Appendix A

AMBIENT PM2.5 DATA ANALYSIS

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Appendix A: Ambient PM2.5 Data Analysis

The concentration of ambient particulate matter that is 2.5 microns or less in diameter (PM2.5) at any given location in the San Joaquin Valley (Valley) is a function of meteorology, the natural environment, atmospheric chemistry, and emissions of directly emitted PM2.5 and PM2.5 precursors from regulated and unregulated sources. The San Joaquin Valley Air Pollution Control District (District), the California Air Resources Board (CARB), and other agencies[1] monitor PM2.5 concentrations throughout the Valley,[2] using filter-based monitoring (starting in 1999) and real-time concentration monitoring (starting in 2002). The U.S. Environmental Protection Agency (EPA) serves as the official repository of ambient PM2.5 data and analysis.[3]

The District uses the collected data to show air quality improvement through the standardized design value (DV) calculations, using EPA protocols to document basin-wide improvement and attainment of the National Ambient Air Quality Standards (NAAQS). As shown in this appendix, the design value data shows steady, long-term air quality improvement that will lead to the attainment of the federal PM2.5 standards.

The District also uses the data to evaluate the impact of changing daily, quarterly, and annual PM2.5 concentrations on public health. These trend analyses provide the District with critical information about how to develop control measures and incentive programs that contribute to the greatest public health improvements and greatest progress toward EPA air quality standards.

This appendix provides the technical details used to evaluate and analyze the District's PM2.5 concentration data. It also shows the multiple factors that affect ambient PM2.5 concentrations in the Valley (e.g. meteorology, exceptional events) and the evidence for air quality improvement through District regulatory actions, including the District's highly successful Rule 4901 (Wood Burning Fireplaces and Wood Burning Heaters).

A.1 PM2.5 CONCENTRATIONS – MEASUREMENT AND INFLUENCES

The District, CARB, and other agencies manage an extensive air monitoring network throughout the Valley. Information obtained from the PM2.5 monitors within this network provides the District with necessary information for demonstrating attainment of the NAAQS and valuable information for protecting public health throughout the year. The monitoring network captures the spatial, seasonal, daily, weekly, and annual variations in PM2.5 concentrations throughout the Valley that result from changing meteorology, the occurrence of exceptional events (e.g., high winds and wildfires), and PM2.5 emissions from regulated and unregulated sources.

[1] Other air monitoring site operators in the Valley include the Monache Tribe and Foothill Yokut Indians, the Tachi Yokut Tribe, and the National Park Service (NPS).
[2] SJVAPCD. *2022 Air Monitoring Network Plan.* October 11, 2022. Retrieved from: https://www.valleyair.org/aqinfo/Docs/2022-Air-Monitoring-Network-Plan.pdf
[3] EPA. Air Quality System (AQS): *AQS Web Application.* (2010). Retrieved from: https://www.epa.gov/aqs

A.1.1 PM2.5 Monitor Types

The District and CARB use four types of PM2.5 monitors in the Valley:

- Filter-based federal reference method (FRM) monitors, defined as the standard for data collection;
- Real-time beta-attenuation method (BAM) monitors designated as federal equivalent method (FEM) monitors, and hereafter referred to as FEM monitors;
- BAMs not designated as FEM and hereafter referred to as non-FEM; and
- Filter-based speciation monitors, similar to FRM monitors.

Only FRM and FEM monitors produce data that is suitable for comparison with the NAAQS, and are therefore used for design value calculations. Real-time monitors (FEM and non-FEM) produce hourly measurements that the District uses to produce daily air quality forecasts, wood burning declarations, public health notifications, and Real-Time Air Advisory Network (RAAN) notifications for schools and the public.

Filter-based speciation monitors operate similarly to standard FRM monitors; however, due to the specific analysis requirements for the different PM2.5 species (e.g. metals, carbon, organics), multiple filter media are required, hence a multi-filter collection system. The evaluation and analysis of multiple PM2.5 species is critical to the development of an effective attainment strategy.

A.1.2 Meteorological Influences on PM2.5 Concentrations

Particulates in the atmosphere are dispersed by horizontal and vertical mixing within an air mass. Wind flow (horizontal mixing) and temperature instability (decreasing temperature with height allowing for vertical mixing) are the strongest mechanisms to allow for dispersing pollutants. Wind speed can greatly influence the pollutant concentrations by horizontally mixing and dispersing pollutants over a large area. Generally, the higher the wind speed, the lower the PM2.5 concentrations; however, in some cases, excessive winds may cause elevated PM2.5 levels as high winds may entrain particulate matter with a diameter of 10 microns or less (PM10), as well as PM2.5.

Vertical mixing of the air mass can result from atmospheric instability. Alternatively, vertical mixing of an air mass can be inhibited and pollutants can remain trapped near the surface under a temperature inversion (when temperature increases with increasing height). Prolonged periods of high pressure and stable conditions with low wind speeds can cause stagnant conditions that can also trap pollutants near the surface. PM2.5 concentrations increase during these poor dispersion periods. Conversely, during low-pressure events, unstable conditions and stronger wind speeds occur. The magnitude of decreasing PM2.5 concentrations can vary depending on the strength and characteristics of the low-pressure system.

A.1.2.1 Valley Drought

According to the U.S. Geological Survey, California experienced its worst drought in over a century between 2011 and 2015. The 2015-2016 winter season represented the fifth consecutive year of drought conditions in the Valley, and 2013-2014 was by far the driest winter during this time. On January 17, 2014, the Governor of California declared a drought emergency for all of California, which was lifted three years and two months later on April 7, 2017. Just four years later, beginning in April 2021 and through October 2021, the Governor of California declared a State of Emergency due to severe drought conditions and signed a set of four new emergency proclamations directing state agencies to take immediate action to bolster drought resilience across the state.[4,5,6,7] Above normal winter precipitation between 2022-2023 brought major drought relief to the west coast, allowing for the roll back of many of the drought emergency provisions in California.[8,9] Increased precipitation amounts allowed for all of California to measure between no drought and moderate drought, with no drought indicated in the entire San Joaquin Valley in May of 2023. The District will continue to monitor these drought conditions for potential impacts to ozone and particulate matter concentrations. Figure A-1 (a-c) are maps produced by the National Drought Mitigation Center depicting the extent and severity of the drought conditions affecting California between May 25, 2021 to May 24, 2022, and measured improvements by May 23, 2023.[10]

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[4] Executive Department, State of California. State of Emergency Proclamation. April 2021. Retrieved from: https://www.gov.cA gov/wp-content/uploads/2021/04/4.21.21-Emergency-Proclamation-1.pdf

[5] Executive Department, State of California. State of Emergency Proclamation. May 2021. Retrieved from: https://www.gov.cA gov/wp-content/uploads/2021/05/5.10.2021-Drought-Proclamation.pdf

[6] Executive Department, State of California. State of Emergency Proclamation. July 2021. Retrieved from: https://www.caloes.cA gov/wp-content/uploads/Legal-Affairs/Documents/Proclamations/7.8.21-Drought-SOE-Proc-attested.pdf

[7] Executive Department, State of California. State of Emergency Proclamation. October 2021. Retrieved from: https://www.gov.cA gov/wp-content/uploads/2021/10/10.19.21-Drought-SOE-1.pdf

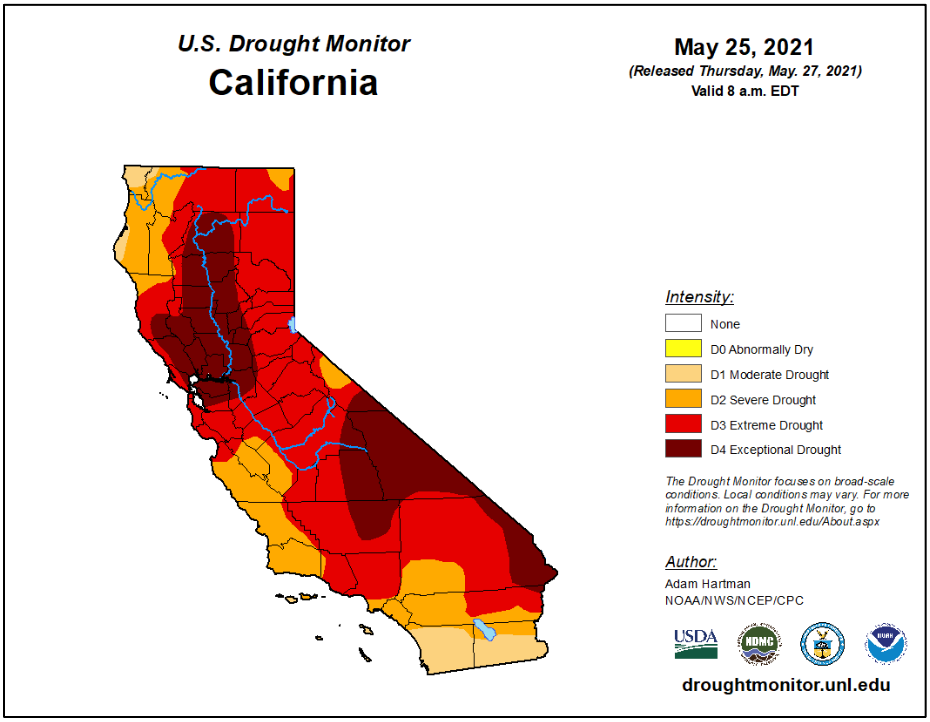
[8] "Water Year 2023 Snow Drought Conditions Summary and Impacts in the West: June 15, 2023." Drought.Gov, www.drought.gov/drought-status-updates/water-year-2023-snow-drought-conditions-summary-and-impacts-west-2023-06-15. Accessed 22 Aug. 2023.

[9] California, State of. "Governor Newsom Eases Drought Restrictions." California Governor, 24 Mar. 2023, https://www.gov.cA gov/wp-content/uploads/2023/03/3.24.23-Drought-update-executive-order.pdf

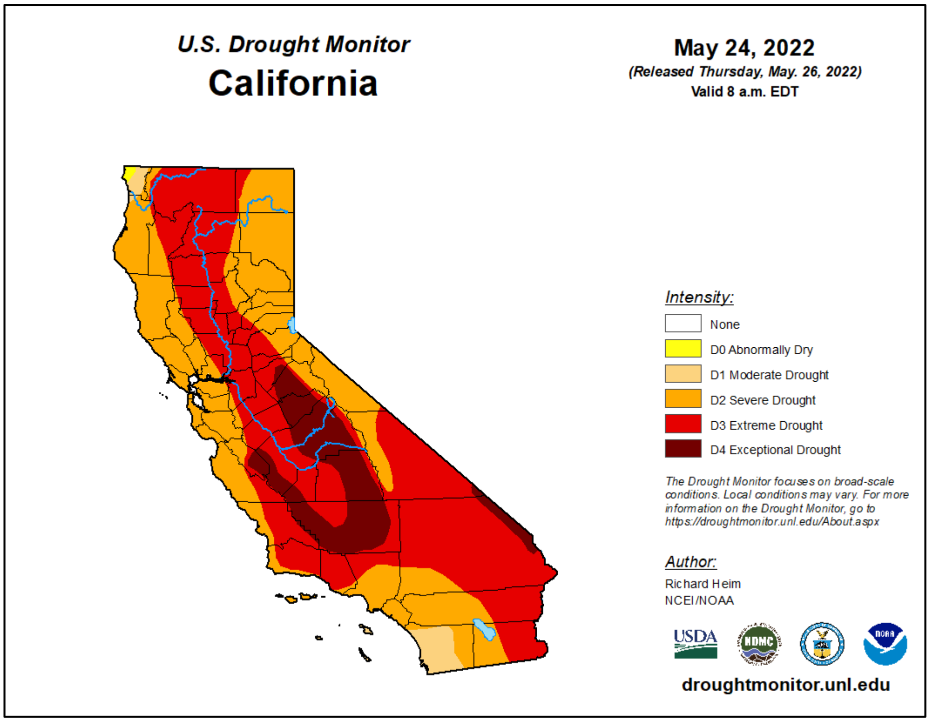
[10] U.S. Drought Monitor California. Retrieved May 25, 2023. https://droughtmonitor.unl.edu/Maps/MapArchive.aspx

Figure A-1 (a-c) Drought Extent and Severity in California

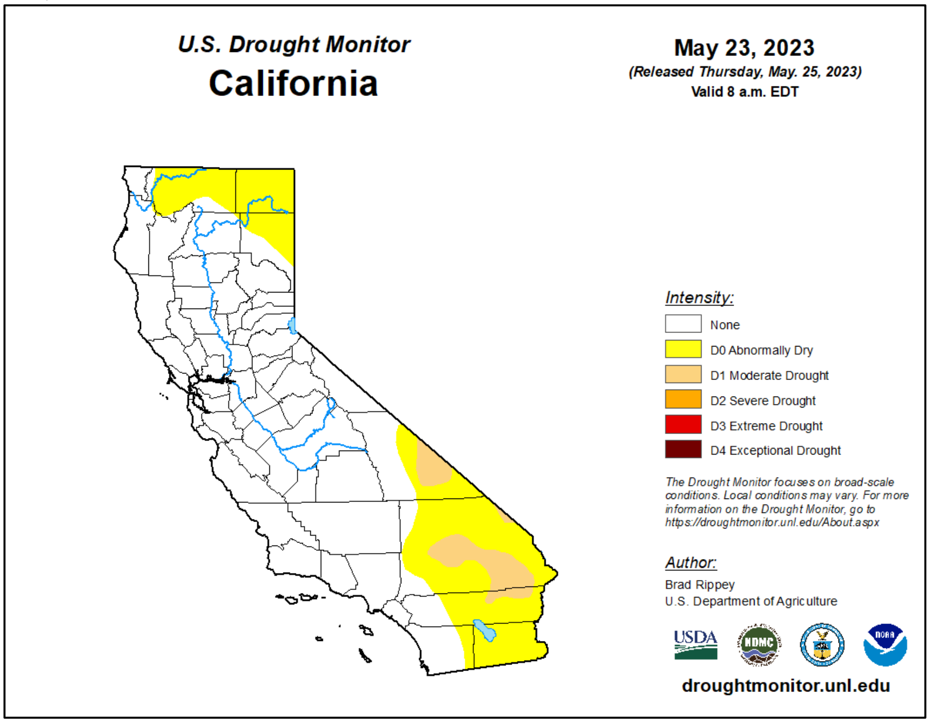
a) May 25, 2021



b) May 24, 2022



c) May 23, 2023



Many cities in California, including those in the Valley, had record low rainfall totals during the 2013 calendar year, with some nearly 100-year old records being broken. Although rainfall totals slowly increased between 2020 and 2022, drought conditions continued to persist with no distinct improvement until 2023, as noted in Table A-1.

Table A-1 Rainfall Totals for Select Cities across California

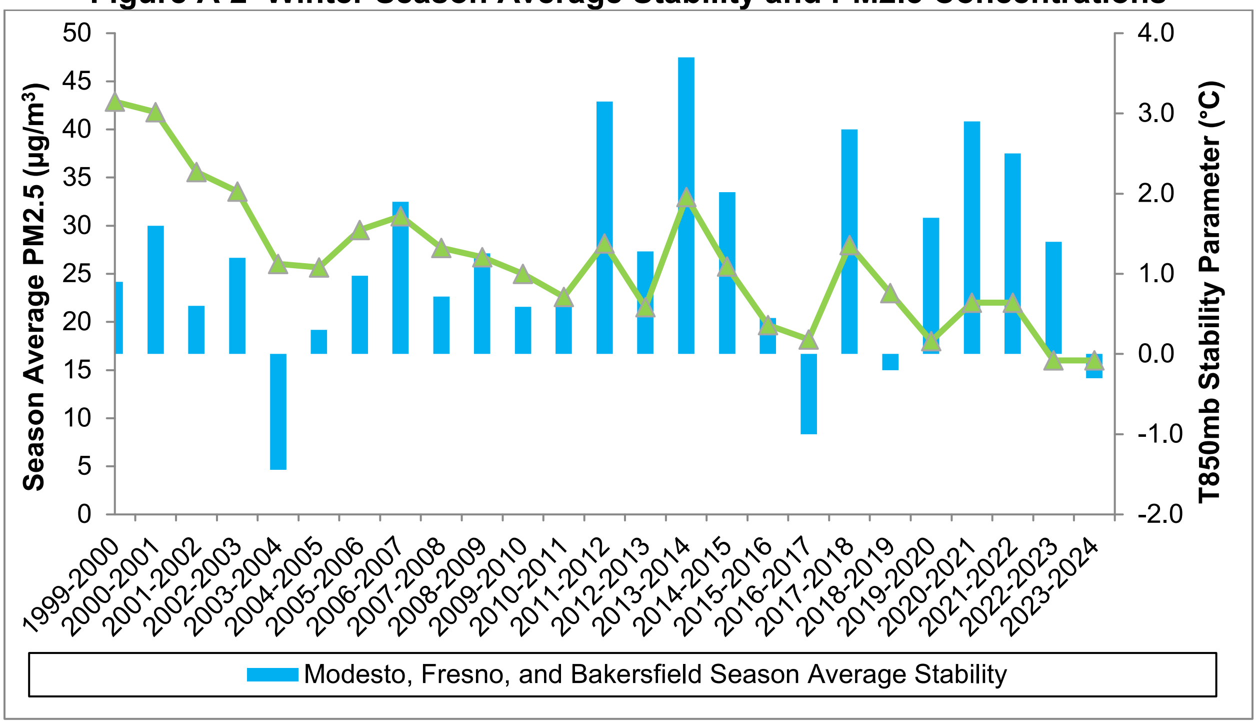
Region	City	1983-2020	2021	2022	2023	Record Low Rainfall (1983-2023)	
		Average (inches)	Total (inches)	Total (inches)	Total (inches)	Year	Total (inches)
Northern California[11]	Sacramento	19.10	21.83	13.42	25.5	2013	3.38
	San Francisco	17.82	18.9	11.19	18.91	2013	5.81
San Joaquin Valley [12]	Stockton	13.19	14.17	11.4	16.93	2013	4.59
	Modesto	12.17	13.76	9.06	15.85	2013	4.69
	Fresno	10.86	10.38	6.44	13.64	2013	3.01
	Hanford	8.43	8.22	5.41	12.68	2013	2.23
	Visalia	9.73	9.72	5.61	15.33	2013	1.41
	Bakersfield	6.11	5.58	4.22	9.95	1989	2.88
Southern California[13]	Los Angeles	11.95	12.09	6.4	25.36	2013	3.65
	San Diego	9.86	7.85	5.9	14.43	1989	3.83

[11] NOWData – NOAA Online Weather Data. Retrieved March 6, 2023. https://nowdata.rcc-acis.org/sto/
[12] NOWData – NOAA Online Weather Data. Retrieved March 6, 2023. https://www.weather.gov/wrh/climate?wfo=hnx
[13] NOWData – NOAA Online Weather Data. Retrieved March 6, 2023. https://nowdata.rcc-acis.org/lox/

During 2011-2015 winter seasons, as well as the 2019-2022 winter seasons, extended periods of stagnation, and lack of ample precipitation were components of the historic drought that challenged the Valley's air quality. These conditions overwhelmed the District's emissions control strategies, and contributed to higher than expected PM2.5 concentrations and exceedances of the NAAQS. During the 2023-2024 winter season there were progressive weather patterns that rendered atmospheric instability more prominent and resulted in lower monthly average stability across the Valley. When compared to prior seasons, such as the 2016-2017 and 2018-2019 seasons with similar or even more favorable average stability as the recent 2023-2024 season, the Valley experienced levels significantly below the comparable prior seasons.

As shown in Figure A-2, the Valley winter season average PM2.5 concentration follows an overall downward trend since PM2.5 monitoring began in the early 2000s. This improvement is despite periods of low precipitation totals, increases in atmospheric stability, and wildfire impacts. Specifically, 2018, 2020, and 2021 were significantly impacted by wildfire activity in California. This provides strong evidence that the District and CARB's comprehensive emission reduction strategies have been achieving permanent emissions reductions, and improved meteorology is not wholly responsible for improved air quality in the District.

Figure A-2 Winter Season Average Stability and PM2.5 Concentrations



A.1.2.2 Wildfire Impacts

The quantity of emissions generated from wildfires is enormous and can well exceed the total industrial and mobile source emissions in the San Joaquin Valley, overwhelming all control measures and resulting in periods of excessively high particulate matter and ozone concentrations that cause significant impacts to public health. In addition to excessive fuel build-up in the state's wildlands due to decades of fire-suppression and widespread drought-driven tree mortality, higher temperatures and drier climate conditions in recent years have contributed to extended and more intense wildfire seasons in the western United States.

For example, in 2020, over 4 million acres were burned due to California wildfires, as shown in Table A-2.[14] The 2021 wildfire season also saw significant wildfire activity, with over 2.5 million acres burned across the state.[15] The District compiles up-to-date wildfire information on its website to keep the public informed about real-time air quality impacts from wildfires.[16] The District and CARB also assess long-term impacts through the attainment planning process.

Table A-2 Number of Acres Burned by Wildfires in California

Timeframe	Acres Burned
January 1 through December 31, 2020[17]	4,304,379
January 1 through December 31, 2021[18]	2,569,386
January 1 through December 31, 2022[19]	331,360
5-Year Average (same interval)	1,891,499

Source: Cal Fire

<u>2020 Wildfire Season</u>

In 2020, according to CalFire, over 8,600 wildfires were recorded in California, with over 4.3 million acres burned across the state, more than double the previous statewide record of approximately 2 million acres burned in 2018.[20,21] In addition, five of the top 20 largest wildfires in California history occurred during the 2020 wildfire season, highlighting the severity of recent wildfire seasons. A new record for the largest wildfire in state history also occurred in 2020, with the August Complex in northern California alone burning over 1 million acres. These points contribute to the understanding of how extreme and extensive the wildfire seasons have become for California in recent years.

