



# San Joaquin Valley

AIR POLLUTION CONTROL DISTRICT

## Shafter 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. 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 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 Shafter 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), 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

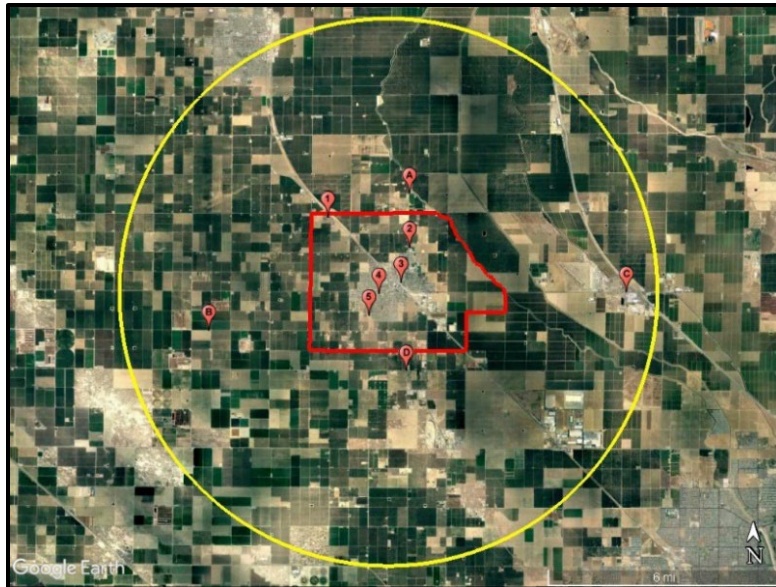
Through the continued implementation of the Shafter CAMP during this period, the following was observed among the pollutants monitored:

- October was dominated by high pressure patterns that caused poor dispersion and residual smoke from wildfires in the Sierra Nevada mountain range was trapped near 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.
- High pressure patterns were dominant in December. Stable conditions and poor dispersion caused air quality to deteriorate into the Moderate to Unhealthy for Sensitive Groups AQI categories.
- During this period, acetaldehyde, acetone, butane, chlorodifluoromethane, 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.
- 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**



**Table 1 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 PM2.5 and PM10	Y
4	Golden Oak Elementary	Real-time PM2.5	Y
5	Grimmway Academy	Real-time PM2.5	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 PM2.5	N

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 a contractor to install electrical infrastructure for a PM2.5 monitor at a site on Rodriguez Street.

## IV. Mobile Air Monitoring Van Activities

Starting on May 17, 2023 and continuing through July 23, 2023 the mobile air monitoring van was placed at a city water tank site, located on the southeast corner of Highway 99 and Lerdo Highway, as per the request of the Community Steering Committee to address community observations of odors in the area. District analysis of the data collected during this time is ongoing and an update will be made available in the future.

There were no additional van monitoring activities during this quarter. A table of all community air monitoring data collected with the mobile air monitoring van is available on the Shafter community air monitoring [website](#).

## V. Summary of PM<sub>2.5</sub> and VOC Speciation Analysis

To build a better understanding of the various constituents that compose the overall PM<sub>2.5</sub> and Volatile Organic Compound (VOC) concentrations in the Shafter community, in January 2020 the District began operating PM<sub>2.5</sub> and VOC speciation sampling at the Shafter-DMV site near the intersection of Walker Street and Pacific Avenues. The collected samples are sent to a third-party laboratory for analysis to determine the contribution of various species of PM<sub>2.5</sub>, 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<sub>2.5</sub> Speciation Analysis**

