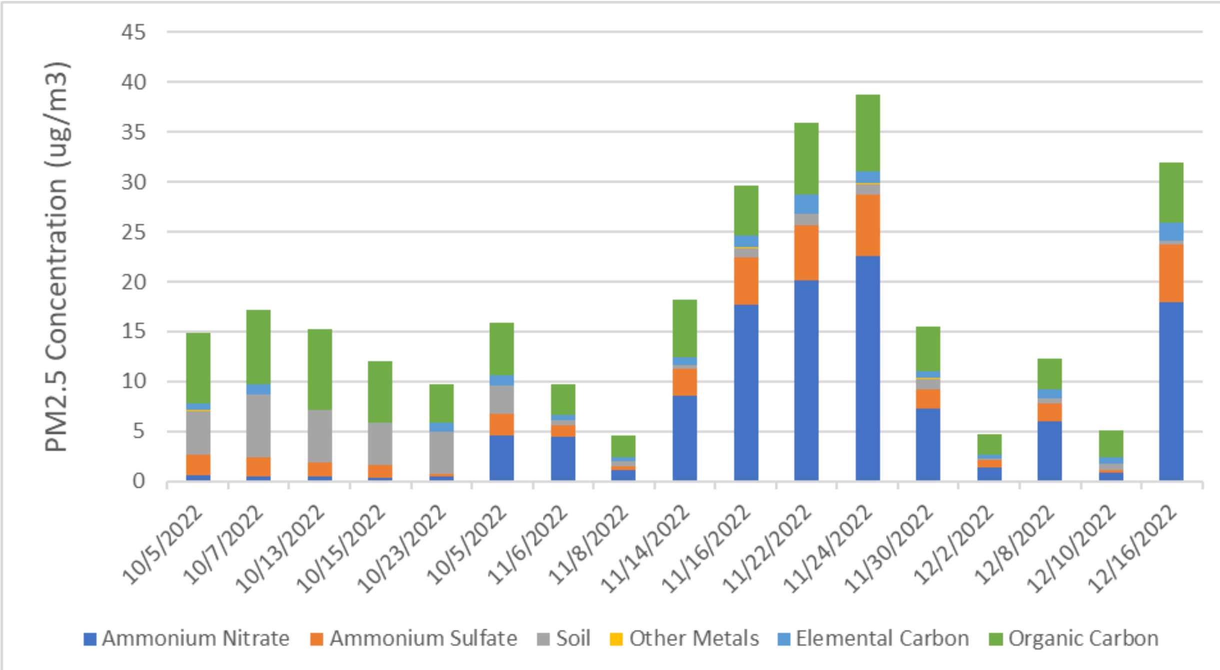
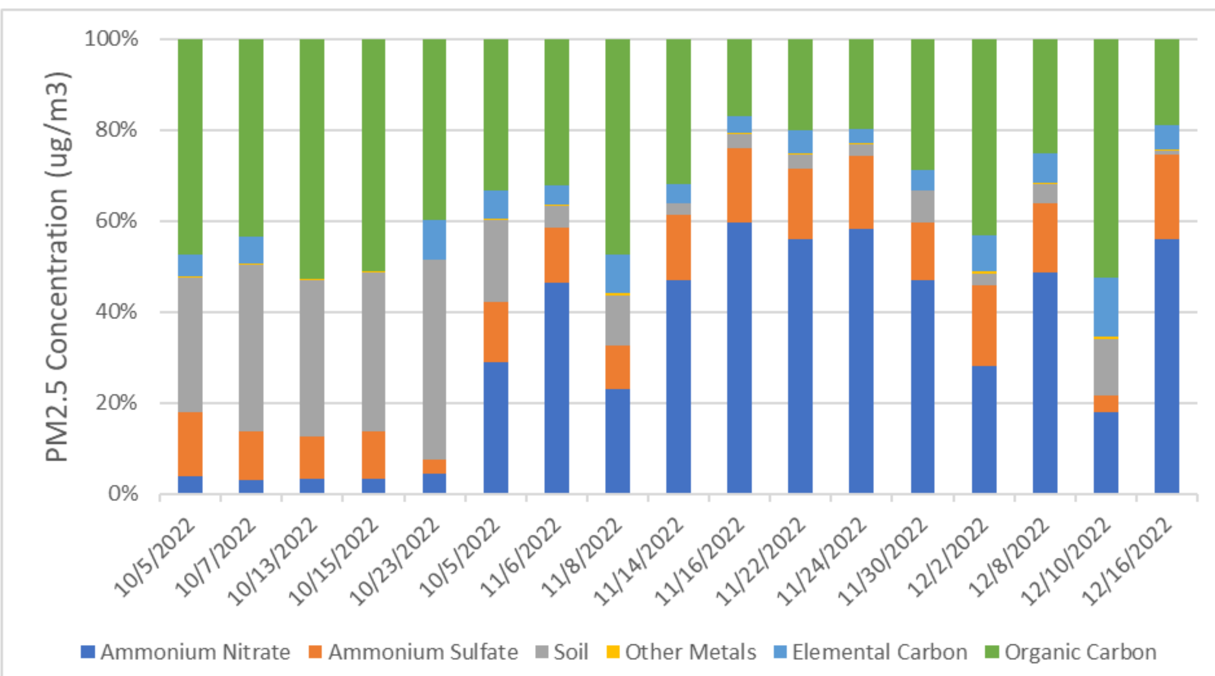