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[14] 2020 Incident Archive. Retrieved March 6, 2023. https://www.fire.cA gov/incidents/2020
[15] CalFire 2021 Incident Archive, https://www.fire.cA gov/incidents/2021/
[16] San Joaquin Valley Air District, Wildfire Prevention and Response, https://ww2.valleyair.org/air-quality-information/wildfire-information/
[17] 2020 Incident Archive. Retrieved March 6, 2023. https://www.fire.cA gov/incidents/2020
[18] 2021 Incident Archive. Retrieved March 6, 2023. https://www.fire.cA gov/incidents/2021
[19] 2022 Incident Archive. Retrieved March 6, 2023. https://www.fire.cA gov/incidents/2022
[20] 2020 Wildfire Activity Statistics. Retrieved from: https://34c031f8-c9fd-4018-8c5a-4159cdff6b0d-cdn-endpoint.azureedge.net/-/media/calfire-website/our-impact/fire-statistics/2020_redbook_final.pdf?rev=72030b4d2cb7466aa573754ecb4f656e&hash=337DB407876BE384081C7D722D82B1BF
[21] CalFire 2020 Incident Archive. Retrieved from: https://www.fire.cA gov/incidents/2020

Leading to the most severe period of the 2020 wildfire season, dry conditions and hot summer temperatures continued to scorch and desiccate the Californian landscape during July and August 2020. On August 15, 2020 a dry lightning storm, later named the August 2020 Lightning Siege, passed through California resulting in over 14,000 lightning strikes to the ground and hundreds of new fires erupting across the state simultaneously. On September 4, 2020, another dry lightning storm passed through California, which caused hundreds of new fires to erupt, including the Creek Fire that burned in Fresno and Madera counties. Major fires that adversely affected air quality in the Valley during the August-September 2020 period include:

- Hills Fire burned 2,121 acres (Fresno County)
- Lake Fire burned 31,089 acres (Los Angeles County)
- SCU Lightning Complex burned 396,624 acres (Stanislaus and San Joaquin Counties)
- CZU Lightning Complex burned 86,509 acres (San Mateo and Santa Cruz Counties)
- Creek Fire burned 379,895 acres (Fresno and Madera Counties)
- SQF Complex burned 174,178 acres (Tulare County)
- August Complex burned 1,032,648 acres (Colusa, Glenn, Humboldt, Lake, Mendocino, Tehama, and Trinity Counties)

The SQF Complex eventually burned nearly 175,000 acres, becoming the 18th largest fire in California history. The SQF Complex reached 100% containment on January 6, 2021, and afterward produced minimal smoke until the fire was fully extinguished. The Creek Fire ignited in late summer on September 4, 2020 and burned nearly 380,000 acres. The Creek Fire went on to become one of the largest single non-complex fires in California history, second only to the Dixie Fire which would burn over 960,000 acres in 2021. The Creek Fire was declared 100 percent contained on December 24, 2020.

The enormous amount of wildfire smoke from these fires significantly impacted the Valley's air quality for nearly three months, leading to some of the worst air quality in recent history and unhealthy conditions across the entire region for a prolonged period of time, particularly for particulate matter.

2021 Wildfire Season

In 2021, more than 7,300 wildfires were recorded in California, with over 2.5 million acres burned across the state, resulting in one of the most severe wildfire seasons in California history, second only to the unprecedented and historic 2020 wildfire season.[22,23] In addition, four of the top 20 largest wildfires in California history all

[22] 2021 Wildfire Activity Statistics. Retrieved from: https://34c031f8-c9fd-4018-8c5a-4159cdff6b0d-cdn-endpoint.azureedge.net/-/media/calfire-website/our-impact/fire-statistics/2021_redbook_final.pdf?rev=525959073bbe4bbe816d67624911e4c3&hash=CFD17F879B2CE984AB5BA9FEA4F73A56

[23] CalFire 2021 Incident Archive. Retrieved from: https://www.fire.cA gov/incidents/2021

occurred during the 2021 season. A new record for the largest single, non-complex wildfire in state history also occurred in 2021, with the Dixie Fire in northern California alone burning over 960,000 acres. These points underscore how extreme and extensive the 2021 wildfire season was for California. Major fires that adversely impacted air quality in the Valley during the August-October 2021 period include:

- Dixie Fire burned 963,309 acres (northern California counties)
- River Complex burned 199,359 acres (Trinity and Siskiyou counties)
- French Fire burned 26,535 (Kern County)
- Walkers Fire burned 8,777 acres (Tulare County)
- KNP Complex burned 88,307 acres (Tulare County)
- Windy Fire burned 97,528 acres (Tulare County)
- River Fire burned 9,656 (Mariposa County)

Both the KNP Complex and the Windy Fire significantly and directly impacted the Valley's air quality beginning in September. Combined, these fires in Tulare County burned over 185,000 acres. These Tulare County fires were declared 100 percent contained by December 16, 2021. The Dixie Fire, and many other significant fires in northern California, severely impacted air quality in the San Joaquin Valley and the western U.S. during the 2021 wildfire season. The enormous amount of wildfire smoke from these fires significantly impacted the Valley's air quality over a three-month period, leading to very poor air quality and unhealthy conditions across the entire region for prolonged periods of time. As in 2020, these wildfires affected particulate matter as well as ozone concentrations.

2022 Wildfire Season

In 2022, approximately 7,400 wildfires were recorded in California, with over 300,000 acres burned across the state.[24] Although the acres burned in 2022 was below the 5-year average, and less than what was measured in 2020-2021, there were still a significant number of wildfires in California in 2022. Major fires that adversely impacted air quality in the Valley during the July-October 2022 period included:

- Oak Fire burned 19,244 acres (Mariposa County)
- Six Rivers Lightning Complex burned 41,600 acres (Humboldt and Trinity counties)
- Mountain Fire burned 13,440 acres (Siskiyou County)
- Fairview Fire burned 28,098 acres (Riverside County
- McKinney Fire burned 60,138 acres (Siskiyou County)
- Mosquito Fire burned 76,788 acres (Placer and El Dorado counties)

The Mosquito Fire was active for 51 days before it was contained, beginning on September 6, 2022, and eventually burning over 76,000 acres. The Mosquito Fire and

[24] CalFire 2022 Incident Archive, https://www.fire.cA gov/incidents/2022

other significant fires in California impacted the Valley's air quality over a four-month period, leading to a deterioration in air quality and poor conditions across the region.

The District works collaboratively with the public, media, land managers, school districts, county public health officers, and other stakeholders to alert the public of poor air quality and increase the understanding of the devastating public health impacts of wildfires, as well as the need for improved management of the public forests. The District continues to pursue enhanced forest management efforts at the state and federal level to address the extraordinary build-up of fuels in our surrounding forests and minimize wildfire impacts in the future.

A.2 ATTAINMENT DEMONSTRATION – DESIGN VALUES

Design values represent the official metric for assessing air quality improvements and attainment of the NAAQS per the federal Clean Air Act (CAA) and EPA regulations. PM2.5 design value calculations are three-year averages that follow EPA protocols for rounding, averaging conventions, data completeness, sampling frequency, data substitutions, and data validity. The results provide consistency and transparency to determine basin-wide attainment for both the 2006 24-hour PM2.5 standard of 35 μg/m³, and the 2012 annual PM2.5 standard of 12 μg/m³. If any monitoring site within the air basin has either a 24-hour or an annual PM2.5 design value higher than the respective standards, then the entire air basin is designated nonattainment.

Table A-3 provides the generalized descriptions of how the 24-hour and annual design values are calculated for PM2.5. EPA provides detailed procedures for the calculation and data handling methodologies.[25]

Table A-3 General PM2.5 Design Value Calculation Methods

Averaging Period	Level	Calculation Method
24-hour	35 μg/m³ (2006)	**Step 1:** *Determine the 98th percentile value for each year over a consecutive three-year period.* **Step 2:** *Average the three 98th percentile values.* **Step 3:** *Round the resulting value to the nearest 1.0 μg/m³.* **Step 4:** *Compare the result to the standard.*
Annual	12.0 μg/m³ (2012)	**Step 1:** *Calculate the average of each quarter of each year over a three-year period.* **Step 2:** *Average the four quarters in a calendar year to determine the average for each year (the annual mean).* **Step 3:** *Average the three annual mean values.* **Step 4:** *Round the resulting value to the nearest 0.1 μg/m³.* **Step 5:** *Compare the result to the standard.*

[25] 40 CFR Appendix-N-to-Part-50 1.0(a) Retrieved May 11, 2023. https://www.ecfr.gov/current/title-40/chapter-I/subchapter-C/part-50/appendix-Appendix%20N%20to%20Part%2050

Table A-4 through Table A-7 show the trend of the 24-hour 98th percentile and annual mean values for each PM2.5 monitoring site in the Valley by year, as well as the three-year average design values through the year 2022.

24-hour single-year 98th-percentile averages (Table A-4) are used to generate the three-year average 24-hour design values (Table A-5). Single-year average PM2.5 concentrations (Table A-6) are used to generate the three-year average annual design values (Table A-7). This data is shown in Figure A-3 through Figure A-18 for sites within each county in the Valley.

Average ambient PM2.5 concentrations vary by monitoring site within the Valley. In general, monitoring sites in the northern part of the Valley record the lowest ambient PM2.5 concentrations, with concentrations increasing toward the central and southern portions of the Valley. With PM2.5 concentrations continuing to improve, both 24-hour and annual design values are trending downward across the Valley, bringing the region closer to attaining the federal PM2.5 standards. Note that the following tables and figures include data that were impacted by wildfire emissions, and therefore recent values for the years 2020, 2021, and 2022 are skewed high due to these impacts.

Note that the Fresno-Foundry air monitoring site in Fresno County serves as the near-road site in the area, meeting the federal NO2 monitoring criteria. Per EPA requirements, this site also measures PM2.5, and since this site became operational in 2020, it has measured higher PM2.5 than other sites in Fresno County. However, based on the analysis, strategy, and modeling for this plan, the Fresno-Foundry site is projected to meet the 12 $\mu g/m^3$ annual PM2.5 standard by 2030, along with the rest of the Valley.

Table A-4 Single Year 24-hour Average PM2.5 98th Percentile Values (μg/m^3)

SJV Monitoring Sites	Average 2000-2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Stockton-University Park	47.3	42.0	48.0	61.6	40.4	29.7	44.8	33.9	56.3	44.5	39.1	32.4	44.2	92.3	32.9	65.9	39.5	35.2	35.4*
Manteca						44.0*	38.9	30.9	40.2	40.0	42.7	29.3	36.4	96.9	26.8*	66.9	37.4	33.1*	29.5
Modesto-14th Street	59.3	52.0	57.4	53.9	54.5	37.3	54.7	40.8	56.4	49.5	30.8*	36.2	51.1	100.4	28.4	67.1	43.1	36.4	32.5
Turlock				67.4*	53.1	43.5	57.4	45.4	55.4	51.2	47.3	38.5	48.0	88.6	36.0	67.7	42.2	34.5	33.2
Merced-M St	52.6	52.5	53.0	53.6*	49.8	39.1	38.5	41.8	67.3	45.9	39.0	34.6	40.3	52.7	29.5	77.1	40.9	31.3	31.8
Merced-Coffee					41.4*	39.9	47.4	35.6	42.3	43.8	40.3	32.8	44.7	56.0	23.4	78.3	40.7	28.7	28.6
Madera-City						57.0*	59.1	43.2	54.6	56.0	43.7	35.7	45.8	50.2	23.9	87.7	47.0	31.5	27.7
Clovis-Villa	62.3	60.5	61.2	49.7	49.0	44.3	68.5	48.0	56.2	59.3	45.7	37.7	50.0	57.0	28*	99.5	49.6	32.9	24.0
Fresno-Garland	69.8	51.0	67.0	57.4	55.8	48.8	64.5	52.6	63.8	66.7	52.0	42.7	68.0	63.5	36.9	85.0	53.5	43.1	33.3
Fresno-Pacific	64.7	65.0	57.9	46.4	52.3	40.2	67.5	51.3	71.6	61.8	42.0	40.0	73.2	65.5	37.1	81.0	48.6	42.4	39.5
Fresno-Foundry																63.9	53.5	40.6	34.6
Tranquility					35.8*	27*	27.5	26.9	35.7	31.2*	35.8	27.0	34.4	51.4	17.1	92.5	32.0	22.0	21.0
Corcoran-Patterson	71.5	63.8	59.5	47.9	53.4	47.2	40.8*	40.0*	66.0	71.0	99.2*	45.9	69.7	78.0	45.1	69.0	51.6	41.8	29.9
Hanford-Irwin						48.5	64.6	48.3	67.6	81.9	51.4	43.3	68.7	78.2	41.1	72.6	56.4	42.7	37.0
Visalia-W. Ashland Avenue	72.5	50.0	59.7	62.1	53.9	36.3	50.7	53.8	62.5	75.4	45.8	40.7	74.6	63.4	45.5	83.4	69.3	41.2	33.6
Bakersfield-Golden / M St	78.3	75.2	69.4	60.9*	68.6	†	†	†	†	107.2*	51.5	51.4	71.3	60.9	44.3	76.9	54.3	51.8	37.5
Bakersfield-California	72.3	60.5	73.0	64.5	66.7	53.3	65.5	56.4	71.8	79.9	57.2	47.0	71.8	69.2	43.4	79.2	56.9	48.5	36.0
Bakersfield-Airport (Planz)	65.9	64.7	72.2	72.3	65.5	56.2	43.2	40.6	96.7	76.7	56.5	50.7	69.7	60.8	46.7	57.1	54.8	45.7	37.5

*The site does not meet completeness criteria for the year, pursuant to Appendix N to Part 50, Title 40.
†Site was not in operation.

Table A-5 24-hour Average PM2.5 Design Values (Three-Year Averages, µg/m³)

SJV Monitoring Sites	Average 2000-2007	2006-2008	2007-2009	2008-2010	2009-2011	2010-2012	2011-2013	2012-2014	2013-2015	2014-2016	2015-2017	2016-2018	2017-2019	2018-2020	2019-2021	2020-2022	2021-2023
Stockton-University Park	48	51	50	44	38	36	45	45	47	39	39	56	56	64	51	52	37*
Manteca				44*	41*	38*	37	37	41	37	36	54	53*	59*	52*	54*	33*
Modesto-14th Street	60	54	55	49	49	44	51	49	46*	39*	39*	63	60	65	51	54	37
Turlock		67*	60*	55*	51	49	53	51	51	46	45	58	58	64	55	55	37
Merced-M St	54	53	52	48	42	40	49	52	51	40	38	43	41	53	49	50	35
Merced-Coffee			41*	41*	43*	41	42	41	42	39	39	45	41	53	47	49	33
Madera-City				57*	58*	53*	52	51	51	45	42	44	40	53	53	55	35
Clovis-Villa	62	57	53	48	54	54	58	55	54	48	44	48	45*	62*	59*	61	36
Fresno-Garland	69	58	60	54	56	55	60	61	61	54	54	58	56	62	58	61	43
Fresno-Pacific	64	56	52	46	53	53	63	62	58	48	52	60	59	61	56	57	44
Fresno-Foundry														64*	71*	61	43
Tranquillity			36*	31*	30*	27*	30	31*	34*	31*	32	38	34	54	47	49	25
Corcoran-Patterson	70	57	54*	50*	47*	43*	49*	59	79*	72*	72*	65	64	64	60	59	41
Hanford-Irwin				49	57	54	60	66	67	59	54	63	63	64	61	62	45
Visalia-W. Ashland Avenue	70	57	59	51	47	47	56	64	61	54	54	60	61	64	66	65	48
Bakersfield-Golden / M St	77	69*	66*	65*	69*	†	†	107*	79*	70*	58	61	59	61	59	61	48
Bakersfield-California	72	66	68	62	62	58	65	69	70	61	59	63	61	64	60	62	47
Bakersfield-Airport (Planz)	64	70	70	65	55	47	60	71	77	61	59	60	59	63	61	61	46

* The site does not meet completeness criteria for the year, pursuant to Appendix N to Part 50, Title 40.
†Site was not in operation.

Table A-6 Single Year Annual Mean PM2.5 Concentrations (µg/m^3)

SJV Monitoring Sites	Average 2000-2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Stockton-University Park	14.2	13.1	12.9	14.4	11.3	10.6	11.3	12.4	17.7	12.1	12.8	11.8	12.1	17.6	9.3	14.0	12.8	10.2	10.7*
Manteca						17.6*	10.7	8.1	11.6	9.8	12.6	9.8	11.1	13.4	8.1*	14.8	11.7	9*	7.9
Modesto-14th Street	15.8	14.8	15.0	16.0	13.0	12.1	14.7	11.9	14.3	11.4	9.1*	11.1	12.9	15.2	7.7	14.5	15.0	13.4	10.5
Turlock				30.3*	16.1	12.7	17.1	14.8	15.0	12.3	14.2	12.6	12.7	17.2	10.6	15.5	12.8	10.8	10.1
Merced-M St	15.8	14.8	15.2	14.9*	13.6	11.2	10.4	9.5	13.5	11.2	12.6	11.2	12.6	14.2	9.6	15.5	11.1	10.5	9.6
Merced-Coffee					22.7*	16.3	15.6	11.0	13.3	10.8	12.7	11.9	13.3	15.1	9.1	14.7	11.3	9.8	8.4
Madera-City						21.1*	20.4	16.0	17.8	14.0	13.8	12.0	12.5	14.0	9.7	16.9	12.4	10.4	9.9
Clovis-Villa	16.6	16.4	16.4	16.2	18.3	14.6	17.9	15.4	15.9	14.8	15.0	12.5	13.1	14.3	10.2*	18.4	15.1	10.5	8.6
Fresno-Garland	18.4	16.8	18.8	17.4	15.1	13.0	15.5	14.1	16.8	15.1	14.4	12.7	14.9	16.2	11.1	19.2	15.6	12.7	10.5
Fresno-Pacific	18.3	17.6	16.8	16.5	14.6	13.4	15.4	12.7	15.9	13.8	14.1	13.0	15.0	17.1	11.2	18.6	13.8	13.5	12.6
Fresno-Foundry																20.3	17.2	14.8	12.5
Tranquillity					11.8*	7*	8.2	7.0	8.3	7.6*	10.0	7.7	8.3	11.1	5.8	11.5	8.9	6.7	4.8
Corcoran-Patterson	18.0	16.9	18.4	15.8	17.7	17.9	12.8*	16.5*	15.6	15.4	35.8*	14.8	16.0	17.1	12.1	19.1	14.8	14.7	10.1
Hanford-Irwin						14.5	18.0	14.8	18.2	17.5	16.5	15.5	17.2	17.7	12.2	19.9	15.6	14.2	12.5
Visalia-W. Ashland Avenue	20.6	18.8	20.4	19.8	16.0	13.6	16.1	14.8	18.9	17.9	16.1	14.7	16.3	17.3	12.9	19.6	20.7	14.9	11.7
Bakersfield-Golden / M St	20.9	18.6	19.9	17.9*	20.0	†	†	†	†	18.1*	16.7	14.8	16.2	18.1	12.4	19.5	17.9	16.6	13.6
Bakersfield-California	20.0	18.7	22.0	21.9	19.0	14.2	16.2	13.0	20.0	18.6	16.3	14.8	15.9	17.7	11.9	19.7	16.6	15.8	12.0
Bakersfield-Airport (Planz)	19.9	19.3	21.8	23.5	22.5	17.6	14.5	14.7	22.8	21.6	17.9	15.9	18.2	19.4	13.0	20.3	20.0	16.1	12.5

* The site does not meet completeness criteria for the year, pursuant to Appendix N to Part 50, Title 40.
†Site was not in operation.

