San Joaquin Valley
AIR POLLUTION CONTROL DISTRICT

Shafter Community Air Monitoring Report

2021 2nd Quarter (April – June)

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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) 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 expected to become available on CARB's statewide AQView data portal once the website is complete.

II. Summary of Findings for the Quarter

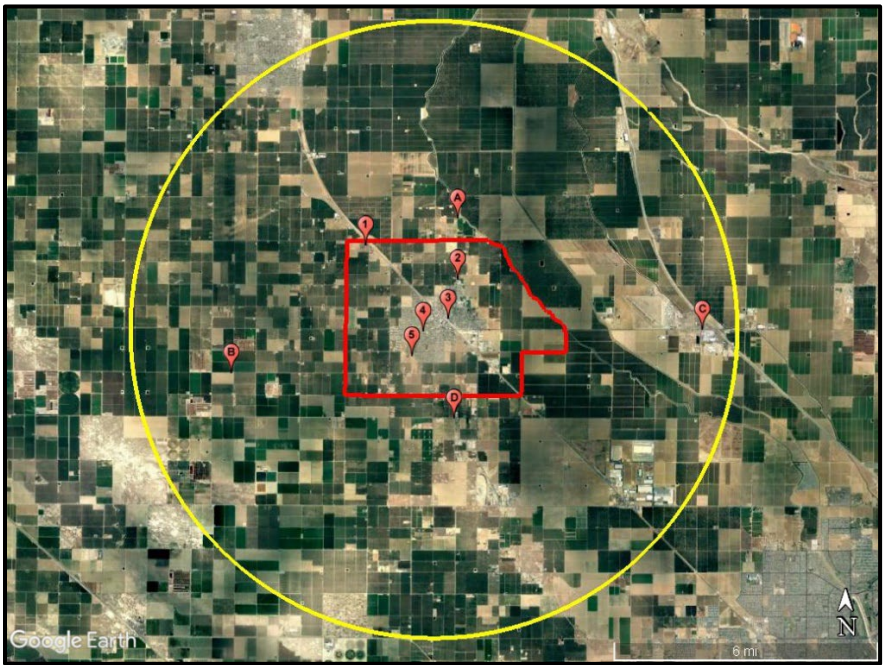
Through the continued implementation of the Shafter CAMP during this period, the following was observed among the pollutants monitored:

- High pressure dominated the period causing warm temperatures and stable conditions across the region. A very small amount of precipitation was observed. Wildfire smoke impacts were observed in June 2021.
- All of the 24-hour average PM2.5 values were below the federal 24-hour standard of 35 µg/m^3 for this quarter. Intermittent improvements in dispersion allowed PM2.5 concentrations to remain low during this quarter.
- Concentrations of PM2.5 speciation analysis indicates the largest contributors to the overall PM2.5 mass were soil and organic carbon.
- During this period, acetaldehyde, methanol, ethanol, 2-propanol, and acetone were the primary VOCs detected. Overall, during this monitoring period no concerning concentrations of VOCs were detected in the samples taken.
- 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 now 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 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	Mexican Colony	Real-time PM2.5	N, Interim use of Air Monitoring Van