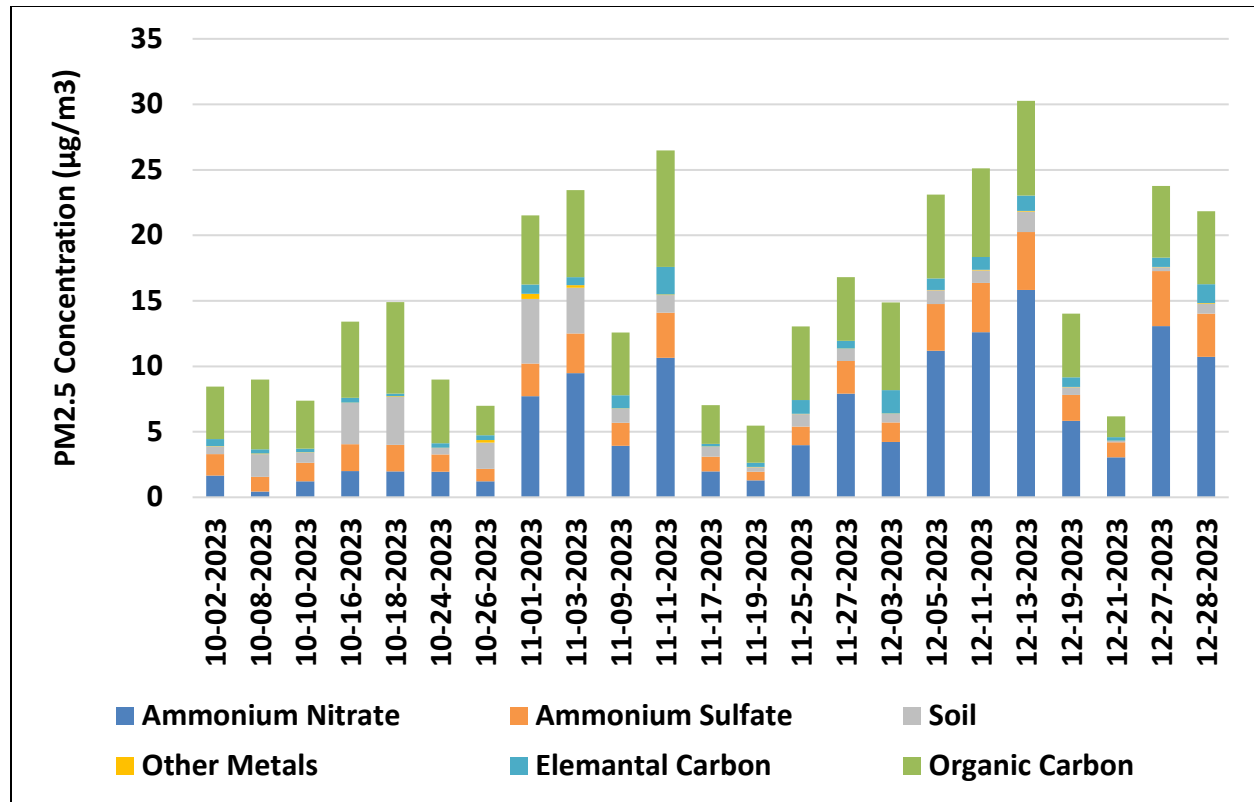
Poor dispersion conditions and high temperatures were common at the beginning of the fourth quarter of 2023. However, as the quarter progressed, cooler temperatures brought lower Ozone concentrations but particulate matter concentrations began to increase under strong temperature inversions.

The following figures show the concentration levels and relative comparison of the various PM<sub>2.5</sub> species sampled at the Shafter-DMV air monitoring site. Results are used to gain a better understanding of the composition of the PM<sub>2.5</sub> in the surrounding areas of the Shafter-DMV air monitoring site. Lab analysis results are available for 23 samples in the October – December monitoring period.