Table A-7 Annual PM2.5 Design Values (Three-Year Averages, µg/m³)

SJV Monitoring Sites	Average 2000-2007	2006-2008	2007-2009	2008-2010	2009-2011	2010-2012	2011-2013	2012-2014	2013-2015	2014-2016	2015-2017	2016-2018	2017-2019	2018-2020	2019-2021	2020-2022	2021-2023
Stockton-University Park	14.7	13.5	12.9	12.1	11.1	11.4	13.8	14.0	14.2	12.2	12.2	13.8	13.0	13.7	12.1	12.4	11.2*
Manteca				17.6*	14.2*	12.1*	10.2	9.8*	11.3*	10.7	11.2	11.5	10.9*	12.2*	11.6*	11.8*	9.5
Modesto-14th Street	16.7	15.3	14.7	13.7	13.3	12.9	13.6	12.5	11.6*	10.5*	11.0*	13.1	11.9	12.5	12.4	14.3	13.0
Turlock		30.3*	23.2*	19.7*	15.3	14.9	15.7	14.0	13.8	13.0	13.2	14.2	13.5	14.5	13.0	13.1	11.3
Merced-M St	16.4	15.0	14.5	13.2	11.7	10.4	11.1	11.4	12.5	11.7	12.1	12.7	12.2	13.1	12.1	12.3	10.4
Merced-Coffee			22.7*	19.5*	18.2*	14.3	13.3	11.7	12.3	11.8	12.7	13.4	12.5	13.0	11.7	11.9	9.8
Madera-City				22.0*	21.2*	19.2*	18.1	15.9	15.2	13.3	12.8	12.8	12.0	13.5	13.0	13.3	10.9
Clovis-Villa	17.2	16.4	17.0	16.4	17.0	16.0	16.4	15.3	15.2	14.1	13.5	13.3	12.5*	14.3*	14.6*	14.7	11.4
Fresno-Garland	20.1	17.7	17.1	15.2	14.6	14.2	15.5	15.4	15.4	14.1	14.0	14.6	14.1	15.5	15.3	15.8	13.0
Fresno-Pacific	18.2	17.0	16.0	14.9	14.5	13.8	14.7	14.1	14.6	13.6	14.0	15.0	14.5	15.7	14.6	15.3	13.3
Fresno-Foundry														20.3*	18.8*	17.5	14.8
Tranquillity			11.8*	9.4*	9.0*	7.4*	7.8	7.7*	8.7*	8.5*	8.7	9.1	8.4	9.5	8.8	9.1	6.8
Corcoran-Patterson	17.5	17.0	17.3*	17.1*	16.2*	15.8*	15.0*	15.8	22.2*	22.0*	22.2*	16.0	15.1	16.1	15.4	16.2	13.2
Hanford-Irwin				14.7	16.4	15.8	17.0	16.8	17.4	16.5	16.4	16.8	15.7	16.6	15.9	16.6	14.1
Visalia-W. Ashland Avenue	21.3	19.7	18.8	16.5	15.2	14.8	16.6	17.2	17.6	16.2	15.7	16.1	15.5	16.7	17.8	18.5	15.7
Bakersfield-Golden / M St	21.3	18.8*	19.3*	19.0*	20.0*	†	†	18.1*	17.4*	16.5*	15.9	16.4	15.5	16.6	16.6	18.0	16.0
Bakersfield-California	20.5	20.9	21.0	18.4	16.5	14.5	16.4	17.2	18.3	16.5	15.7	16.1	15.2	16.4	16.1	17.4	14.8
Bakersfield-Airport (Planz)	20.0	21.5	22.6	21.2	18.2	15.6	17.3	19.7	20.8	18.4	17.3	17.8	16.9	17.6	17.8	18.8	16.2

* The site does not meet completeness criteria for the year, pursuant to Appendix N to Part 50, Title 40.
†Site was temporarily not in operation.