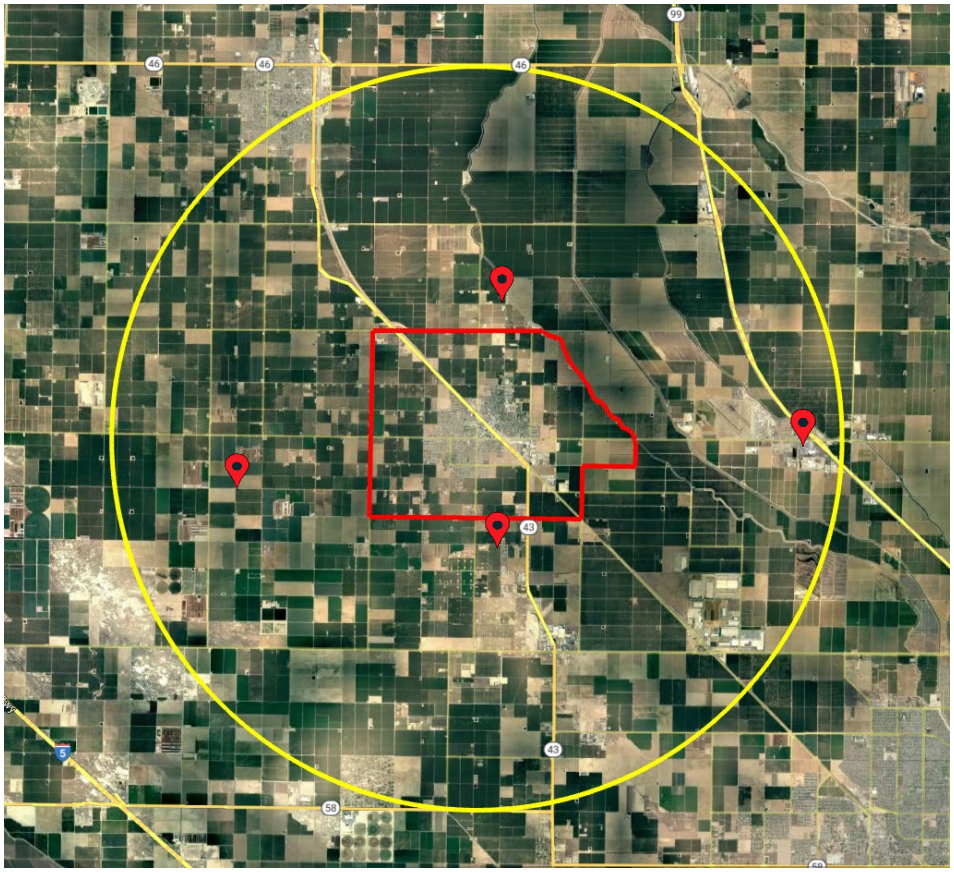
The District continues to work on implementing the Shafter CAMP, as well as making changes as needed based on CSC member comments and other logistical reasons. During this period, the following list highlights recent changes or continued work to implement the Shafter CAMP:

- Air Monitoring in Mexican Colony: The District continued to move forward in deploying the last remaining air monitor to Mexican Colony. The District is working on lease agreements with Kern County to place a monitor at a future community park on Martinez Street.

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 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
PM2.5 *	19 µg/m^3*	35 µg/m^3 (24-hr average)
Ozone *	71.7 ppb*	70 ppb (8-hr average)
CO	0.5 ppm	35 ppm (1-hr average)
NO2	9.4 ppb	100 ppb (1-hr average)
SO2	2.9 ppb	75 ppb (1-hr average)
Benzene	0	8 ppb (Acute Risk Exposure Level) 1 ppb (Chronic Risk Exposure Level)
Toluene	0	9,818 ppb (Acute Risk Exposure Level) 80 ppb (Chronic Risk Exposure Level)
Ethylbenzene	0	461 ppb (Chronic Risk Exposure Level)
Xylene	0	5,067 ppb (Acute Risk Exposure Level) 161 ppb (Chronic Risk Exposure Level)
H2S	2.8 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 PM2.5 and VOC speciation sampling instruments at the Shafter-DMV site near the intersection of Walker Street and Pacific Avenue. 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 sources, 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 Shafter-DMV air monitoring site. Samples were taken over the 3-month period of this report, Samples collected on May 13, 2021, experienced sampling errors and full analysis could not be completed for that date.

This analysis shows that concentrations of PM2.5 were low during this period, with the largest contributors being the constituents of soil and organic carbon. Wildfire smoke impacts were also experienced in June 2021 in the region. The higher amounts of Organic Carbon could be attributed to an increase in the combustion of hydrocarbons like mobile source exhaust on the day of sampling. Like organic carbon, the increase in the amount of soil found in the samples are likely attributed to an increase in soil disturbance caused by airflow from traffic.