Figure 4 Relative Comparison of $PM_{2.5}$ Species Measured at Shafter DMV Site



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].

During this period, the District collected 21 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-propanol, 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 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	35.0	21,367	14.7	3,052
Acetaldehyde	Wood combustion in fireplaces and woodstoves, coffee roasting, burning of tobacco, vehicle exhaust fumes, and coal refining and waste processing	10.0	261	5.4	78

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

Ammonia Analysis

In September of 2020, per request from the Community Steering Committee, the District commenced ammonia sampling at the Shafter DMV air monitoring site. During this quarter, the ambient ammonia concentration levels in all samples collected continue to remain lower than the laboratory's detection limit.

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.

- **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.

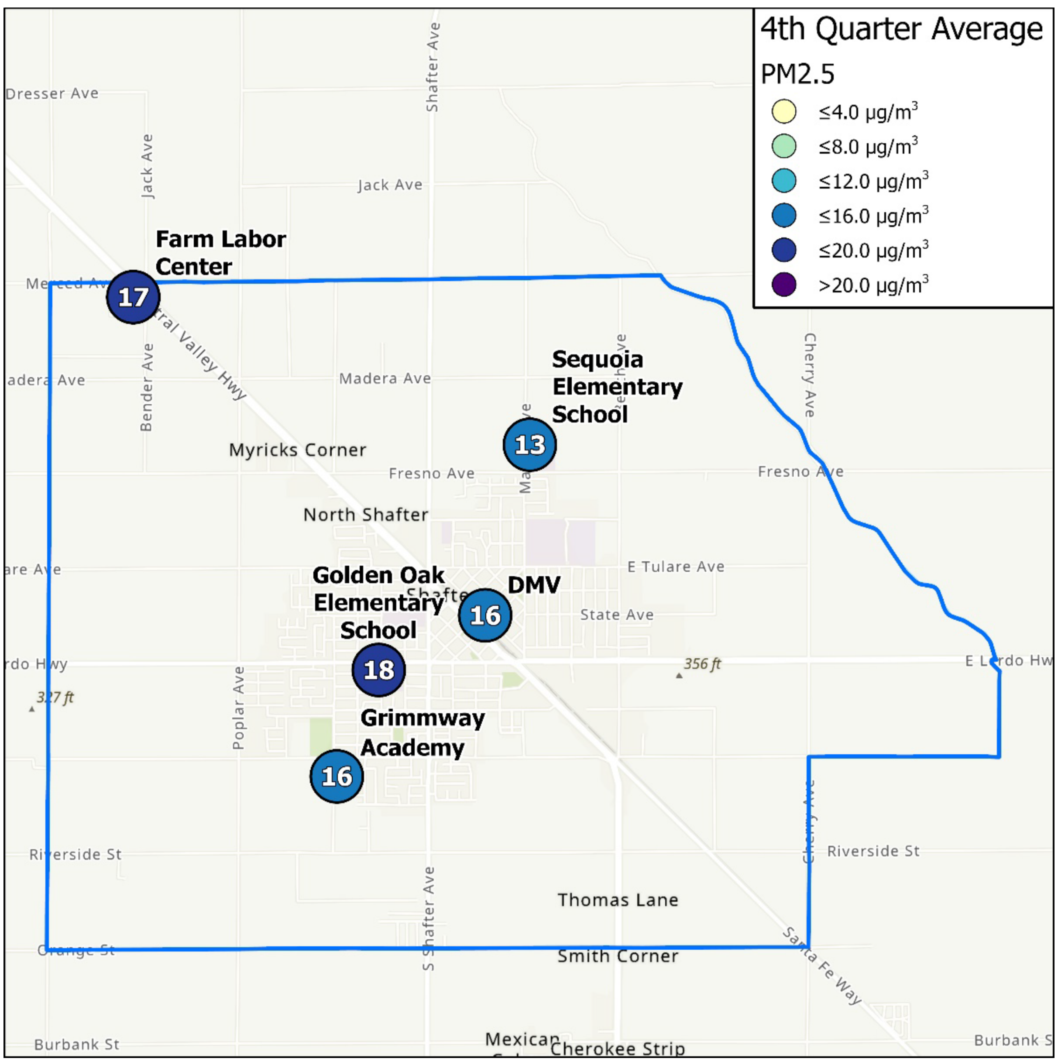
- **Other Metals:** Identified as components from soil emissions or found in other particulates having been emitted in connection with combustion from engine wear, brake wear, and similar processes. Certain metals are also emitted from the use of fireworks.