Figure A-3 San Joaquin County 24-Hour Design Value Trend

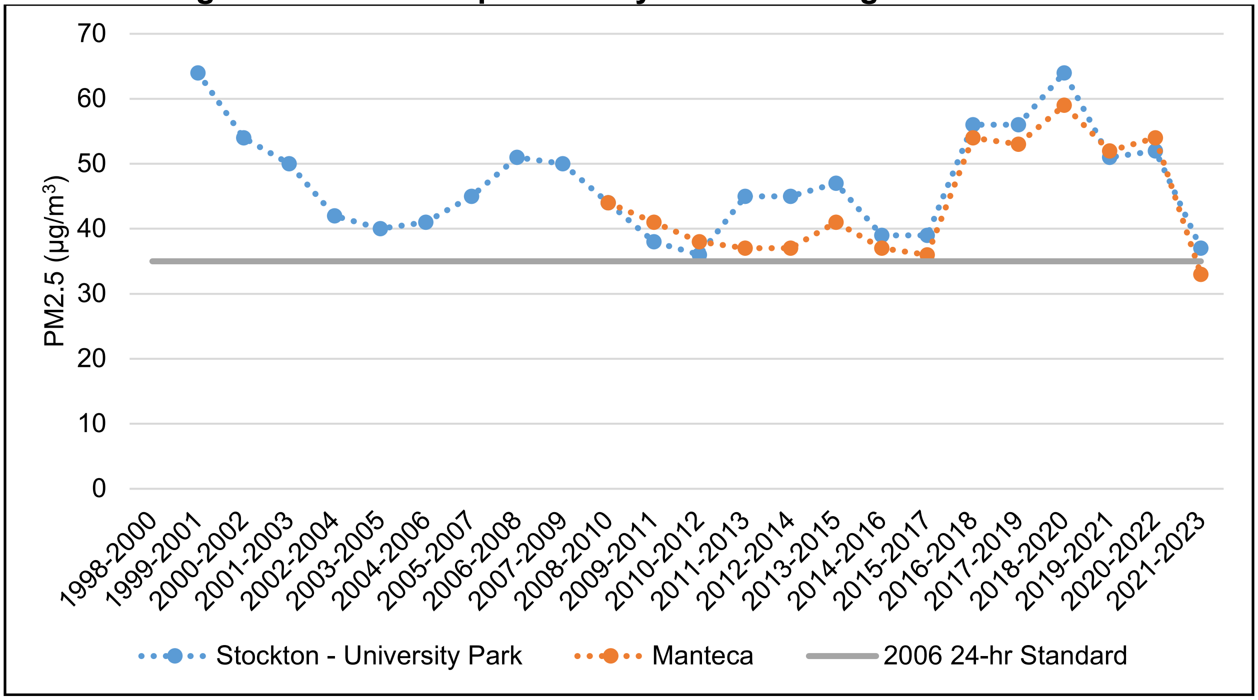


Figure A-4 San Joaquin County Annual Design Value Trend

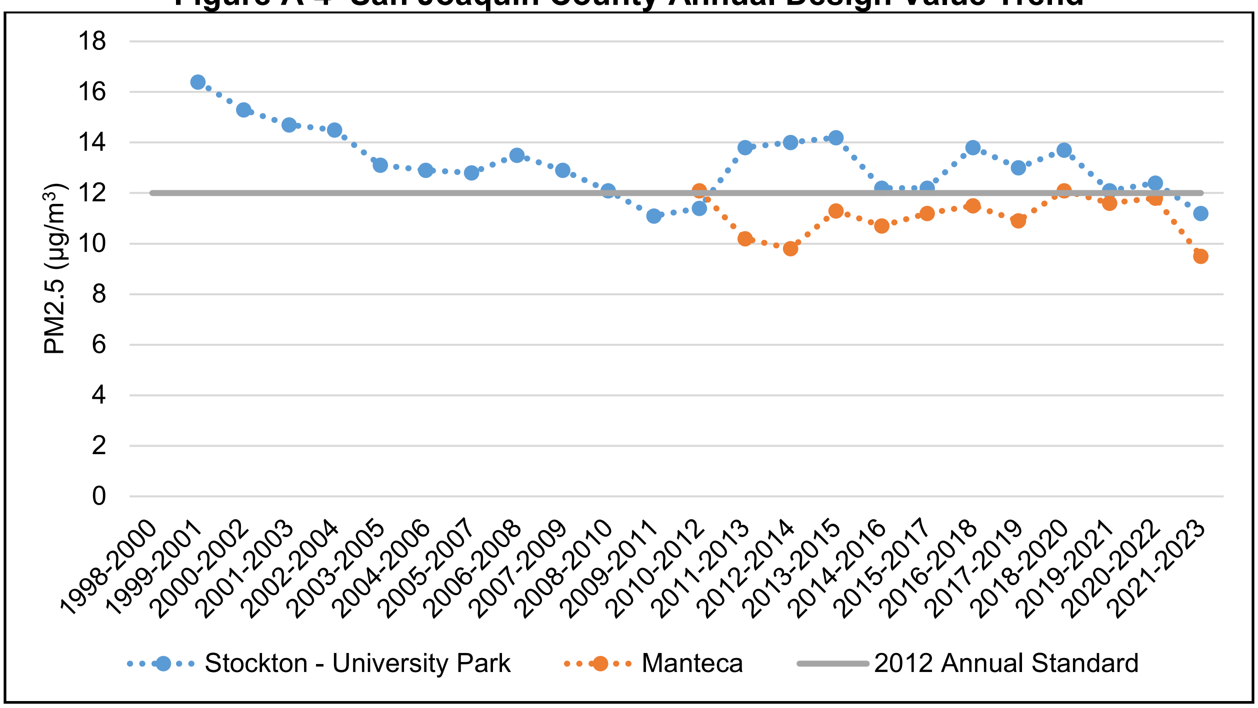


Figure A-5 Stanislaus County 24-Hour Design Value Trend

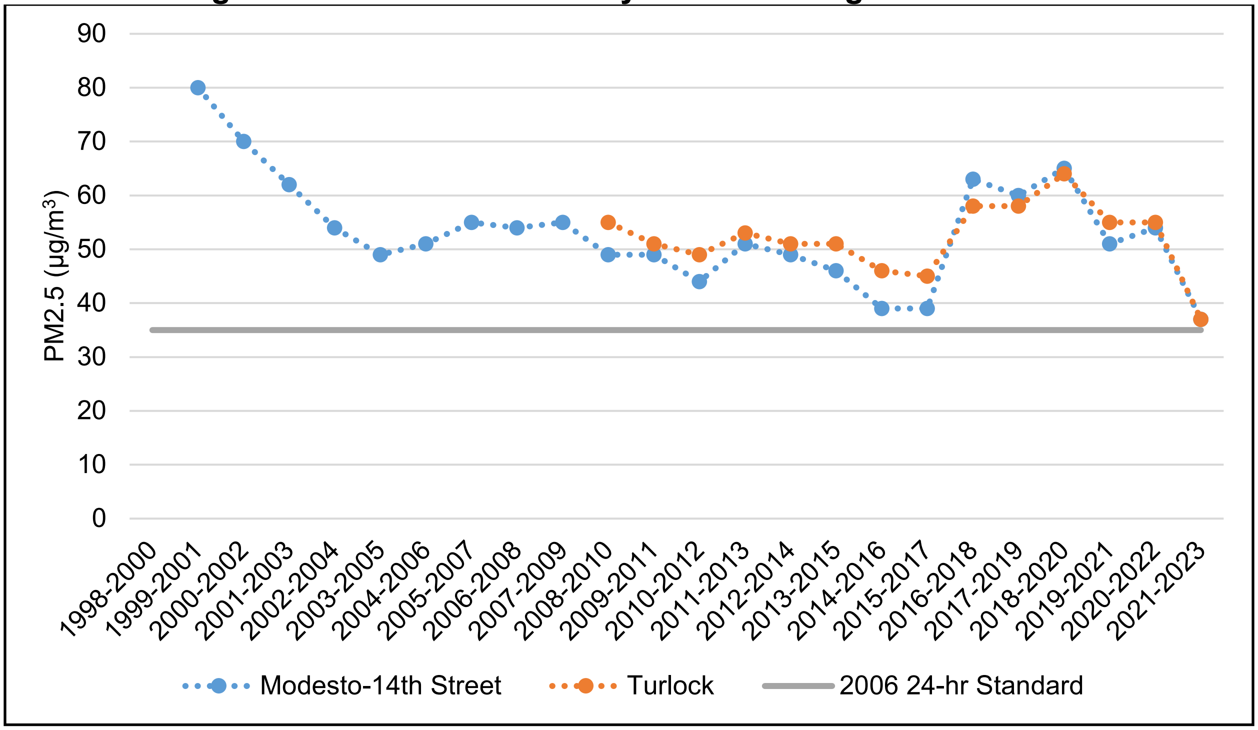


Figure A-6 Stanislaus County Annual Design Value Trend

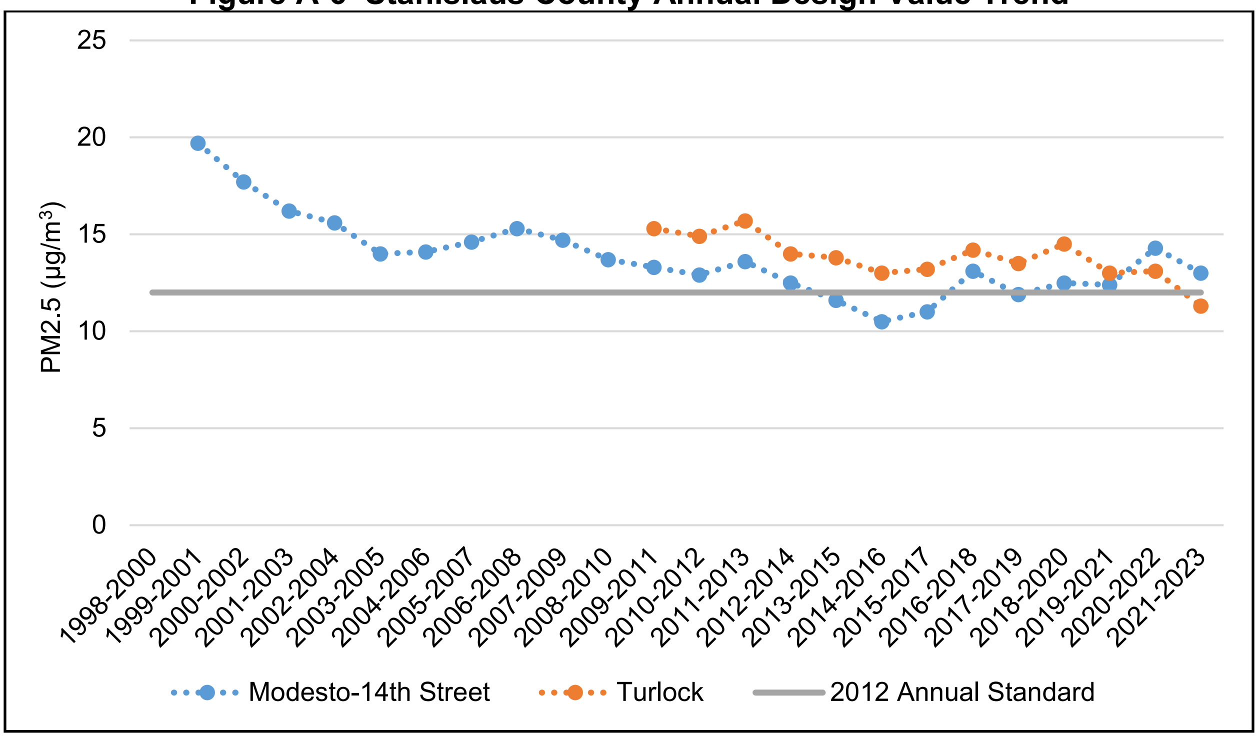


Figure A-7 Merced County 24-Hour Design Value Trend

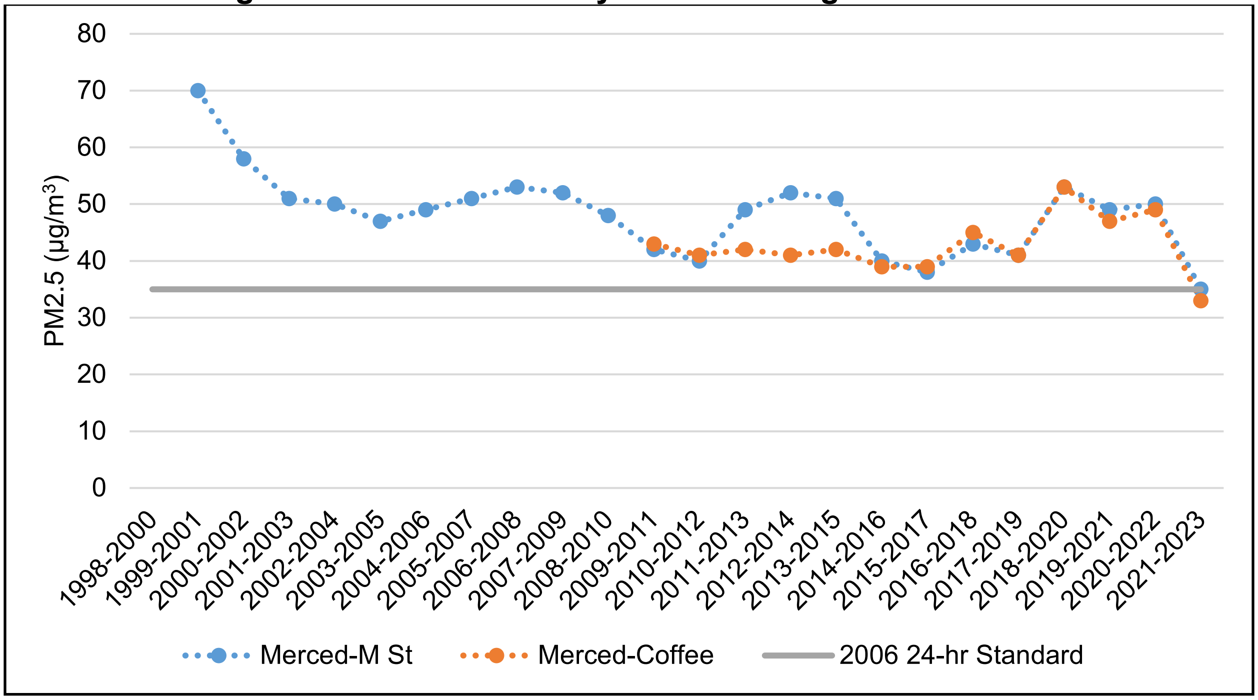


Figure A-8 Merced County Annual Design Value Trend

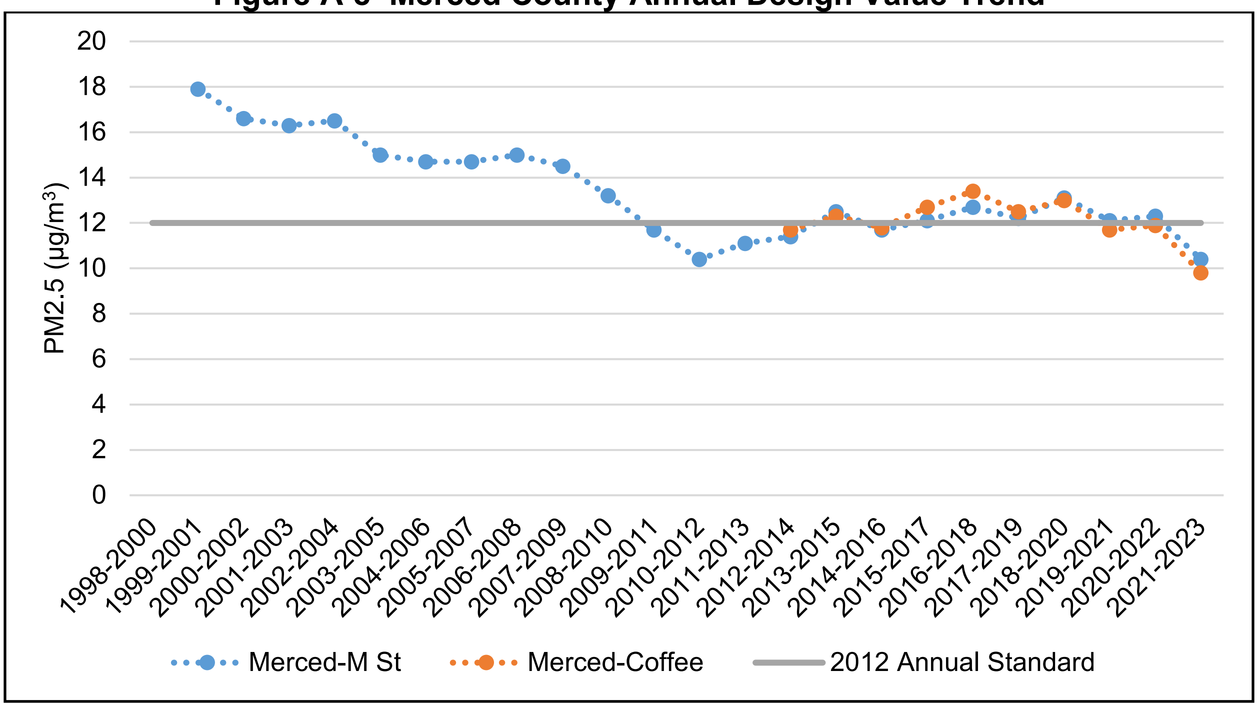


Figure A-9 Madera County[26] 24-Hour Design Value Trend

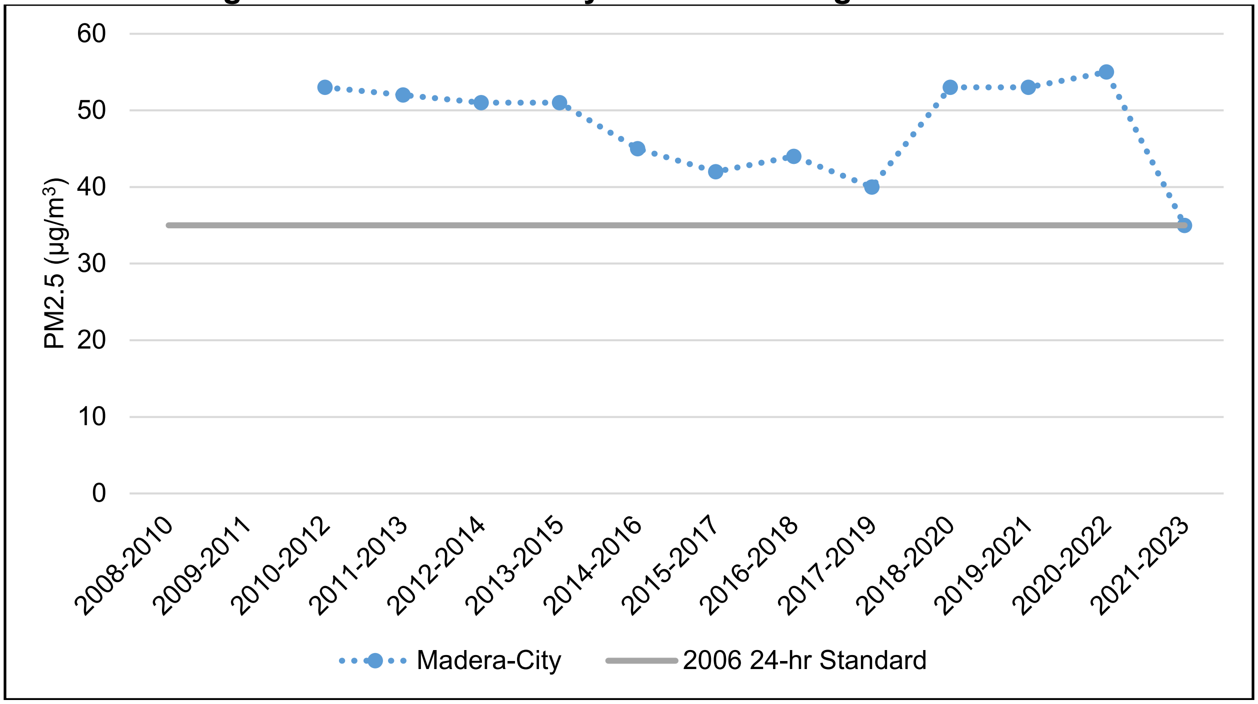
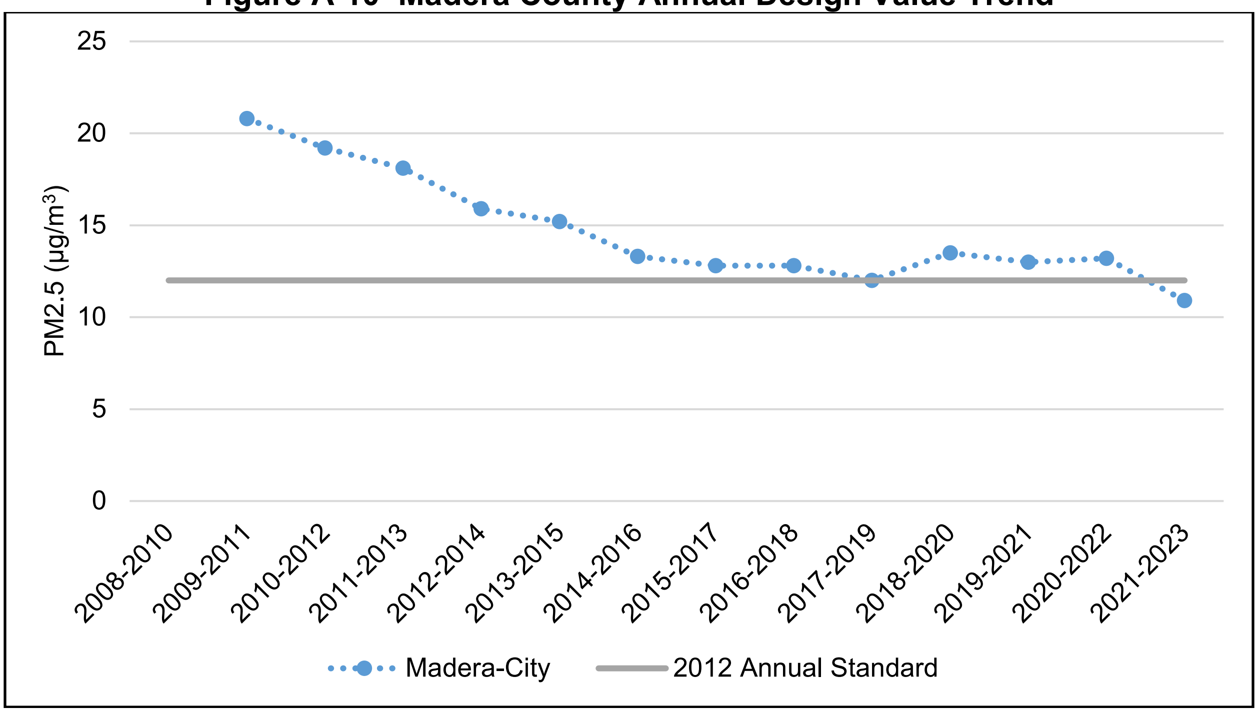


Figure A-10 Madera County Annual Design Value Trend



[26] PM2.5 monitoring in Madera County began in 2010.