Figure 3 Speciated PM2.5 Concentrations at Shafter DMV Site

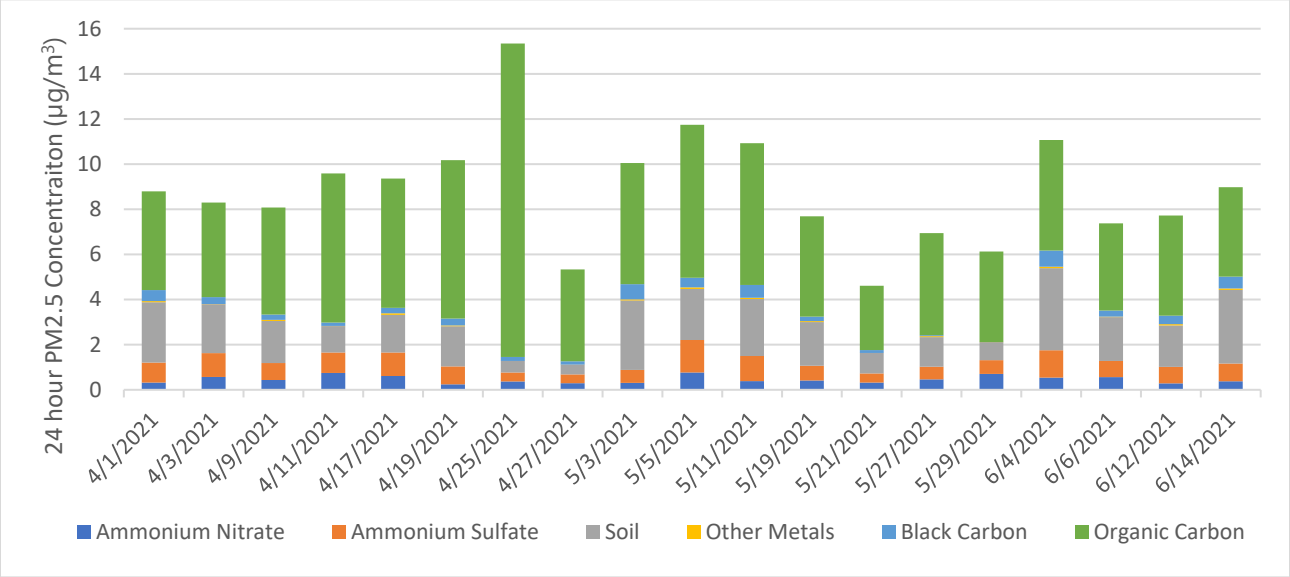
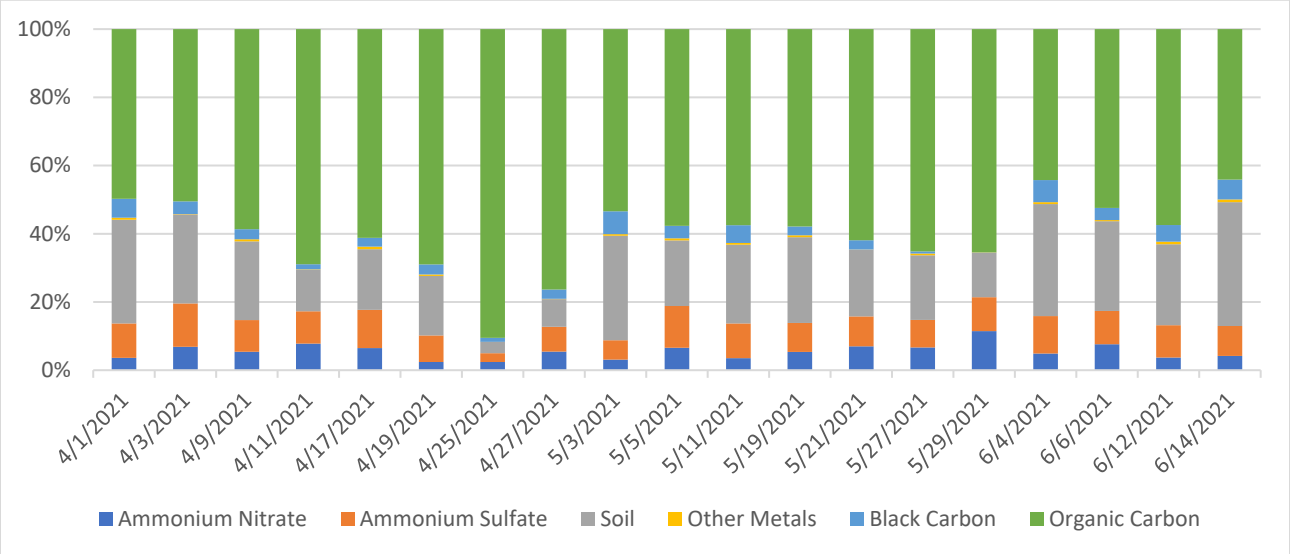