Comparative Analysis of Measured Pollutants

The following 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	Bakersfield-California	Corcoran	Shafter-DMV	Grimmway Academy	Golden Oak Elementary	Farm Labor Center	Sequoia Elementary
2022 Q4	17.4	19.6	15.6	16.0	17.5	16.6	12.6

Figure 5 Spatial Comparison of $PM_{2.5}$ Quarterly Averages



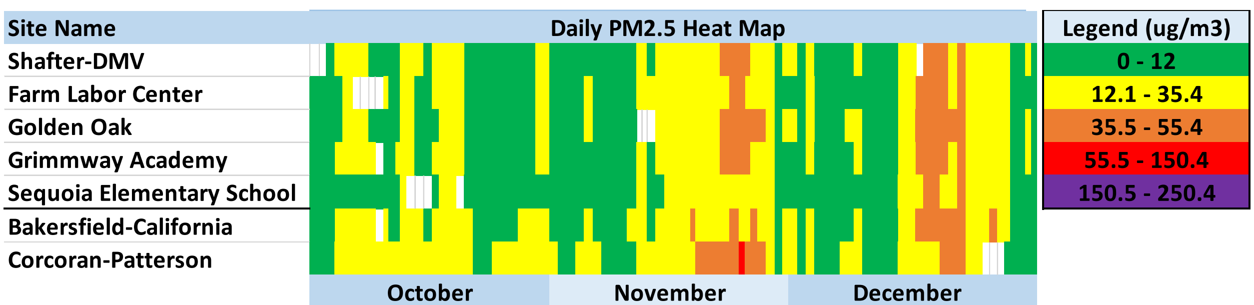
Pollutant Concentration Heat Maps

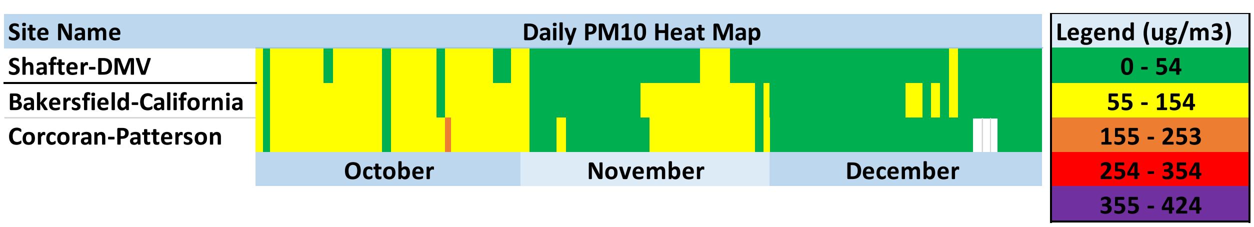
The following Heat Maps provide a comparative analysis of various pollutants being measured at the air monitoring sites as a part of the community air monitoring network. The color scales for each table are based on the Air Quality Index (AQI) or the associated Reference Exposure Level (REL).