Figure A-11 Fresno County 24-Hour Design Value Trend

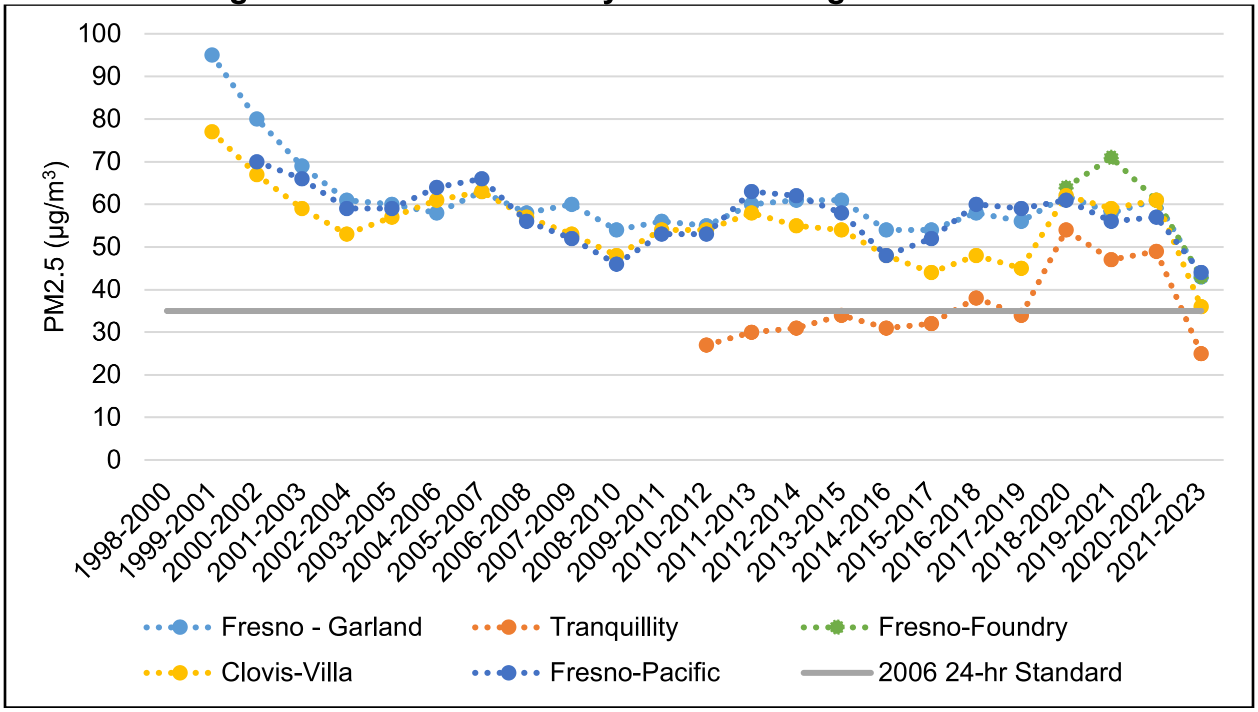


Figure A-12 Fresno County Annual Design Value Trend

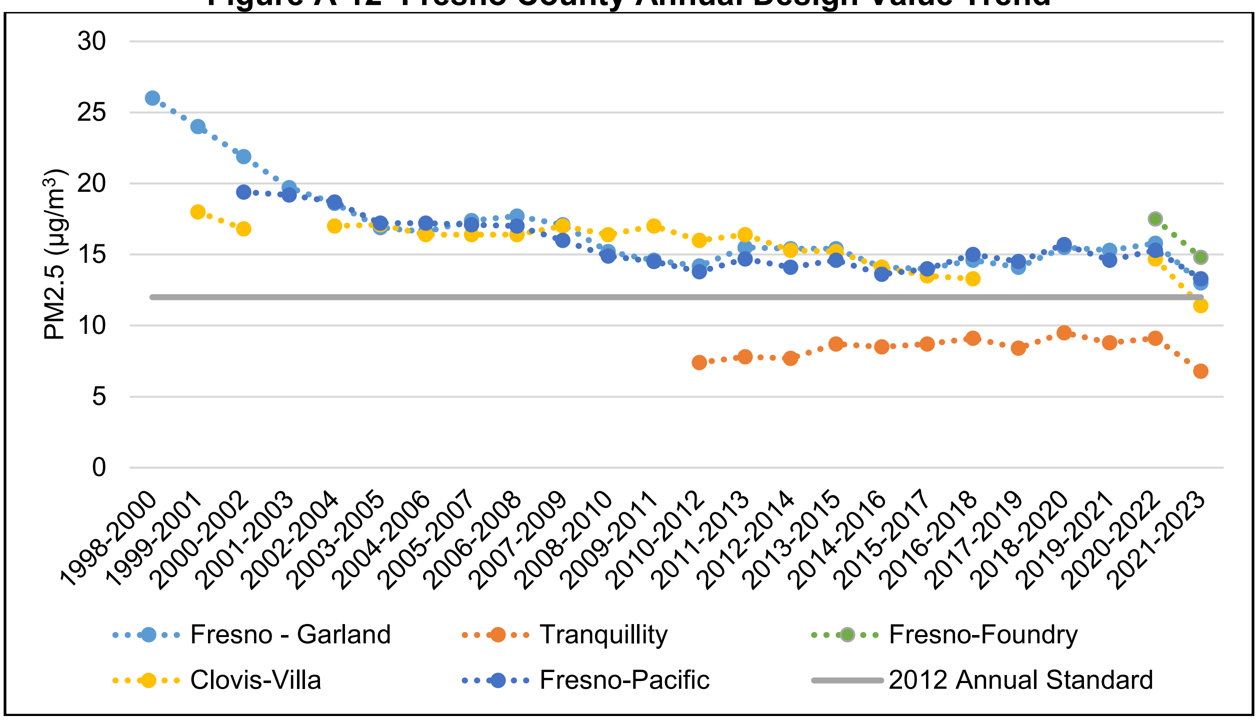


Figure A-13 Kings County 24-Hour Design Value Trend

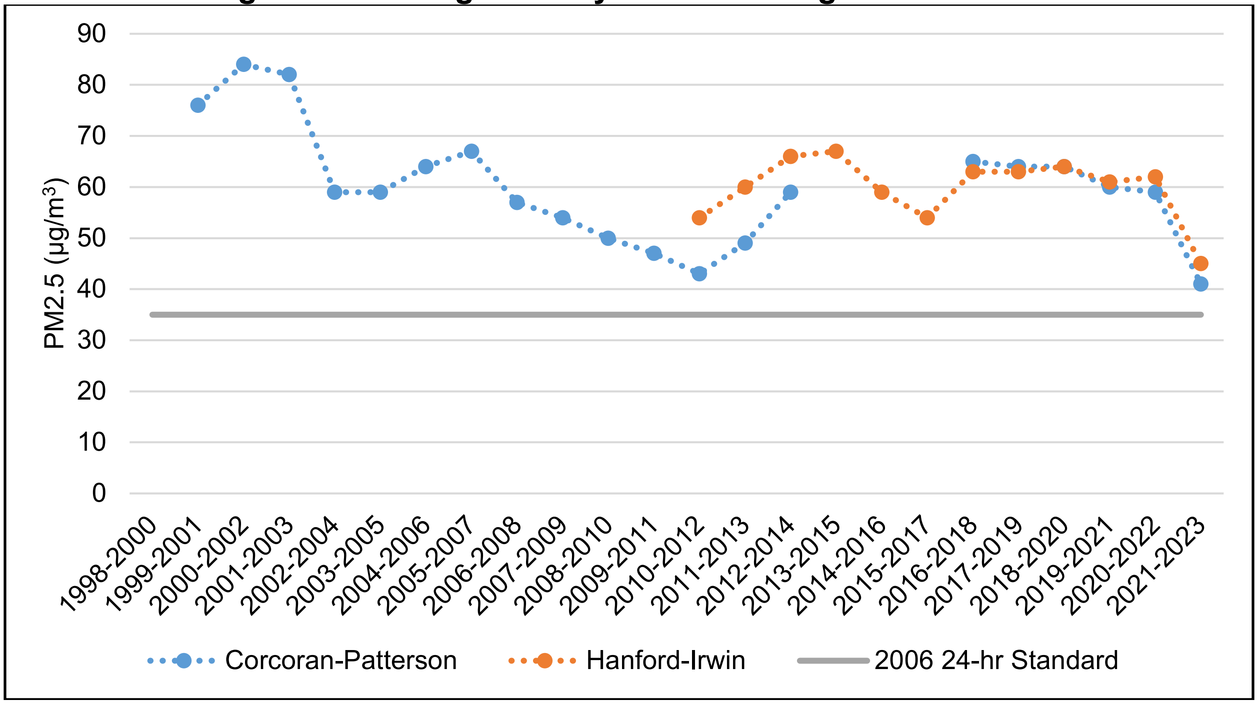


Figure A-14 Kings County Annual Design Value Trend

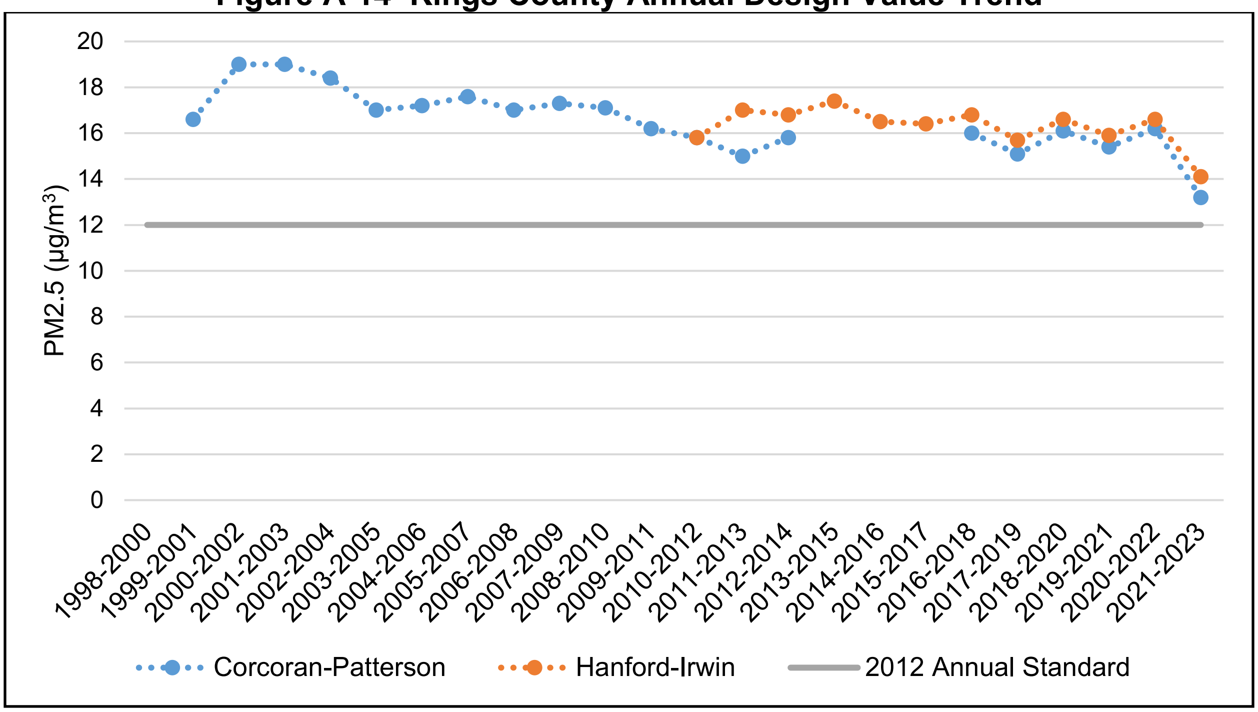


Figure A-15 Tulare County 24-Hour Design Value Trend

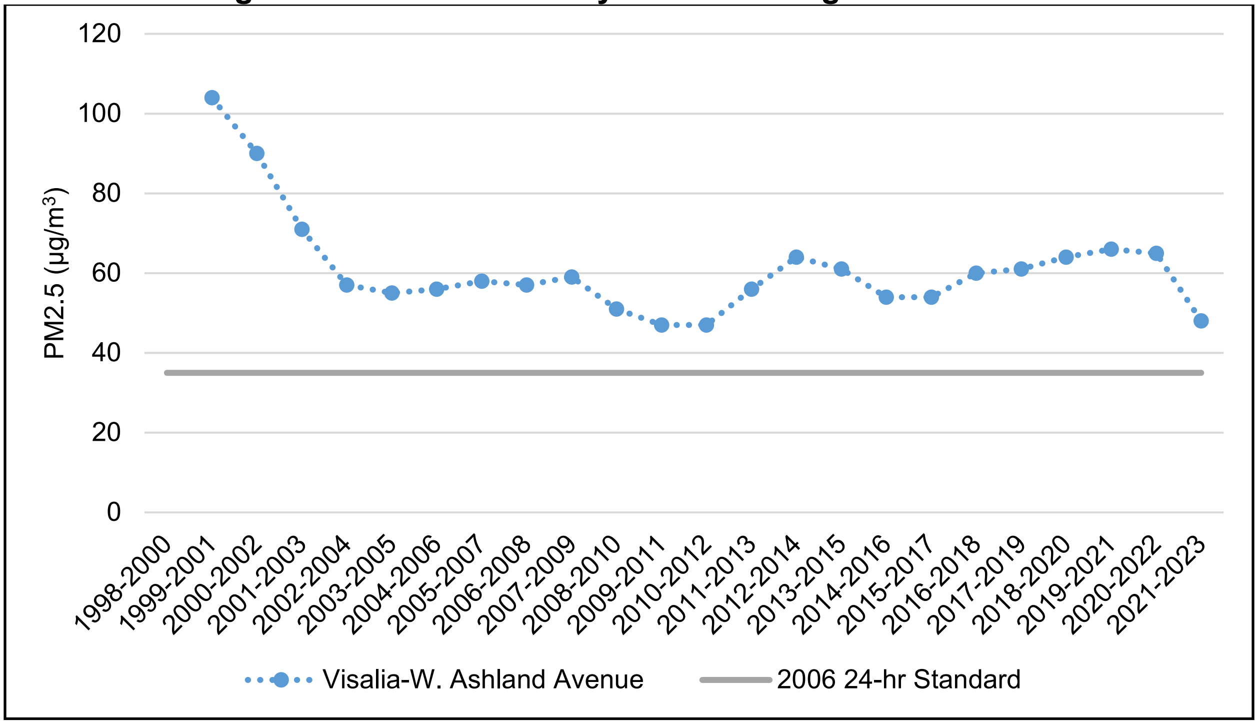


Figure A-16 Tulare County Annual Design Value Trend

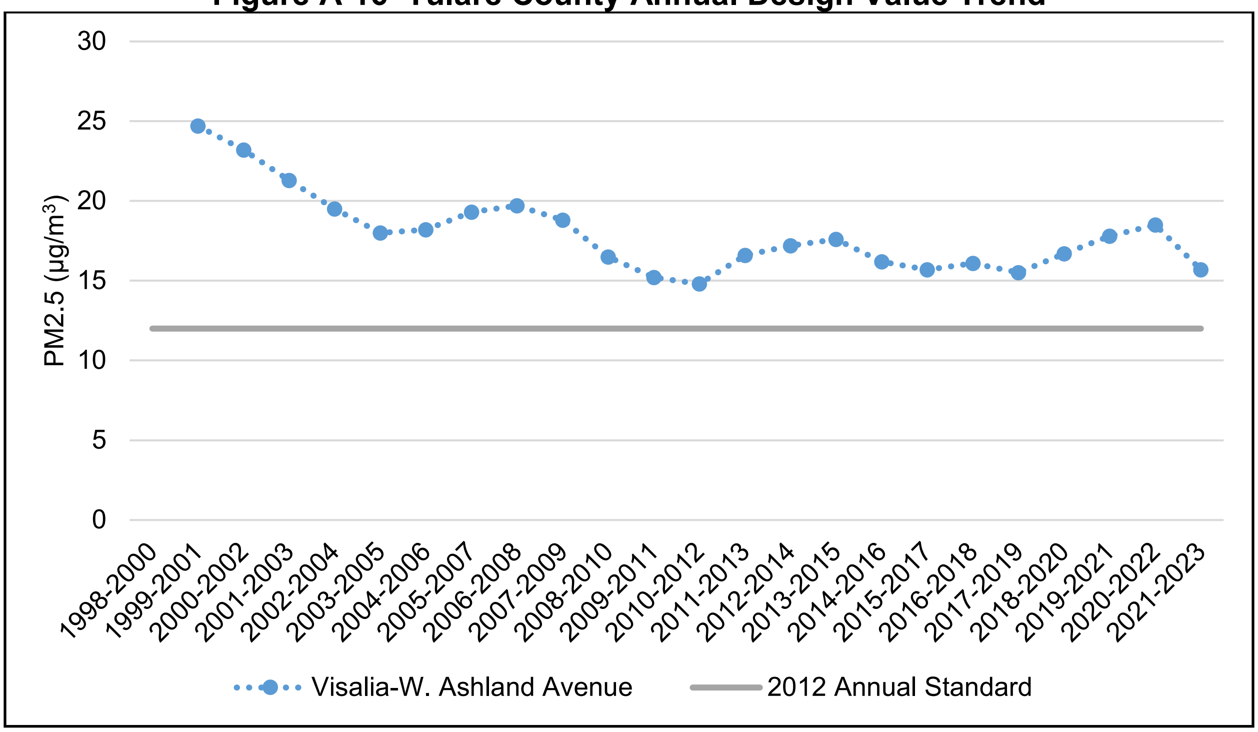


Figure A-17 Kern County 24-Hour Design Value Trend

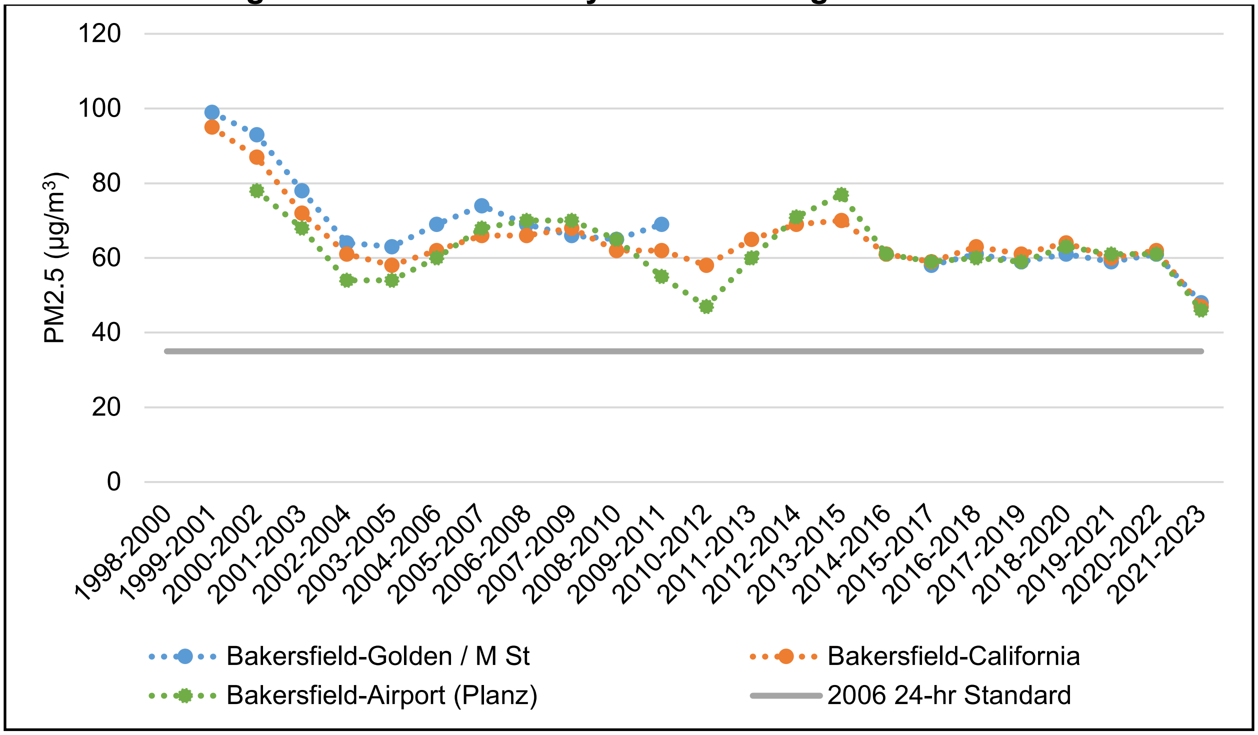
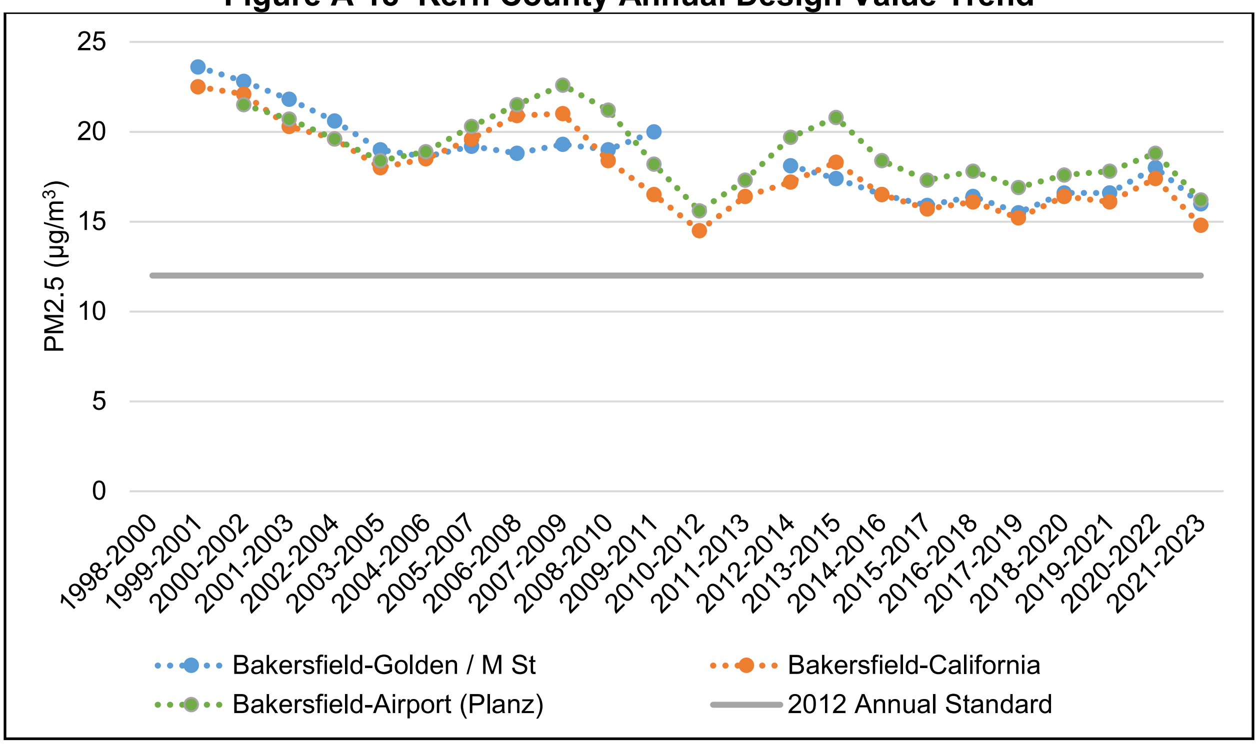


Figure A-18 Kern County Annual Design Value Trend



A.3 AMBIENT PM2.5 CONCENTRATION DATA TRENDS

A design value is a metric for summarizing data for a three-year time period from a monitoring site for comparison to the NAAQS. Although these parameters are required for attainment demonstrations, design values alone do not reveal the hourly, daily, weekly, seasonal, and regional PM2.5 effects on public health, nor do they track air quality improvements within such parameters. The District uses data from air monitoring sites to analyze air quality trends for a deeper understanding of changes in ambient PM2.5 concentrations as they relate to the implementation of District programs. Trends also inform the attainment planning process and Health Risk Reduction Strategy.

A.3.1 Days Over the 24-Hour PM2.5 Standard of 35 µg/m³

Design value calculations for the 24-hour standard use the 98th-percentile concentration value from each monitoring site (higher values in the 99th and 100th percentiles represent extreme outliers and are not used for comparing to the NAAQS). Because of this, a region may experience a limited number of days over the standard and still be considered in attainment.

The number of days over the 24-hour PM2.5 standard is another indicator of air quality progress. Figure A-19 shows the trend of the number of days the Valley exceeded the 2006 24-hour PM2.5 standard of 35 µg/m³. There is an overall decrease in the number of exceedances of the 35 µg/m³ standard since PM2.5 has been monitored.

During the height of the drought years from 2013 to 2015, the Valley experienced an increase in the number of days exceeding this standard. As previously mentioned in Section A.1.2.2, 2020 and 2021 were heavily impacted by wildfires. Increases in atmospheric stability over recent years also caused an increase in PM2.5 concentrations, as shown in Figure A-2.

As shown in Figure A-20 to Figure A-27, the Valley has experienced a drop in exceedances in each county within the District's jurisdiction. As an example of the progress that has been made, Figure A-24 shows that Fresno County recorded 81 exceedances in 2002, and recorded 10 exceedances in the year 2023, which is an 87.7% improvement. Similarly, Figure A-27 shows that Kern County recorded 78 exceedances in 2002, and recorded 9 exceedances in the year 2023, which is a decrease of 88.5%. As these trends display, exceedances of the 2006 24-hour PM2.5 standard have decreased in the Valley, despite some years influenced by drought, wildfires, or exceptionally poor dispersion conditions.

Over the past quarter of a century, the District has worked to develop and operate a robust PM2.5 air monitoring network; however, there was not a complete record of daily PM2.5 measurements for each county in the Valley until about the past decade, from around 2010 forward. Even after 2010, with the intermittent monitoring schedule at the FRM monitoring sites (e.g., 1 sample every 3 days), a complete daily record of PM2.5 measurements has not been available for all counties in the Valley. In order to compare the count of days over the standard from year to year, the District's gap-filling methods were used to create a daily PM2.5 record for each county in the Valley. Spatial interpolation and regional models are often used to estimate air quality between monitors. Regression equations were developed to estimate missing observations by using other sites in the network as independent variables. The estimated PM2.5 concentrations are representative of air quality beginning in the early 2000s and are thus comparable to concentrations collected by the District's modern day air monitoring network for the purpose of determining the number of county days above or below the respective standards. The gap-filling method is not used in the calculation of design values or when determining attainment status of a NAAQS.

Figure A-19 Number of Days Valley Exceeded the 24-hour 35 μg/m³ Standard

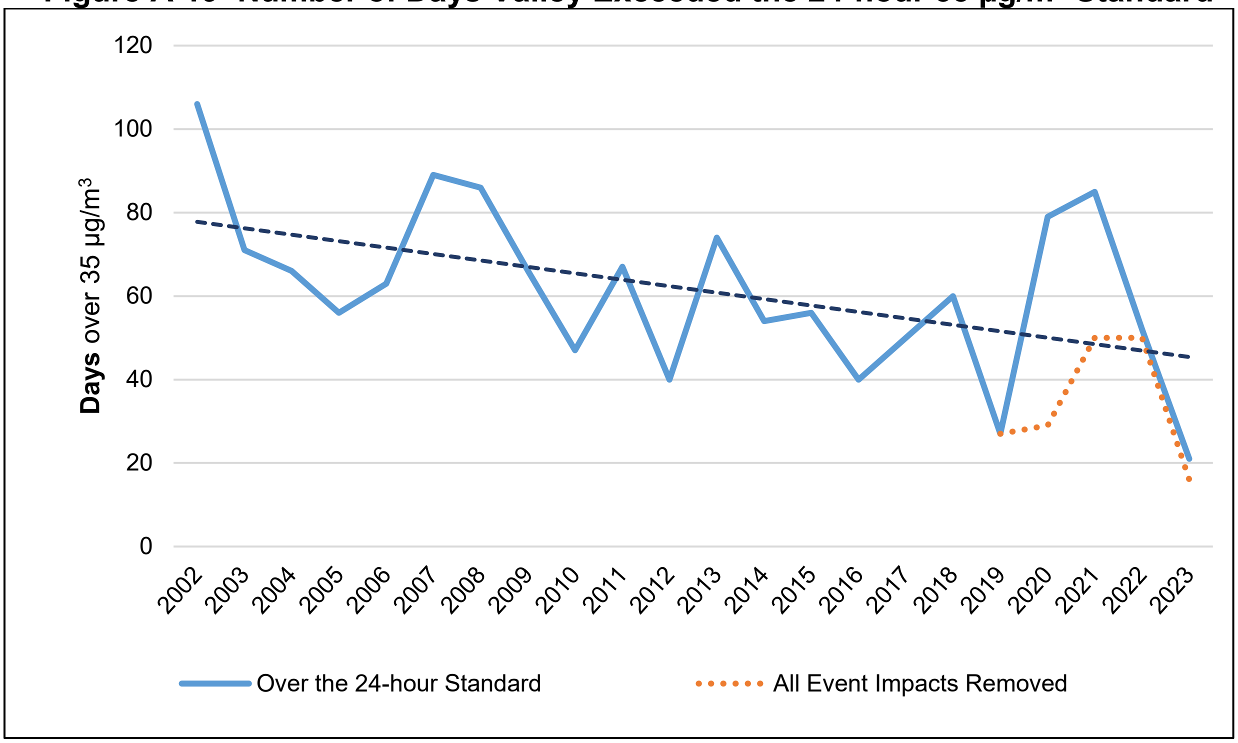


Figure A-20 San Joaquin County - Days Over the 24-hour 35 µg/m^3 Standard

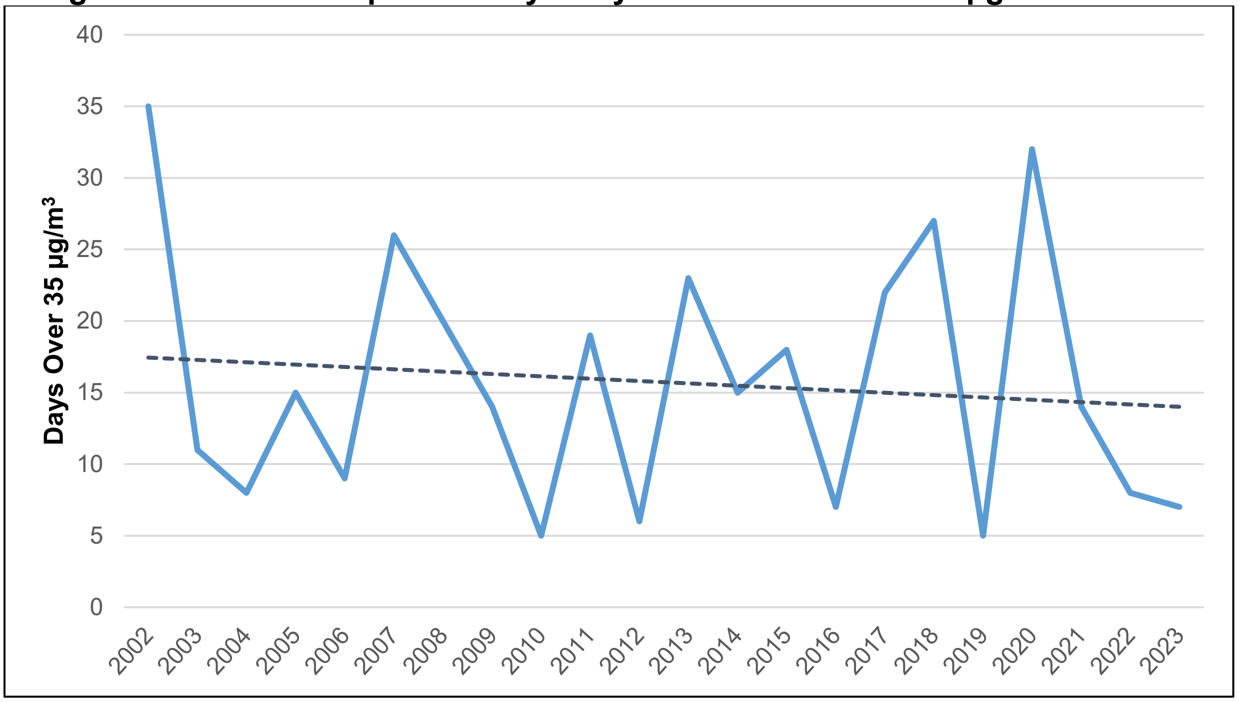


Figure A-21 Stanislaus County - Days Over the 24-hour 35 µg/m^3 Standard

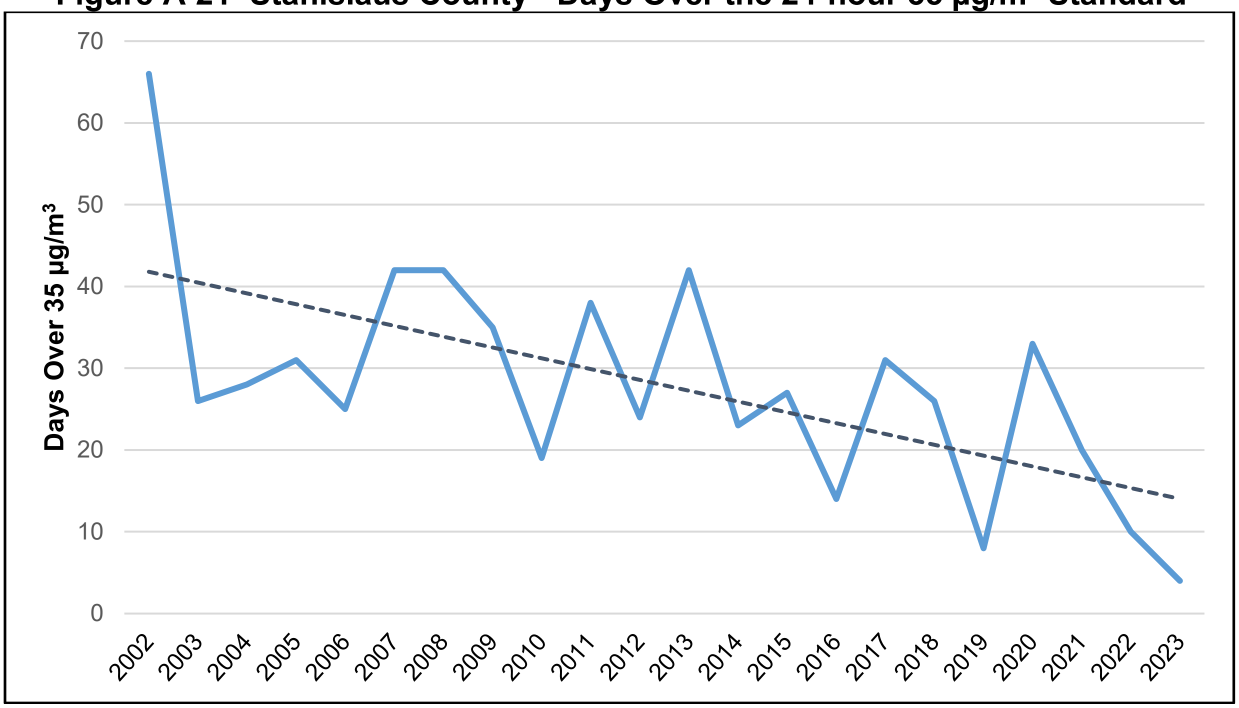


Figure A-22 Merced County - Days Over the 24-hour 35 µg/m³ Standard

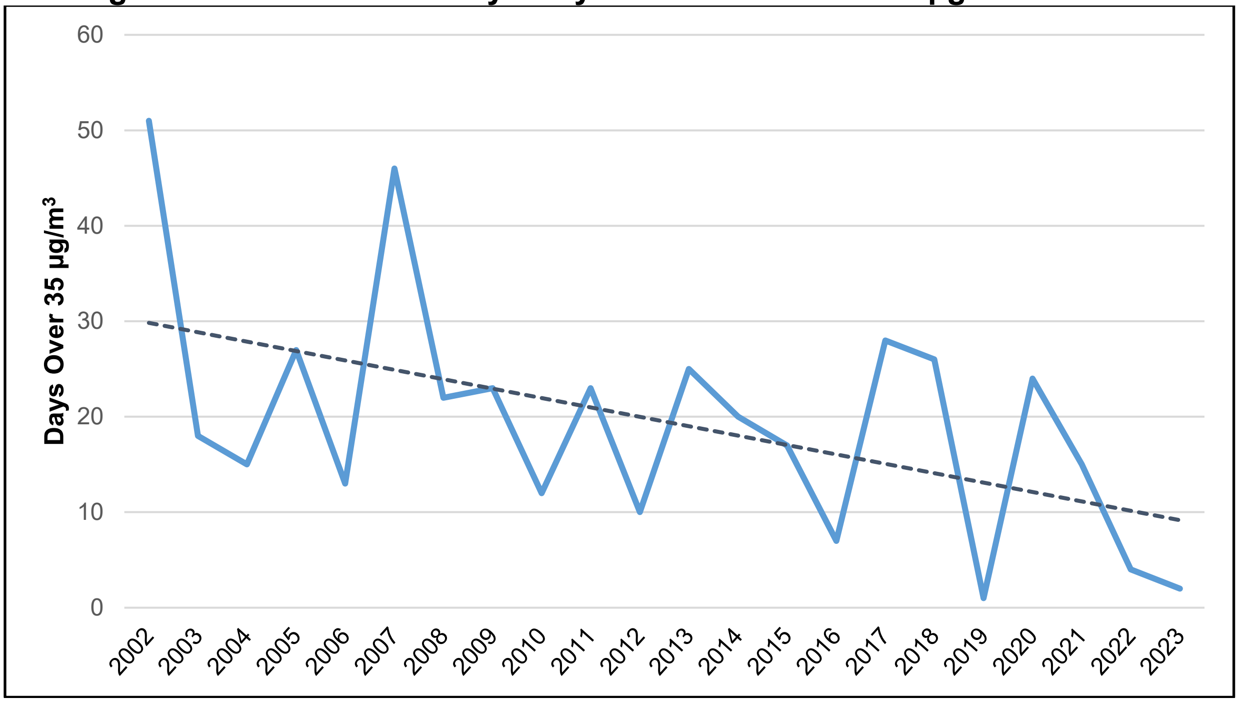
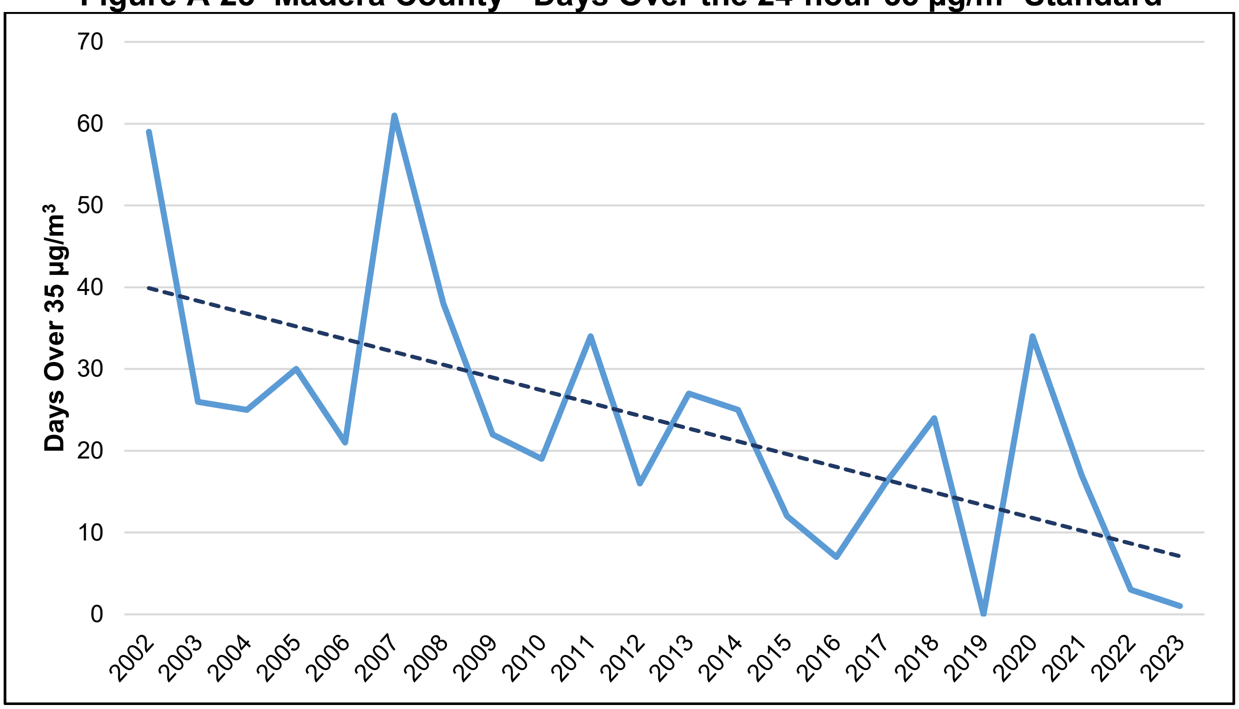


Figure A-23 Madera County - Days Over the 24-hour 35 µg/m³ Standard



* PM2.5 monitoring in Madera County began in 2010.