Figure 4 Relative Comparison of PM2.5 Species Measured at Shafter DMV Site



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, 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 22 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 dominant VOCs detected. Of these, 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	Highest 24-hour Average Concentration Detected (ppb)	OEHHA Acute REL (ppb)	OEHHA Chronic REL (ppb)
Methanol	Automobile exhaust, solvent use, and naturally from vegetation and microbes	93.8	21,367	3,052
Acetaldehyde	Wood combustion in fireplaces and woodstoves, coffee roasting, burning of tobacco, vehicle exhaust fumes, and coal refining and waste processing	11.2	261	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.

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

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 composed 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.

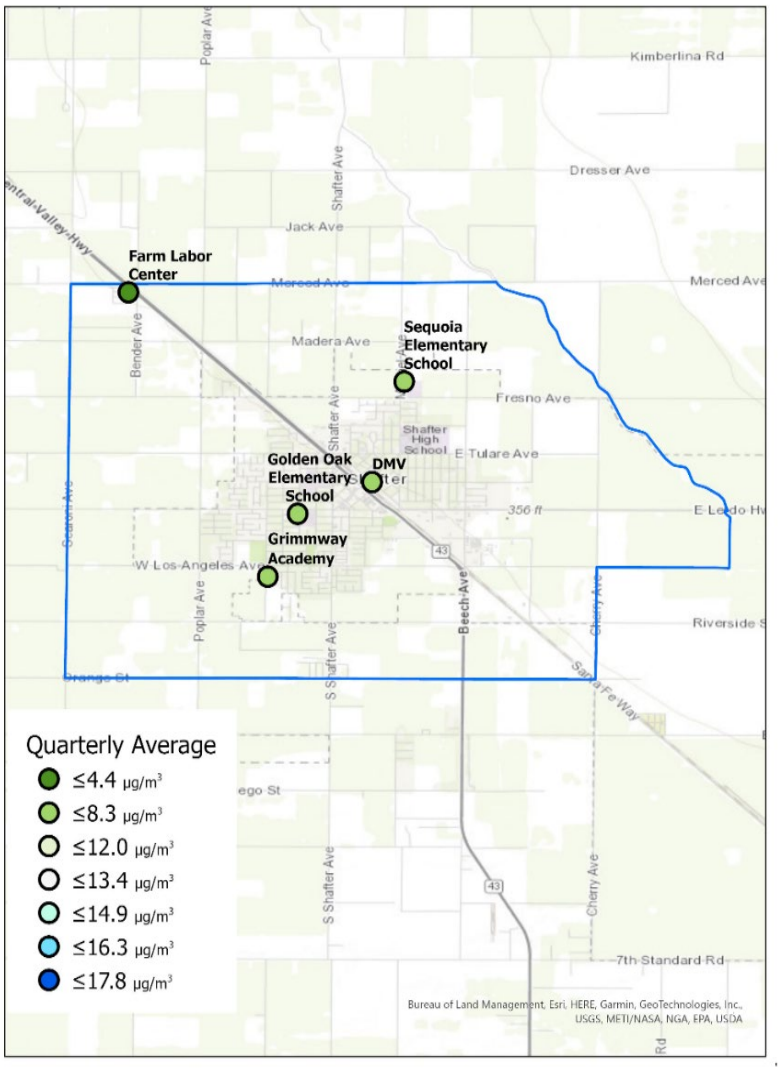
- **Other Metals:** Identified as components from soil emissions or found in other particulates having been emitted in connection with combustion from engine wear, brake wear, and similar processes. Certain metals are also emitted from the use of fireworks.