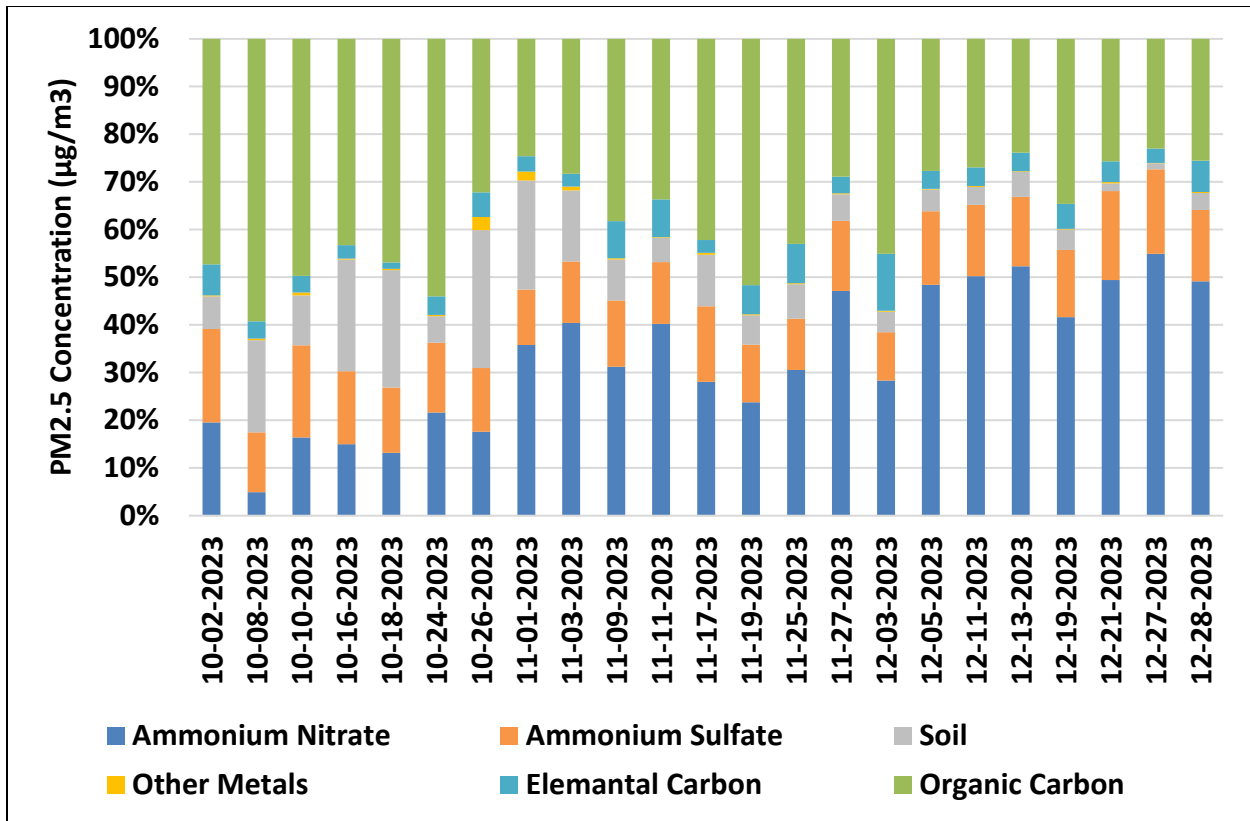
Analysis of the available PM<sub>2.5</sub> speciation samples shows that the PM<sub>2.5</sub> in the area of the Shafter-DMV site was primarily made-up of soil, ammonium nitrate, and organic carbon in the beginning of the quarter. Later in the quarter, PM<sub>2.5</sub> speciation samples primarily shifted to organic carbon, ammonium sulfate, and ammonium nitrate. Noticeably, ammonium nitrate constitutes the majority of the total PM<sub>2.5</sub> concentration during sampling days that occurred later in the quarter. Ammonium nitrate is PM<sub>2.5</sub>