Figure A-24 Fresno County - Days Over the 24-hour 35 µg/m³ Standard

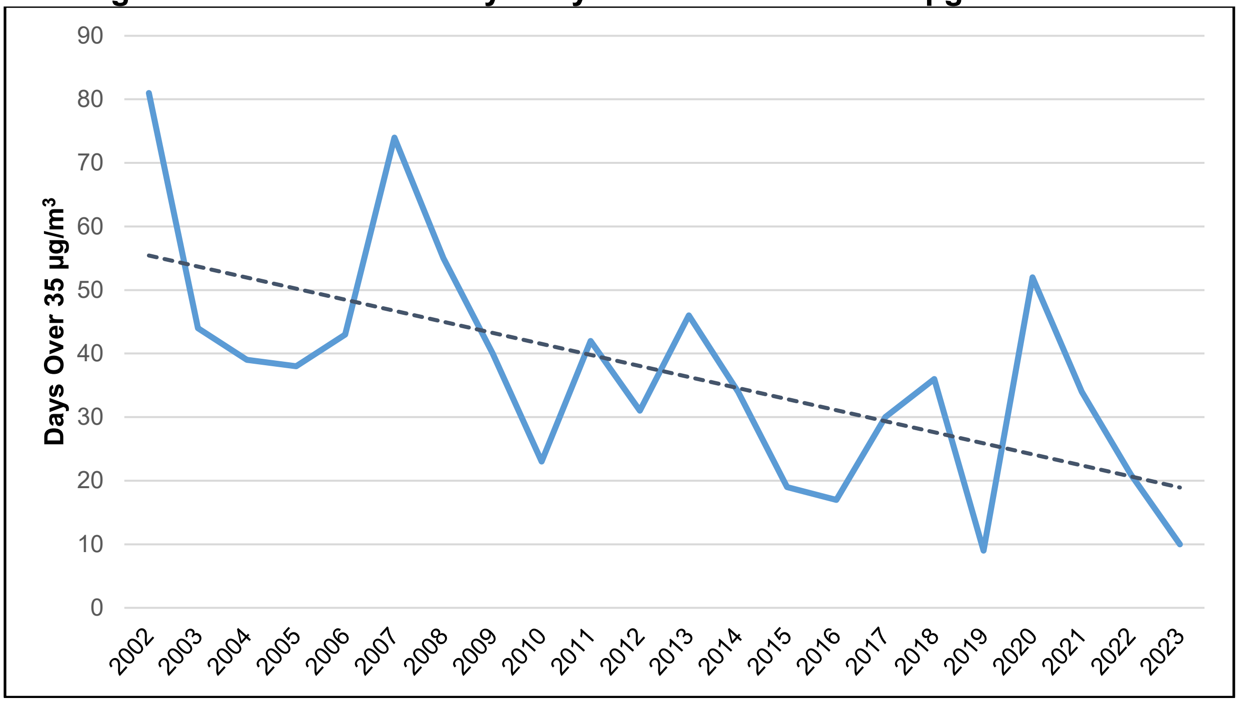


Figure A-25 Kings County - Days Over the 24-hour 35 µg/m³ Standard

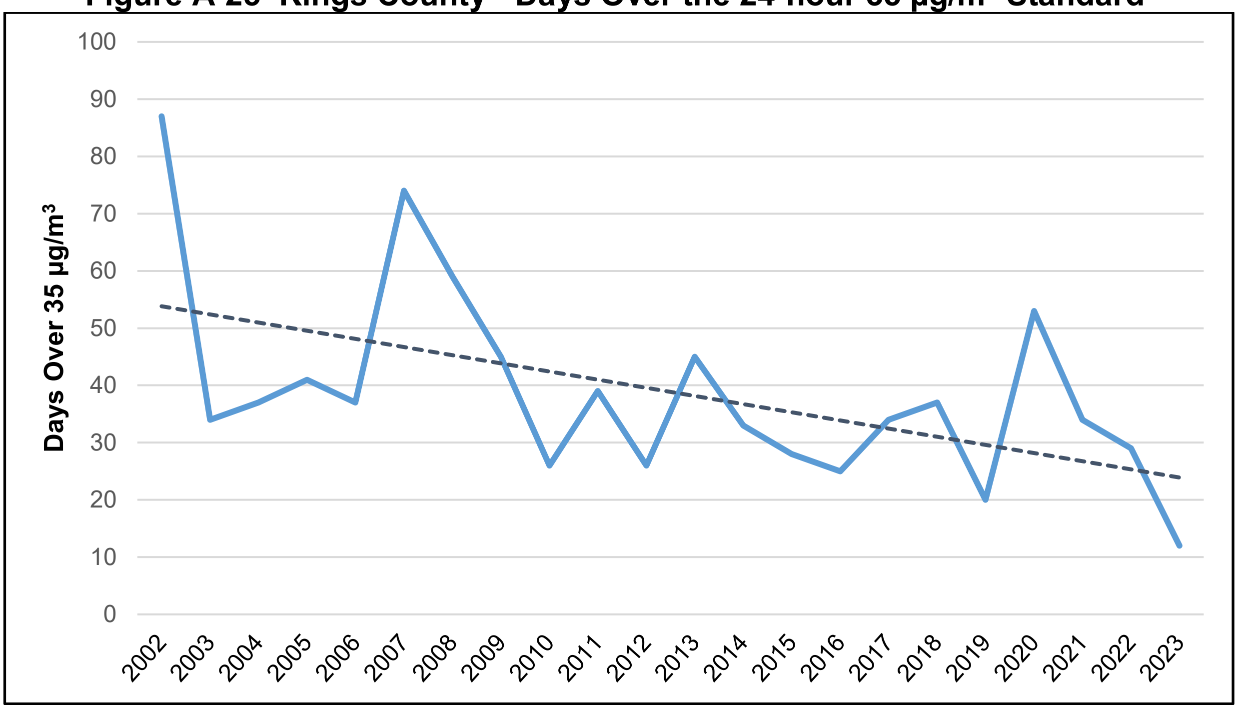


Figure A-26 Tulare County - Days Over the 24-hour 35 µg/m³ Standard

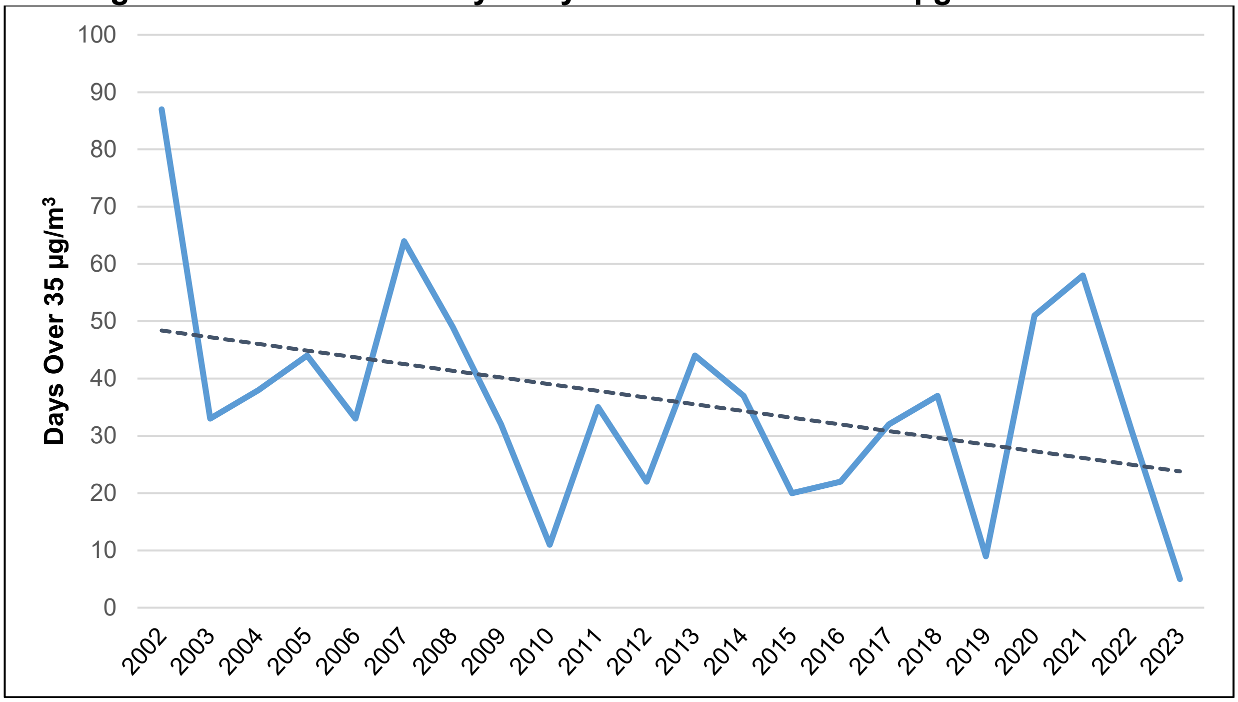


Figure A-27 Kern County - Days Over the 24-hour 35 µg/m³ Standard

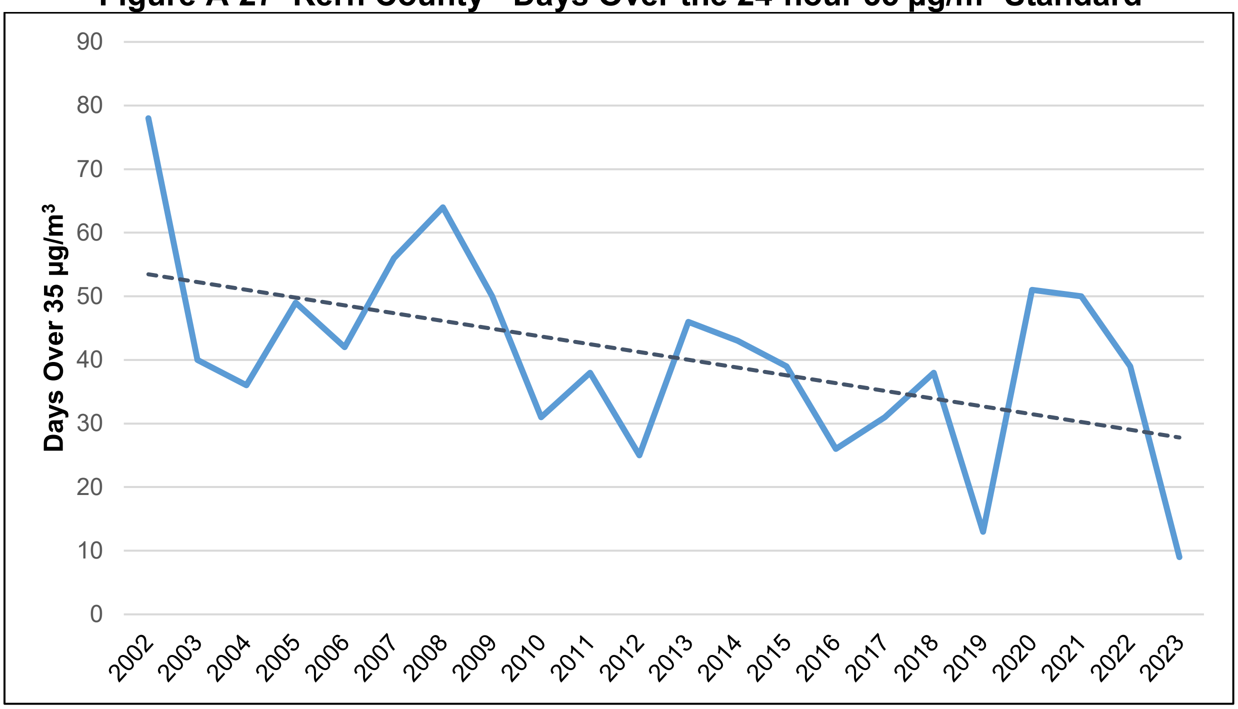


Table A-8 shows the number of days per month the Valley exceeded the 2006 24-hour PM2.5 standard of 35 µg/m³. The data are grouped by winter season (November – February) instead of calendar year (January – December) to highlight the decrease in PM2.5 per season when concentrations are the highest in the year.

Starting in 2008, the District began to increase the number of real-time PM2.5 analyzers operating throughout its air monitoring network, allowing for more daily samples instead of collecting samples every three or six days through filter-based methods. Through this change, the PM2.5 monitoring record is able to better demonstrate the day-to-day air quality trends throughout the Valley. As shown in Table A-8, the Valley has seen a significant drop in the number of exceedances of 35 $\mu g/m^3$ standard, even with additional real-time analyzers added to the network.

In the 2000-2001 winter season, there were 83 days where the 2006 24-hour PM2.5 standard was exceeded across the District. Comparing this to the 35 exceedances that occurred in the 2022-2023 period, this represents a 57.8% decrease in the number of violations throughout the District even with the addition of real-time monitors, and even with the poor dispersion conditions that occurred in November and December of 2022. This difference demonstrates the progress that the District has made in improving the PM2.5 air quality throughout the Valley.

As noted in Section A.1.2.1, the 2011-2012, 2013-2014, 2019-2020, 2020-2021, and 2021-2022 winter seasons had very stable atmospheric stagnation periods, which, combined with California's drought conditions, increased the District's PM2.5 concentrations. Despite the increase during the drought, the District has still experienced a downward trend in the number of exceedances of the 35 $\mu g/m^3$ standard compared to the beginning of PM2.5 measurements in the Valley during the 1999-2000 period, highlighting the efficacy of the Valley's attainment strategy.

Table A-8 Number of Days Valley Exceeded 35 µg/m³ PM2.5 Standard

Year	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Total
2000-2001				5	23	27	18	7	3				**83**
2001-2002	1			4	18	15	25	16		1			**80**
2002-2003		7		9	24	14	23	9	1				**87**
2003-2004				3	14	9	17	4	4				**51**
2004-2005	1			5	18	12	4	10	3				**53**
2005-2006				4	15	15	11	12					**57**
2006-2007			3	2	11	18	25	10					**69**
2007-2008	2		2	4	21	13	13	10	2		1	8	**76**
2008-2009	6		2	6	18	16	24	5					**77**
2009-2010				8	14	21	10	8		1			**62**
2010-2011	1		2	4	14	10	14	5				1	**51**
2011-2012				8	9	28	22	2					**69**
2012-2013					11	5	20	6	1		1		**44**
2013-2014	4	2		1	15	27	27	3				3	**82**
2014-2015	1			1	13	5	23	11					**54**
2015-2016		3	2		6	8	6	8					**33**
2016-2017			1		11	12	2	2	1				**29**
2017-2018	1		3	4	9	28	13	7					**65**
2018-2019	4	13			16	11	10						**54**
2019-2020	1			2	14	2	3	1					**23**
2020-2021	2	12	22	17	14	18	15	4					**104**
2021-2022	1	12	10	17	18	12	21	10					**101**
2022-2023	1			1	14	13	4	2					**35**

Note: Months with no data represent zero exceedances. 2017, 2020, 2021 impacted by wildfires.

A.3.2 PM2.5 Driven Air Quality Index Analysis

The EPA and the District use the Air Quality Index (AQI) to provide daily information about the Valley's air quality, educate the public about how they can protect their health, and to inform the public about how unhealthy air may affect them. AQI scales exist for all of the criteria pollutants regulated under the CAA, including PM2.5. The current 24-hour average PM2.5 AQI scale is shown in Table A-9 below.

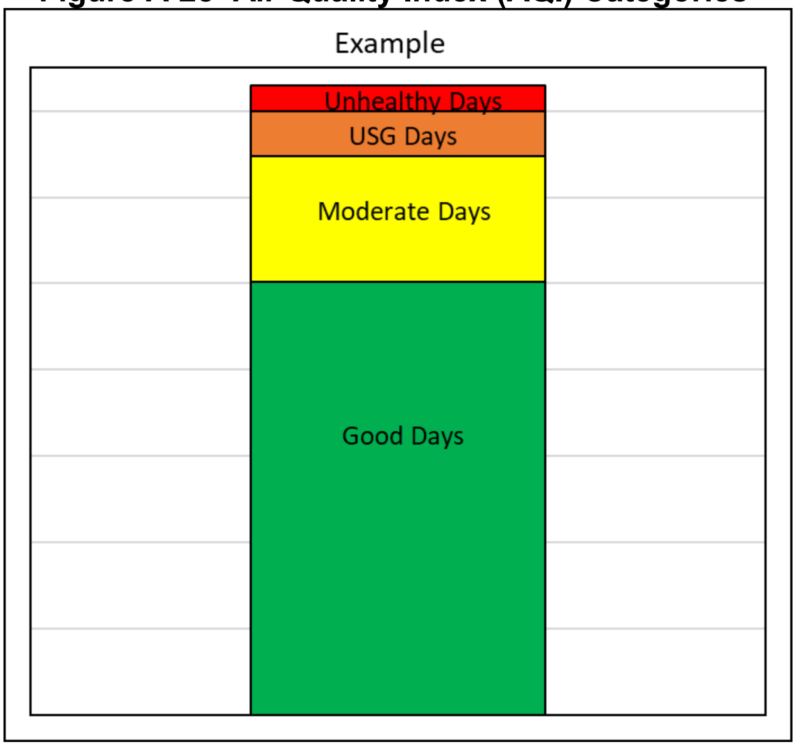
Table A-9 PM2.5 AQI Scale

AQI Category	Index Values	Concentration (µg/m³, 24-hr average)
Good	0 – 50	0 – 12.0
Moderate	51 – 100	12.1 – 35.4
Unhealthy for Sensitive Groups (USG)	101 – 150	35.5 – 55.4
Unhealthy	151 – 200	55.5 – 150.4
Very Unhealthy	201 – 300	150.5 – 250.4
Hazardous	301+	250.5+

For this analysis, the AQI trends are based upon PM2.5 concentrations only, and do not include ozone, PM10, or other pollutants. By excluding the other pollutants, the District is able to isolate the change in air quality trends related to PM2.5.

Figure A-28 is shown as a reference for interpreting the AQI trends shown in Figure A-29 through Figure A-36. The stacked bars represent the percentage of days within each year that fell within each of the AQI categories. Within each stacked bar, the categories are ordered as Good, Moderate, etc. from the bottom up.

Figure A-28 Air Quality Index (AQI) Categories



For the majority of the Valley sites, the observed PM2.5 AQI data for the 2009-2023 timeframe shows an improvement in PM2.5 air quality. Over these 14 years, the frequency of Good PM2.5 AQI days increased, coupled with a decrease in the frequency of the Moderate, Unhealthy-for-Sensitive-Groups (USG), and Unhealthy PM2.5 AQI days. For example, in Fresno County (Figure A-33), the number of Good days increased from 147 in 2009, to 224 in 2023. At the same time, the USG and higher PM2.5 AQI days decreased from 40 to 10.

A similar pattern occurred in other counties, with the frequency of Good PM2.5 AQI days increasing and the frequency of the Moderate and USG AQI days decreasing. For example, in Kern County (Figure A-36), the number of Good days increased from 122 in 2002 to 209 in 2023. In Figure A-29 to Figure A-36, the annual count of PM2.5 AQI county days is based on the highest daily PM2.5 AQI observed from any air monitoring site in the county. These figures, arranged from north to south by county, show that the northern sites have more Good PM2.5 AQI days than the southern sites. For example, San Joaquin County in the northern portion of the Valley averaged nearly 75% Good

AQI days in 2023, about 18% more days in the Good AQI category than Kern County, which averaged around 57% Good AQI. Analysis of Figure A-29 to Figure A-36 demonstrates that the dominant annual PM2.5 AQI categories are the Good and Moderate across the Valley.