Comparative Analysis of Measured Pollutants

The following table and spatial comparison map depicts the quarterly PM2.5 averages and locations of each site within the community, and other nearby air monitoring sites. 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. During this period, the Shafter-Grimmway Academy site measured the highest average PM2.5 among the sites in Shafter, but less than the other air monitoring sites in Bakersfield and Corcoran.

Quarter	Bakersfield-California	Corcoran	Shafter-DMV	Shafter-Grimmway Academy	Golden Oak Elementary	Farm Labor Center	Sequoia Elementary
2021 Q2	8.6	7.0	5.8	6.9	6.2	3.6	4.9

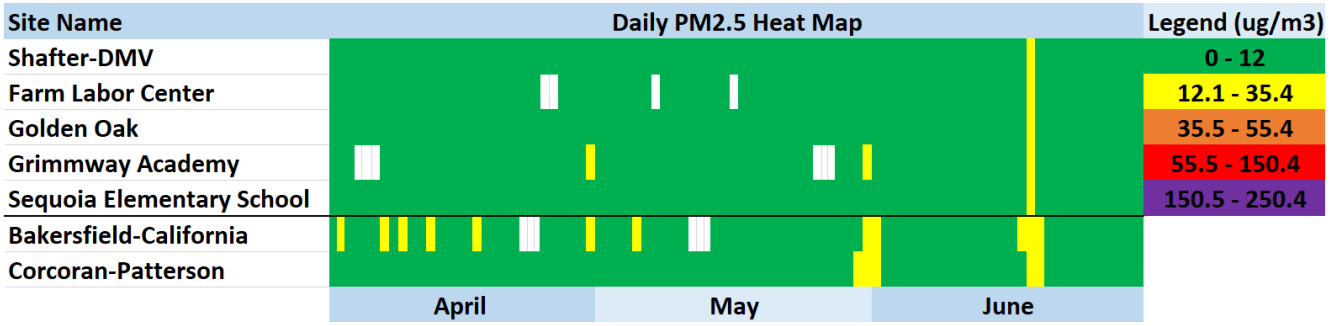
Spatial Comparison of PM2.5 Quarterly Averages