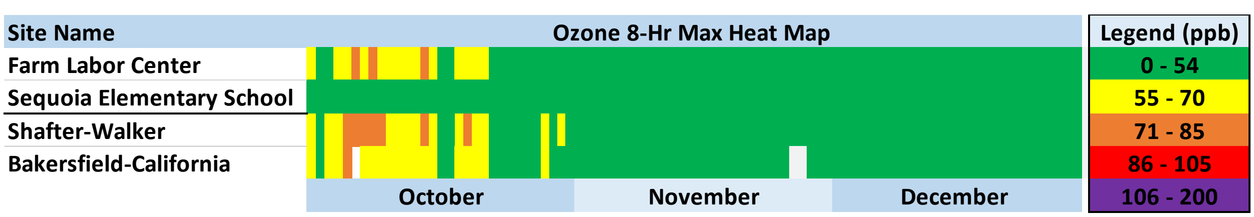
The 4th quarter of 2022 was dominated by high pressure systems in October and early November that trapped particulates from residential wood burning. December was dominated by low pressure systems that alleviated some of the pollution throughout the month. Many energy-driven troughs dug through California through the month of December, bringing lots of rainfall to the Valley. The poor dispersion conditions and strong temperature inversions associated with high pressure systems exacerbated particulate pollution due to wood burning.

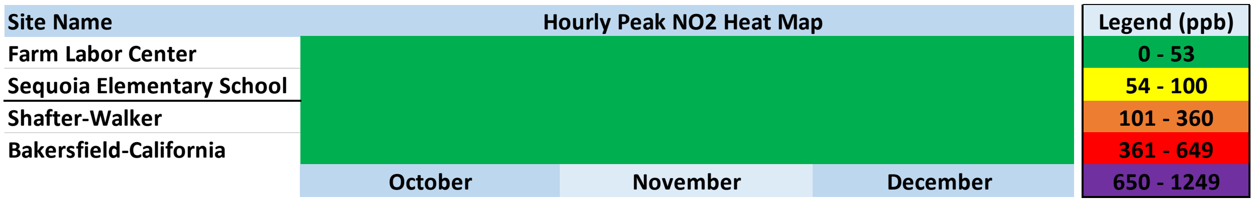
Despite the low pressure systems bringing relief to the Valley there were high pressure systems which caused $PM_{2.5}$ concentrations to rebound. A majority of the quarter was spent in the Moderate AQI category due to strong temperature inversions exacerbating particulate concentrations. Six days out of the quarter were spent with at least 4 community sites in the Unhealthy for Sensitive Groups AQI category.

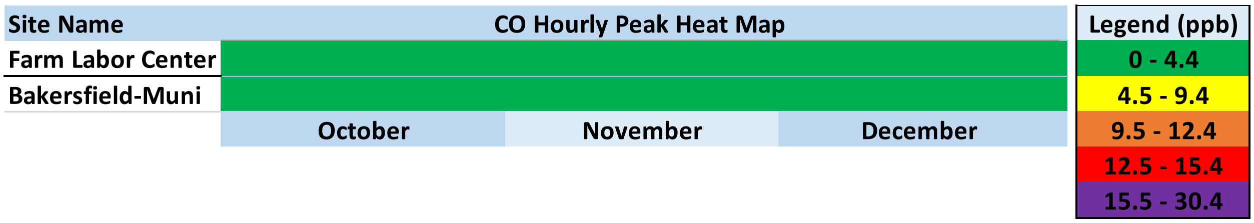
BTEX data was not reporting at the Farm Labor Center during the latter half of Q4 and the concentrations at Sequoia Elementary School remained under the detection limit of the instrument.