In the Valley, PM2.5 concentrations tend to be highest during winter nights as a result of a strong temperature inversion that can trap PM2.5 near the surface, including pollution from residential wood burning. Temperature inversions, in which temperatures increase with altitude, impede the upward flow of air and trap pollutants near the Earth's surface. During these inversions, population exposure to wood smoke increases. In recent winter seasons between 2018 and 2022, a persistent and strong high-pressure ridge over the eastern Pacific Ocean and the western United States effectively blocked weather disturbances from entering California that would normally have removed and replenished the Valley's air with clean air. The historic strength and longevity of this high pressure resulted in a lack of rainfall and stagnation conditions leading to a subsequent increase in the suspended particulate matter in the atmosphere. In addition, the Valley was also impacted by multiple wildfires, which significantly elevated PM2.5 concentrations in 2018, 2020, and 2021. This caused the exceptionally high PM2.5 concentrations found in the Valley and throughout the state of California.

During the 2022-2023 winter season, the weather pattern did fluctuate; however, stable conditions were more prevalent during November due to a prolonged period of high pressure that lasted half of the month. In contrast, the remainder of the 2022-2023 winter season was characterized by unstable conditions as a progressive weather pattern produced a series of dispersive low pressure systems that passed through California during December, January, and February. It should be noted that the progressive weather pattern did alternate between high pressure and low pressure systems at times; however, the high pressure systems were short-lived and not strong enough to offset the degree of instability that governed much of the season. Despite fluctuating dispersion patterns and impacts from wildfires, air quality has improved over the entire period of PM2.5 monitoring in the Valley, as this analysis indicates. During the end of 2023, November and December both saw significant periods of high-pressure stability.

Figure A-29 San Joaquin County PM2.5 AQI Trend

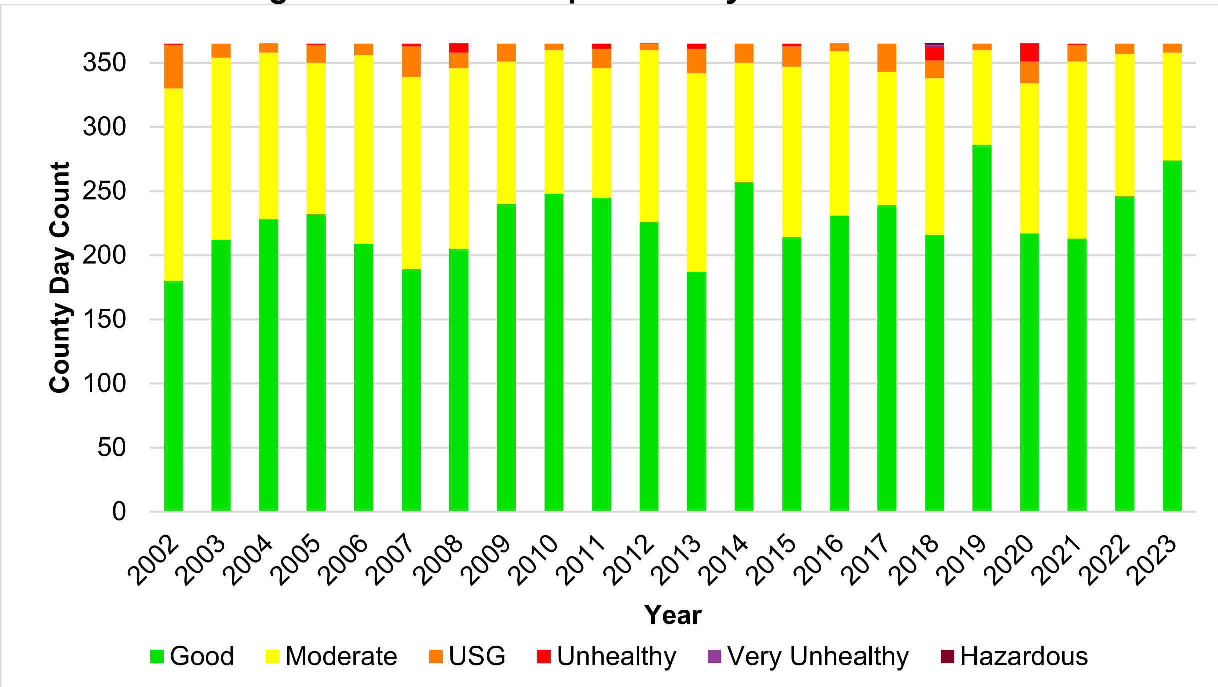


Figure A-30 Stanislaus County PM2.5 AQI Trend

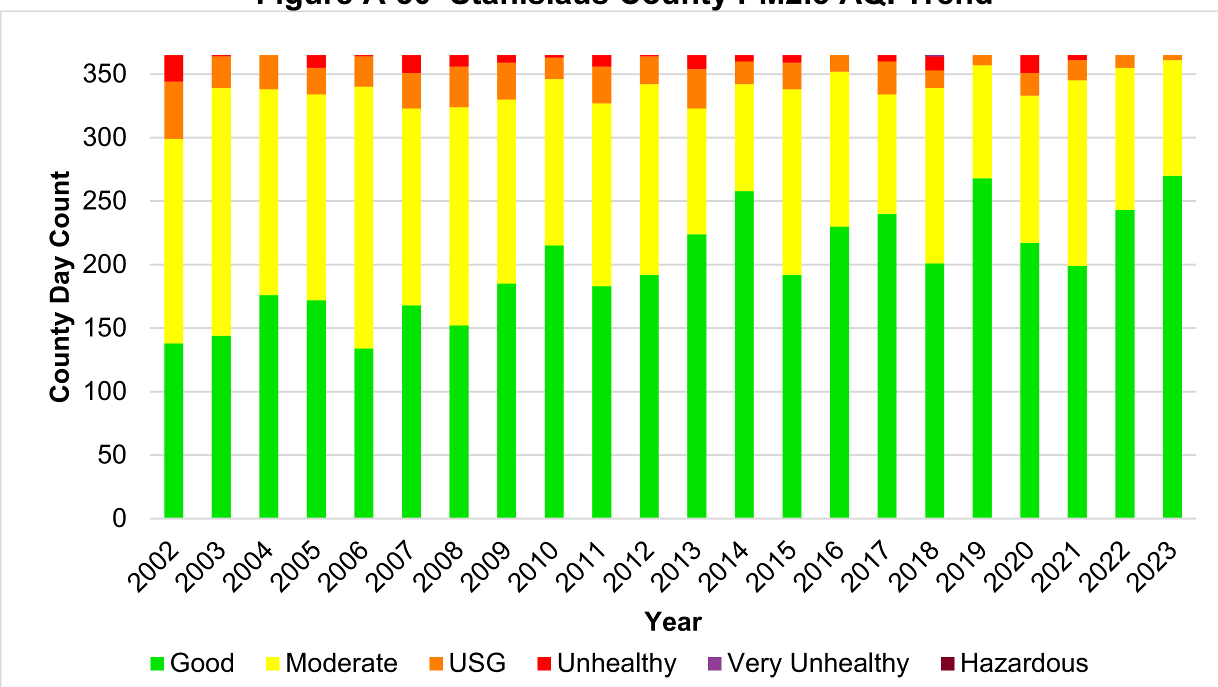


Figure A-31 Merced County PM2.5 AQI Trend

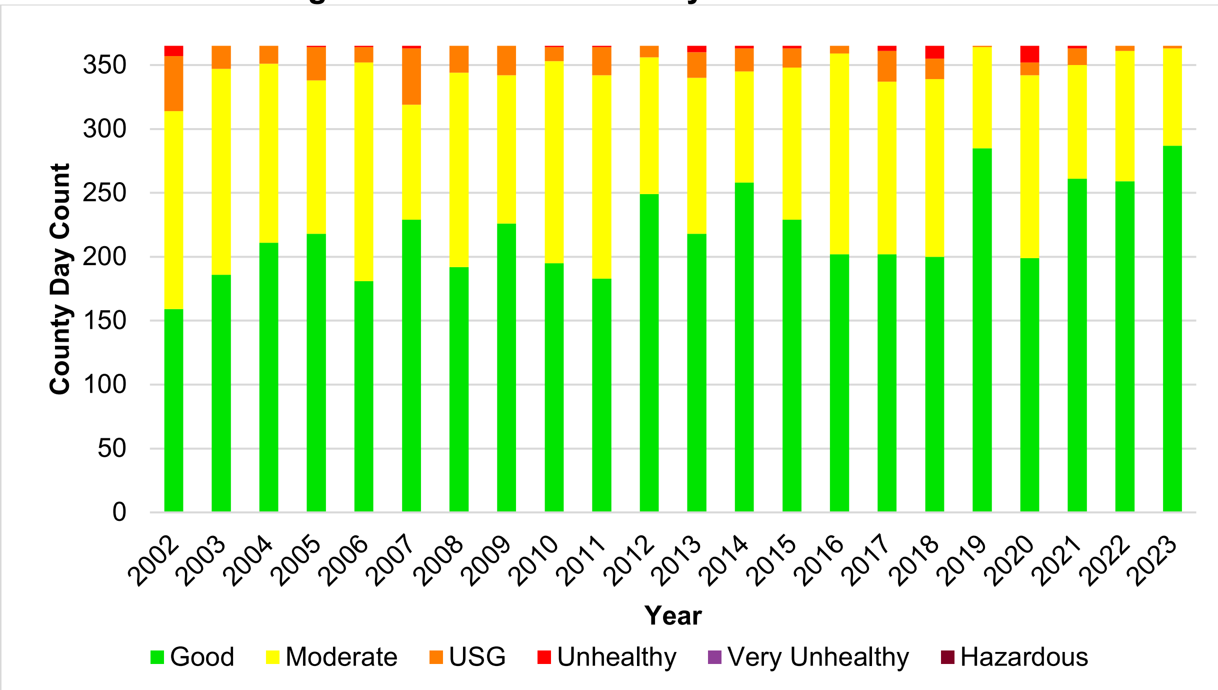
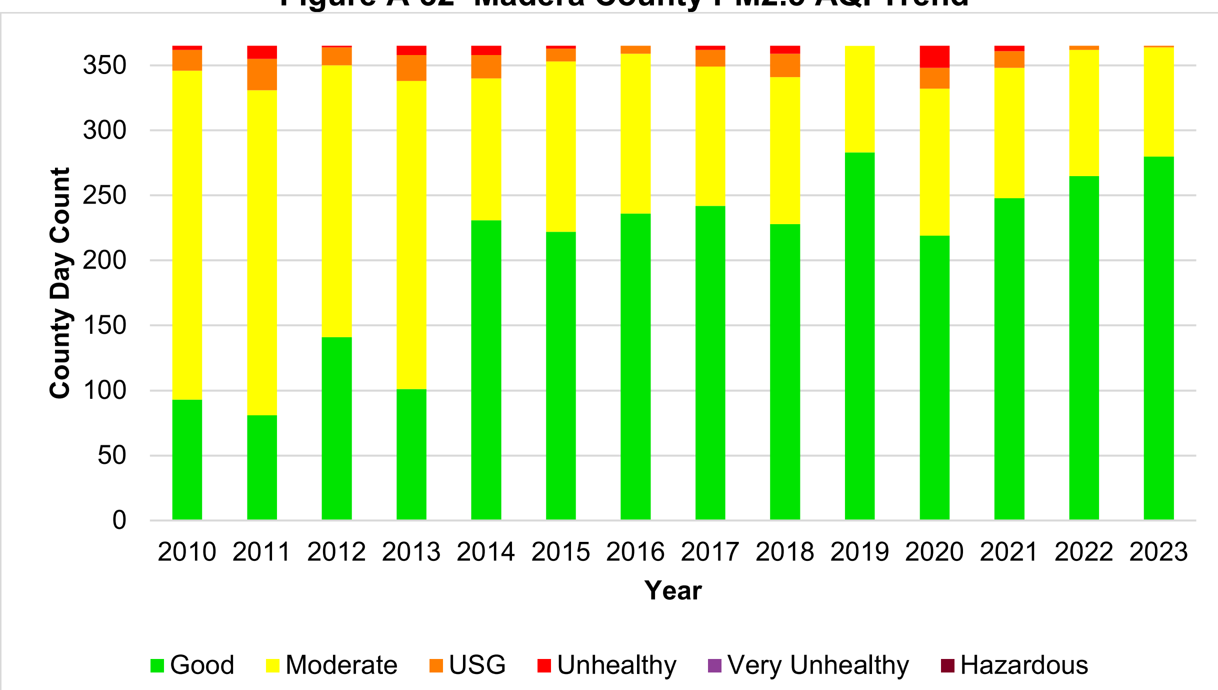


Figure A-32 Madera County PM2.5 AQI Trend



*PM2.5 monitoring in Madera County started in 2010.

Figure A-33 Fresno County PM2.5 AQI Trend

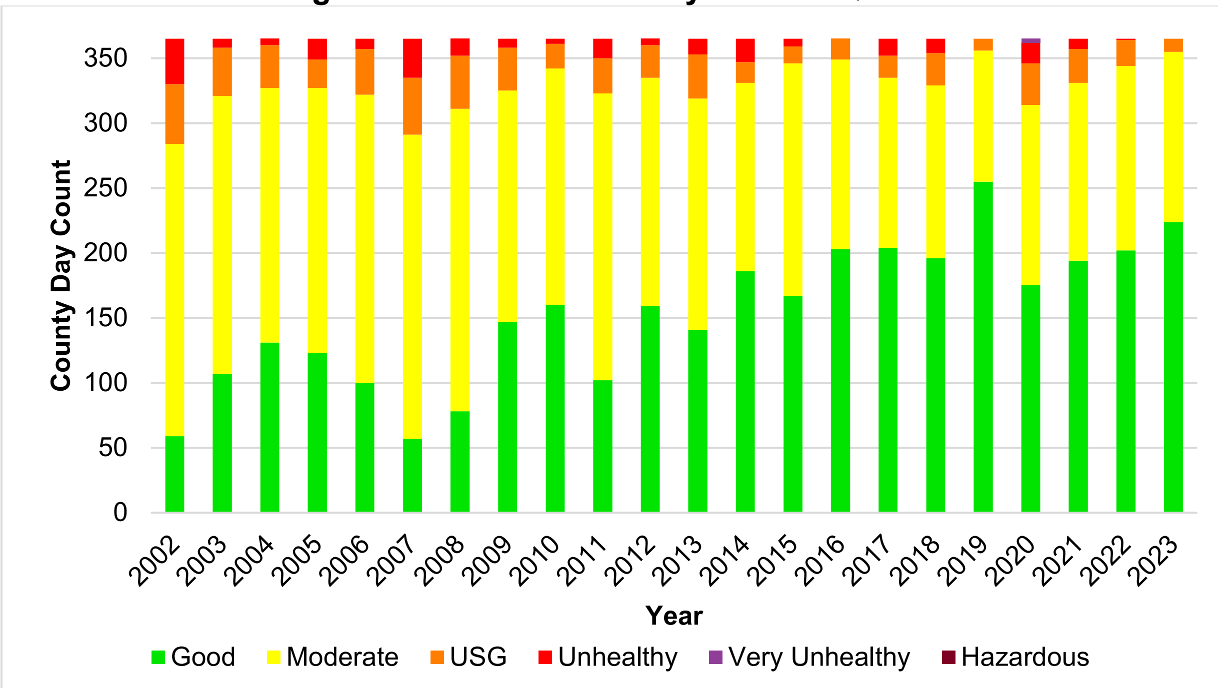


Figure A-34 Kings County PM2.5 AQI Trend

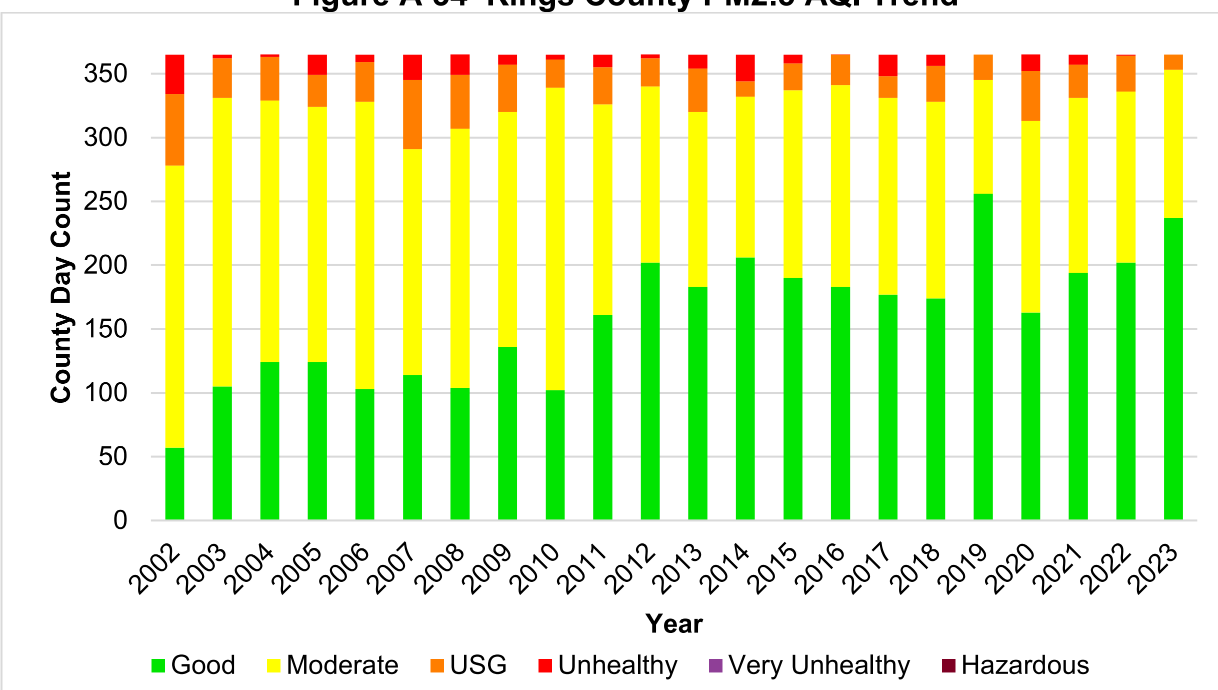


Figure A-35 Tulare County PM2.5 AQI Trend

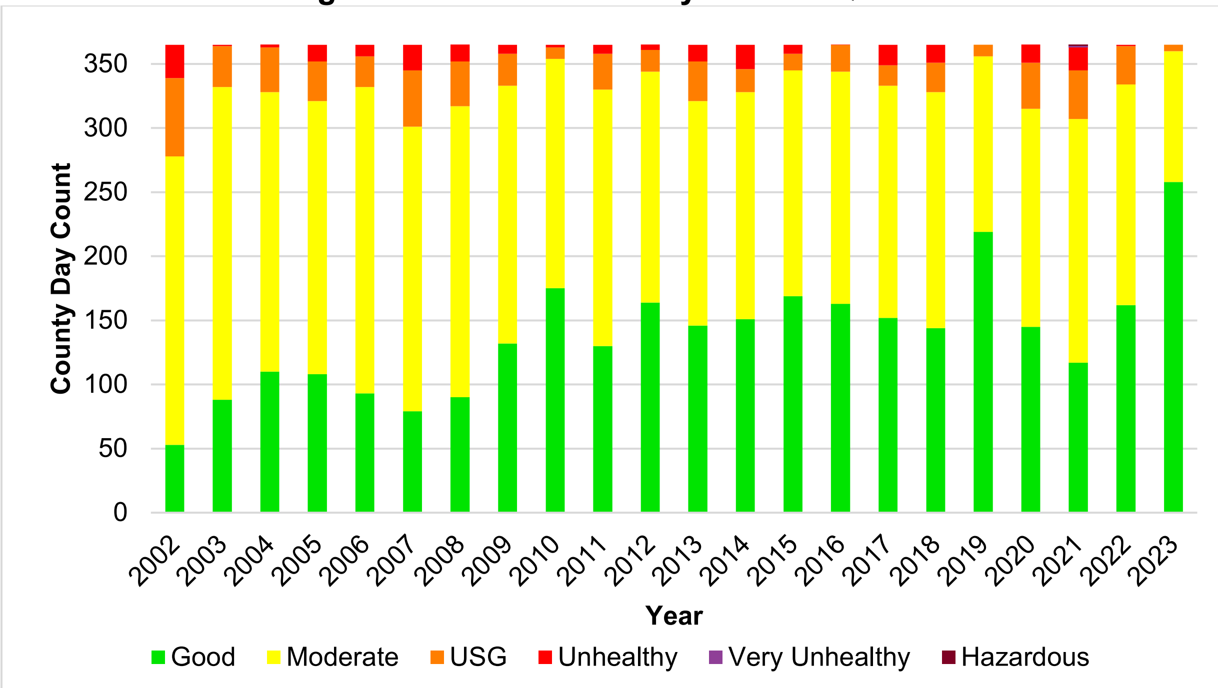


Figure A-36 Kern County PM2.5 AQI Trend

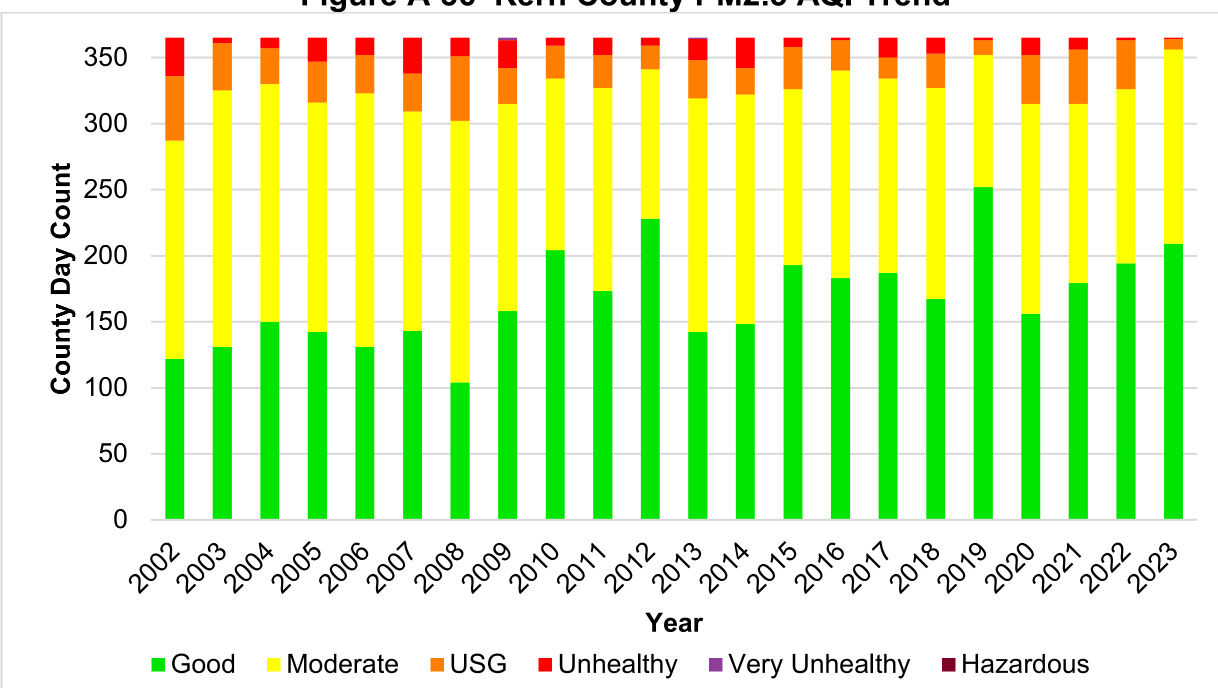


Figure A-37 shows the AQI category frequencies among all of the Valley's counties during the winter season and further illustrates the continuing trend of improving air quality. The 2022-2023 winter season recorded a lower number of days in the USG AQI category and a higher number of Good AQI category days, marking a notable achievement for the region. Over the entire period since the 2000-2001 season, this analysis shows that the Valley has significantly increased its number of Good days and has decreased its number of Unhealthy days, both indicative of improving air quality.