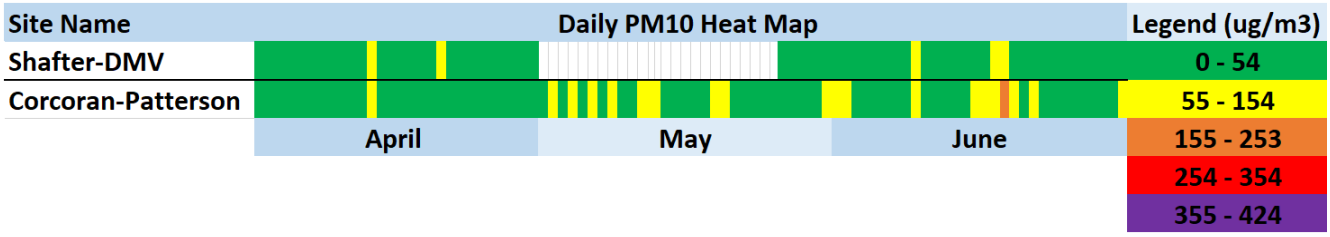


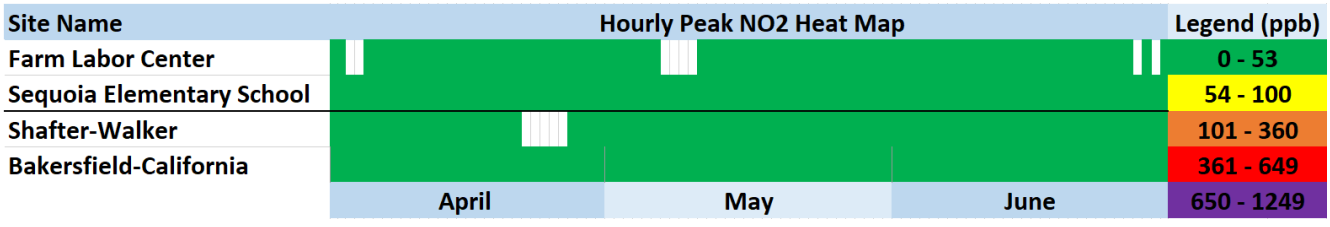
Pollutant Concentration Heat Maps

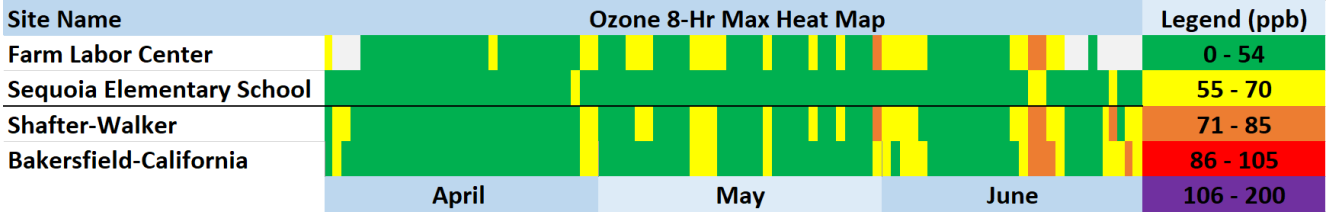
The following Heat Maps provide a comparative analysis of various pollutants being measured at the air monitoring sites as a part of the community air monitoring network. The color scales for each table are based on the Air Quality Index (AQI) or the associated Reference Exposure Level (REL).

Strong stability along with high temperatures throughout the quarter led to higher levels of ozone during the period, as expected during the warmer summer months in the Valley. As the 2nd quarter progressed, temperatures grew warmer and the high pressure systems that built over the region rendered stronger stability, particularly during the end of May-beginning of June and mid-June time frames. The low pressure systems that passed through brought good dispersion to the area yet only one of them delivered precipitation to the Valley. As such, conditions across the Valley were quite dry by the end of the 2nd quarter.









Site Name	Hourly Peak CO Heat Map			Legend (ppm)
Farm Labor Center				0 - 4.4
Bakersfield-Muni				4.5 - 9.4
	April	May	June	9.5 - 12.4
				12.5 - 15.4
				15.5 - 30.4

Site Name	Hourly Peak SO2 Heat Map			Legend (ppb)
Farm Labor Center				0 - 35
Sequoia Elementary School				36 - 75
	April	May	June	76 - 185
				186 - 304
				305 - 604

Benzene	Peak 1-Hour Peak BTEX Heat Map			Acute REL (ppb)
Site Name				0
Farm Labor Center				≥8
Sequoia Elementary School				

Toluene				Acute REL (ppb)
Site Name				0
Farm Labor Center				≥9818
Sequoia Elementary School				

Ethylbenzene				Chronic REL (ppb)
Site Name				0
Farm Labor Center				≥461
Sequoia Elementary School				

Xylene				Acute REL (ppb)
Site Name				0
Farm Labor Center				≥5067
Sequoia Elementary School				
	April	May	June	

Site Name	Hourly Peak H2S Heat Map			Acute REL (ppb)
Farm Labor Center				0
Sequoia Elementary School				≥30
	April	May	June	