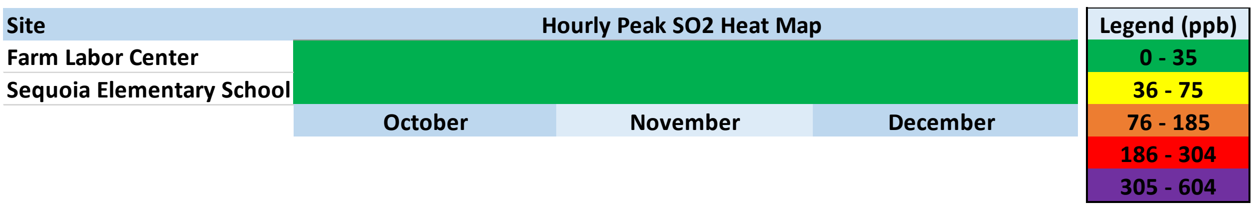


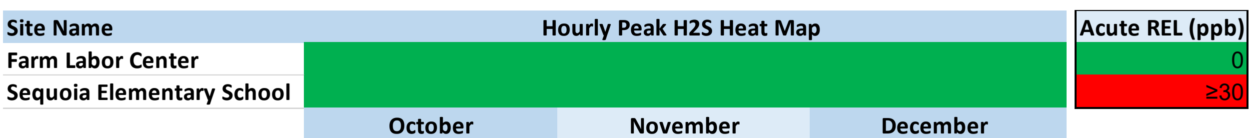


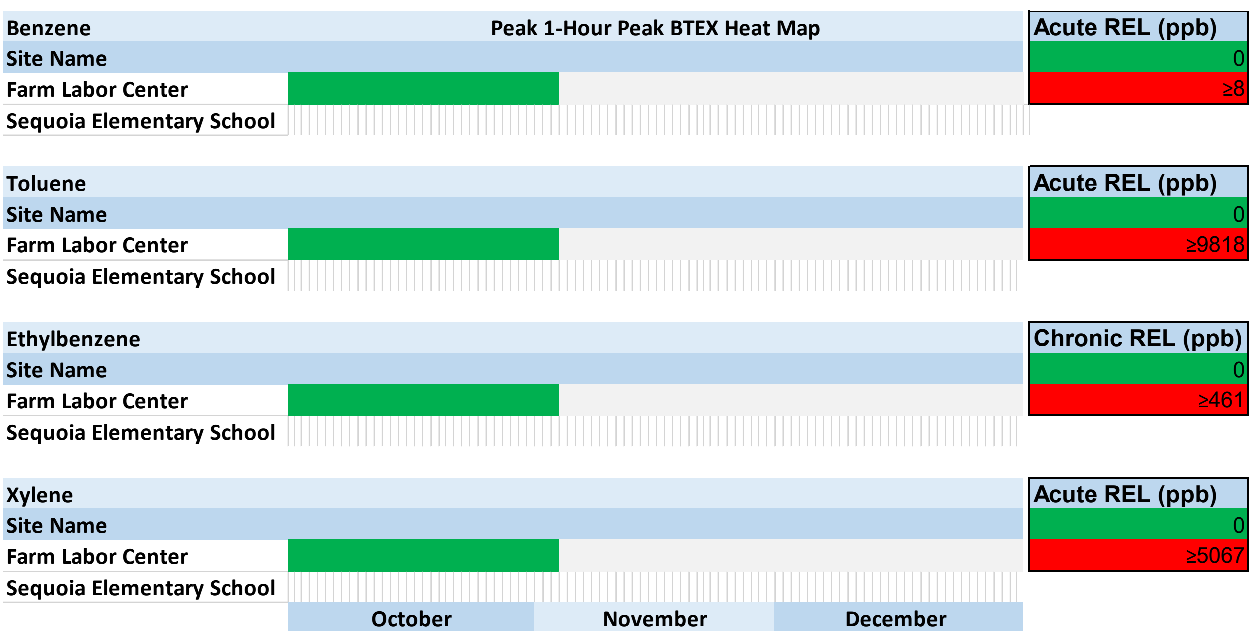



Site Name
Hourly Peak NO2 Heat Map
Legend (ppb)
Farm Labor Center
Sequoia Elementary School
Shafter-Walker
Bakersfield-California
October
November
December
0 - 53
54 - 100
101 - 360
361 - 649
650 - 1249


Site Name
CO Hourly Peak Heat Map
Legend (ppb)
Farm Labor Center
Bakersfield-Muni
October
November
December
0 - 4.4
4.5 - 9.4
9.5 - 12.4
12.5 - 15.4
15.5 - 30.4


Site
Hourly Peak SO2 Heat Map
Legend (ppb)
Farm Labor Center
Sequoia Elementary School
October
November
December
0 - 35
36 - 75
76 - 185
186 - 304
305 - 604


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


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