Figure A-37 Basin-Day AQI Frequencies during the Winter Season

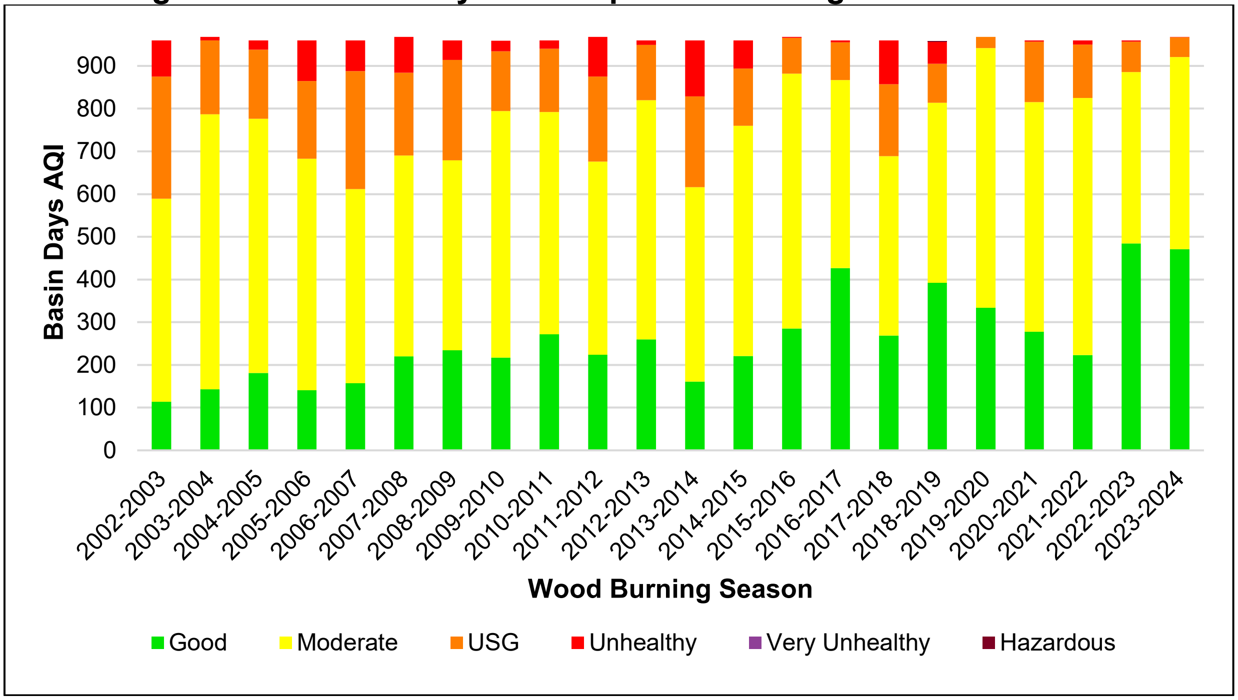


Figure A-38 to Figure A-43 compare the AQI categories for PM2.5 from 2002 and 2023 in San Joaquin, Fresno, and Kern counties. Each county shows a significant improvement within 20 years. San Joaquin County shows an increase in Good and Moderate PM2.5 AQI categories from 330 days in 2002 to 358 days in 2023, representative of an increase of 7.8%. Fresno County observed 284 days in the Good and Moderate AQI categories for 2002, and in 2023 increased to 355 days, an increase of 20%. Kern County changed from 287 days in 2002 to 356 days in 2023, an increase of nearly 18.7% for Good and Moderate AQI days. These figures also show that the USG and Unhealthy AQI categories have decreased for PM2.5. San Joaquin County had 9 days in the Unhealthy AQI category in 2002, and in 2023, there were zero. Fresno County had 100 Unhealthy days and 22 Very Unhealthy days in 2002. In 2023, Fresno County reported zero Unhealthy days and zero Very Unhealthy days. A similar trend was experienced in Kern County, where in 2002, there were 101 Unhealthy days reported compared to 1 Unhealthy day in 2023.

Figure A-38 Percent AQI Days in San Joaquin County 2002

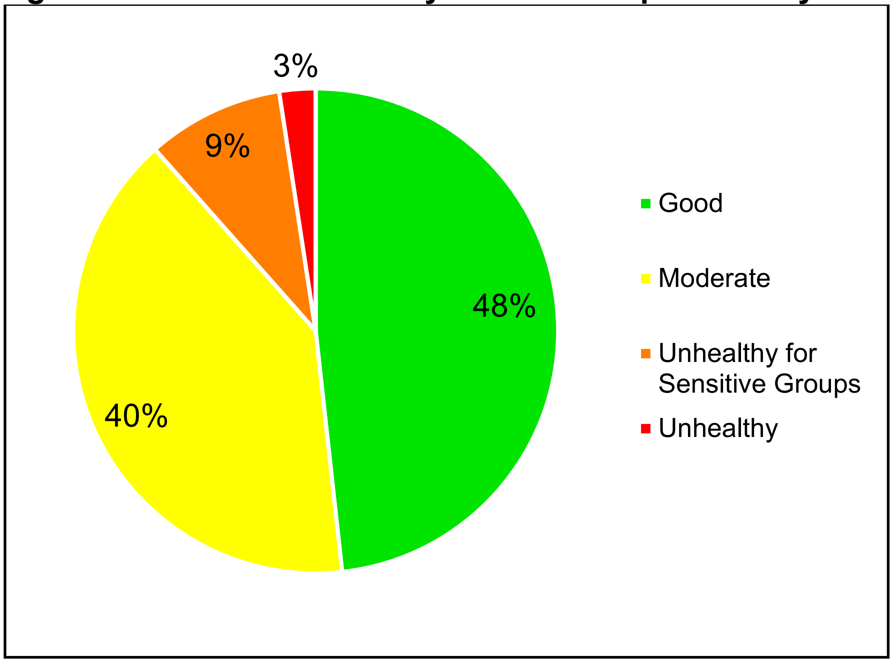


Figure A-39 Percent AQI Days in San Joaquin County 2023

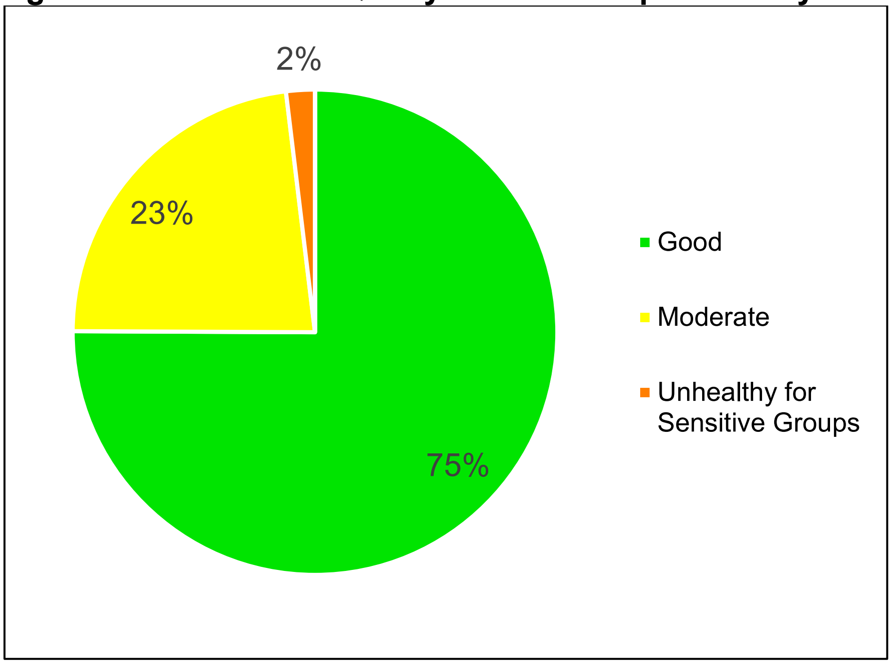


Figure A-40 Percent AQI Days in Fresno County 2002

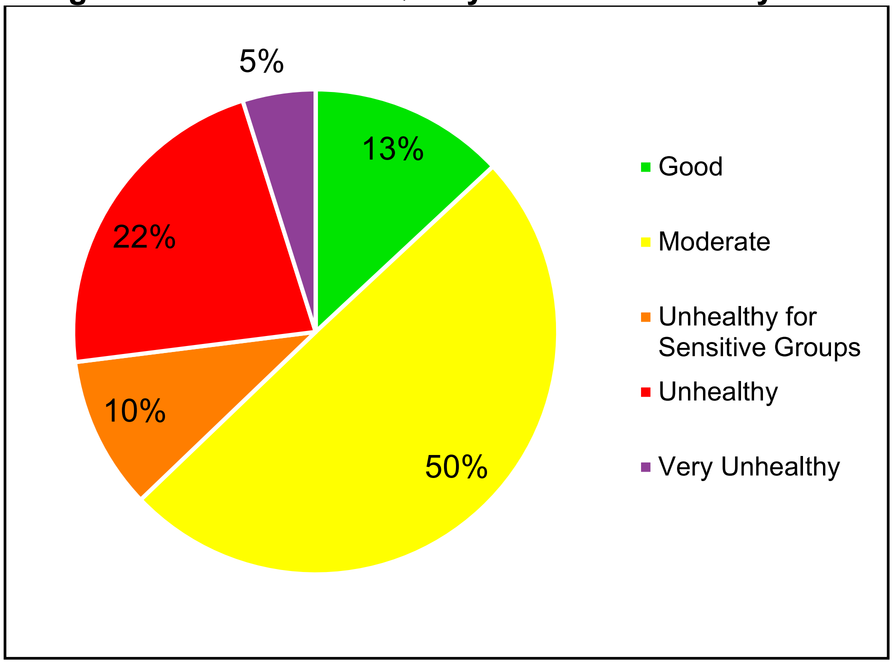


Figure A-41 Percent AQI Days in Fresno County 2023

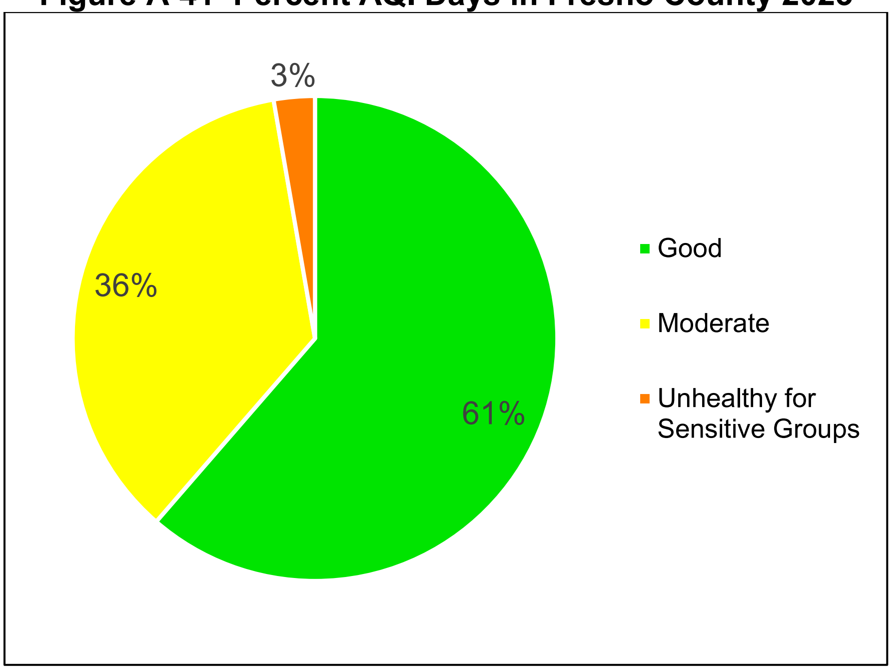


Figure A-42 Percent AQI Days in Kern County 2002

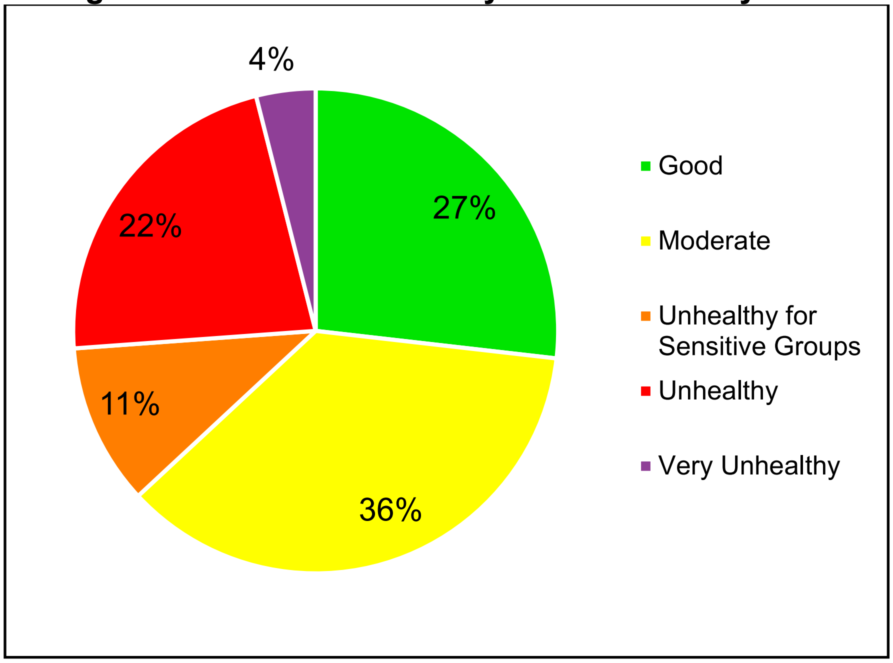
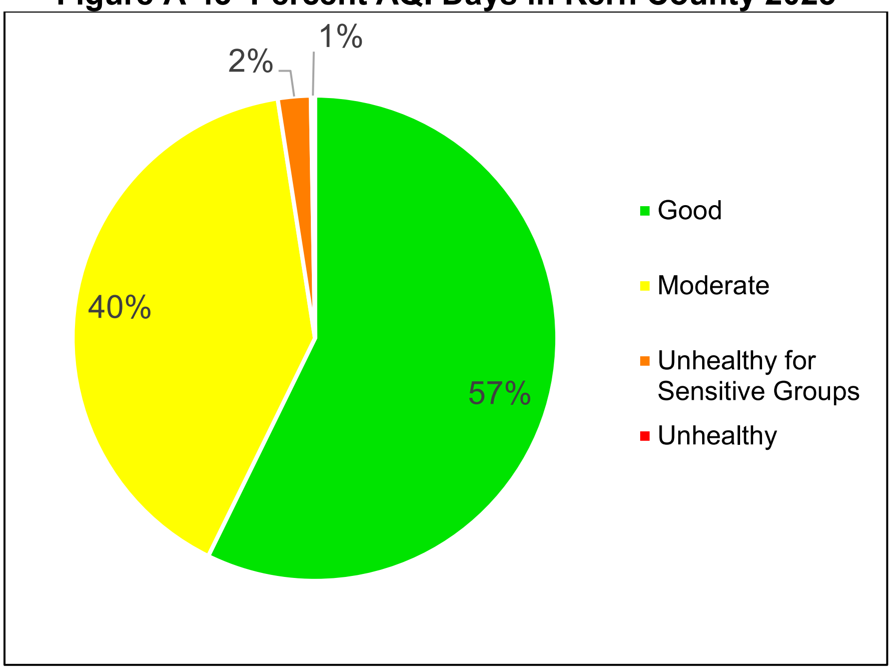
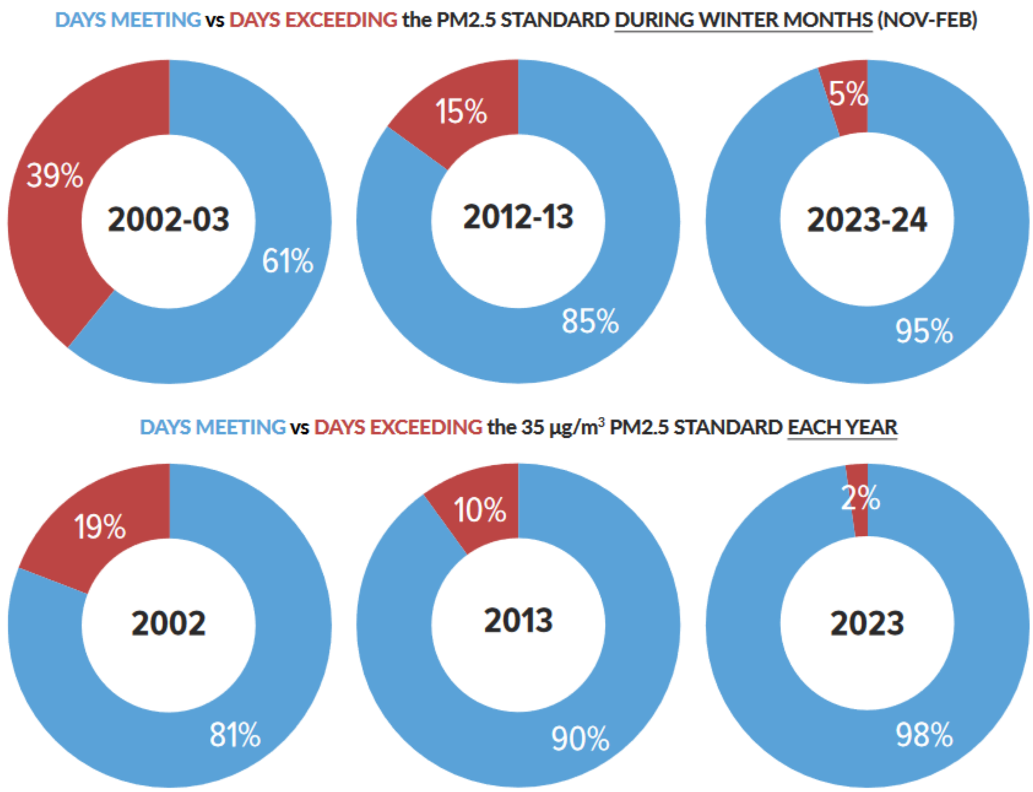


Figure A-43 Percent AQI Days in Kern County 2023



When observing the change in days over a long period when the Valley's counties exceeded the federal 24-hour PM2.5 standard of 35 µg/m^3, a significant change is clear. As shown in Figure A-44, when comparing the winter season of 2002-03 to the recent 2023-24 season, the number of days when the Valley's counties exceeded this standard decreased from 39% to only 5%, while the days when the federal standard was met increased from 61% to 95%. Similarly, when this comparison is focused on the calendar years between 2002 and 2023, the number of days exceeding the standard decreased from 19% to only 2%, while the number of days meeting this standard increased from 81% to 98%. With 98% of the days during the year 2023 meeting the 24-hour PM2.5 standard, this increase is indicative of the positive progress the Valley is making towards minimizing peak concentrations throughout the region.

Figure A-44 Progress in Reducing Days Exceeding 24-hour PM2.5 Standard



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