that more readily forms in the atmosphere when temperatures are low and relative humidity is higher. Increases in the ammonium nitrate fraction of PM2.5 are typical and expected for wintertime conditions and are a key reason for increased PM2.5 totals in all areas of the San Joaquin Valley during the winter season.

**Figure 2 Speciated PM2.5 Concentrations at Shafter DMV Site**

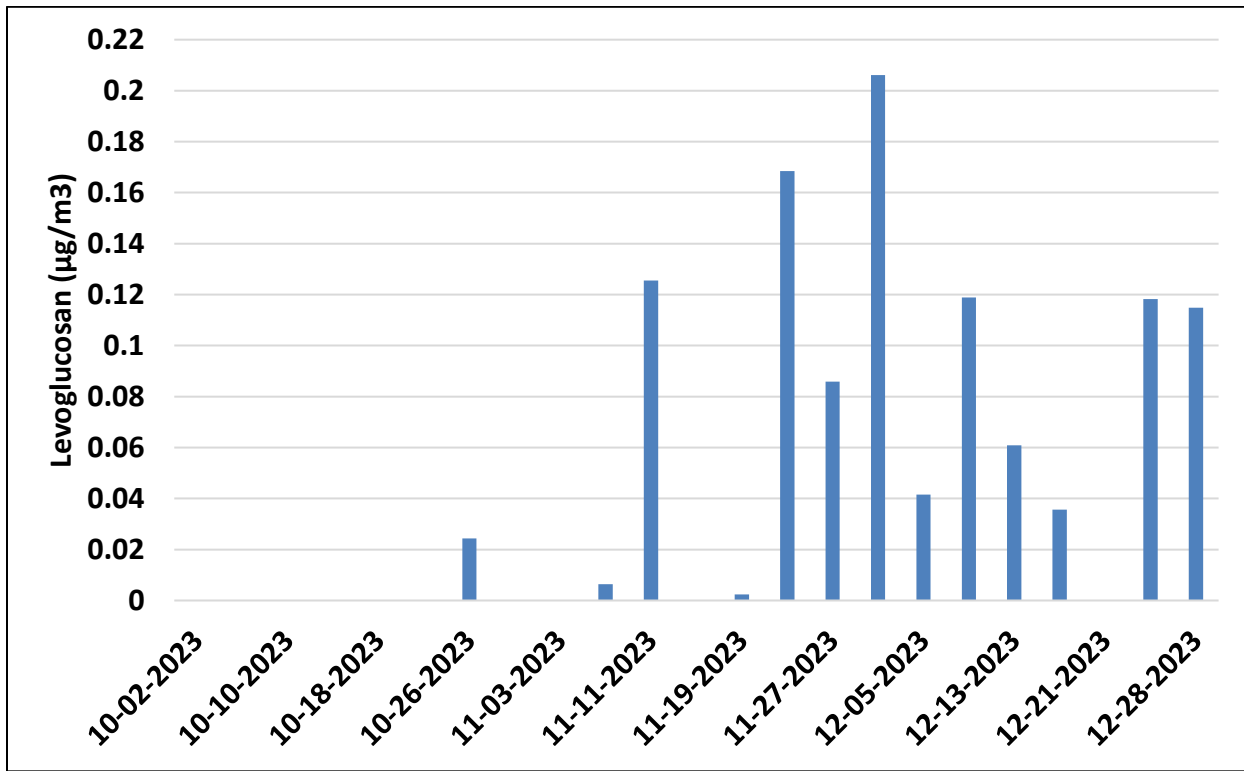


**Figure 3 Relative Comparison of PM2.5 Species Measured at Shafter DMV Site**



For the Shafter 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 that currently have results in this October - December period, only 13 samples indicated detectable levoglucosan levels. A majority of the results 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 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)<sup>1</sup>.

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, acetone, butane, chlorodifluoromethane, ethanol, ethyl acetate, isopropanol, and methanol 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

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

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	17	21,367	10.5	3,052
Acetaldehyde	Wood combustion in fireplaces and woodstoves, coffee roasting, burning of tobacco, vehicle exhaust fumes, and coal refining and waste processing	4.4	261	2.2	78

**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 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 formed from the reaction of ammonia and sulfuric acid, where the sulfuric acid is formed primarily from emissions of sulfur dioxide, 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.

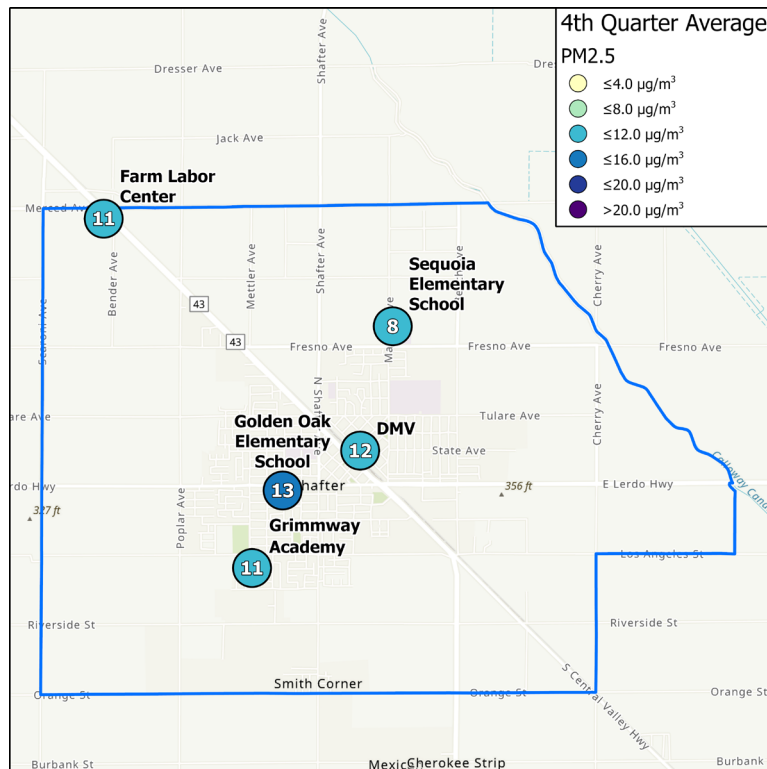
**Comparative Analysis of Measured Pollutants**

The following spatial comparison map depicts the quarterly PM2.5 averages and locations of each site within the community. Good air quality is represented 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. Bakersfield-California and Corcoran regulatory air monitoring sites are shown in Table 3 as a reference. They are not shown in Figure 5 due to the distance from the Shafter community.

**Table 3 PM2.5 Quarterly Averages**

Quarter	Bakersfield -California	Corcoran	Shafter-DMV	Grimmway Academy	Golden Oak Elementary	Farm Labor Center	Sequoia Elementary
2023 Q4	16.3	15.5	12.0	10.9	12.7	11.0	8.4

**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).

Initially the 4<sup>th</sup> quarter of 2023 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. Stable conditions led to higher Ozone concentrations, with the Farm Labor Center air monitoring site experiencing an exceedance of the federal 8-hour ozone standard of 70 ppb in October.

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. High pressure patterns were dominant at the end of the quarter. Stable conditions and poor dispersion caused air quality to deteriorate into the Moderate to Unhealthy for Sensitive Groups AQI categories for the Shafter community. Some Carbon Monoxide data and BTEX data was not recorded during this period with Farm Labor Center’s CO monitor not recording for the first half of the quarter and Sequoia Elementary’s BTEX monitor not recording until early December.

