

ANNUAL AIR QUALITY REPORT | 2023



Air Pollution Control District
San Luis Obispo County

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Executive Summary

Air quality continues to show overall steady long-term trends of decreasing pollutant concentrations and improving air quality with some year-to-year variability

- **Ozone** trends show continued improvements with decreasing design values at all locations except for Red Hills whose design value remained unchanged in 2023 (Figure 9). Most stations saw a decrease in the number of days with ozone levels in the Moderate AQI range (Figure 8).
- **PM₁₀** on the Nipomo Mesa continued to show marked improvement relative to 10-year trends (Figures 10 – 12; Appendix A). The state 24-hour PM₁₀ standard of 50 µg/m³ was exceeded 23 times at CDF and 19 times at Mesa 2—the fewest number of exceedances since daily monitoring began in 2010. Similarly, annual averages at all stations decreased, with Mesa 2 attaining the state annual average standard of 20 µg/m³ for the first time since monitoring began there.
- **PM_{2.5}** annual averages decreased across the county with many sites near or below their lowest recorded annual averages. Notably at current levels all sites will meet the new more stringent federal PM_{2.5} annual average standard of 9 µg/m³ that was implemented on February 7th, 2024.

There were five exceedances of the state and federal 8-hr ozone standard of 70 ppb at the Red Hills monitoring station in the Eastern County non-attainment zone. Three exceedances in July on the 15th, 20th, and 21st and two exceedances in October on the 18th and 19th. These exceedances all occurred under high pressure systems with hot stagnant conditions over the San Joaquin Valley leading to high ozone concentrations that were transported into the Red Hills region by easterly winds.

There were no exceedances of the standards for nitrogen dioxide or sulfur dioxide at any stations this year.

South County air quality continues to be impacted by dust blown from the Oceano Dunes State Vehicle Recreation Area (ODSVRA) but shows continued improvements. While the federal PM₁₀ standard was not exceeded anywhere in 2023, the more stringent state standard was exceeded on 25 days, most of these exceedances were due to windblown dust. In addition, the Rule 1001 performance standard was violated 11 times during 2023—a substantial improvement from the 30 violations in 2022.

Appendix A presents an analysis of the effects of the ODSVRA dust control projects on downwind PM₁₀ concentrations. Using the same methodology as in previous Annual Air Quality Reports, it is estimated that for 2023 (compared to the baseline year of 2017), the dust controls yielded a 38.1% decrease in event-day PM₁₀ at CDF and a 22.2% decrease at Mesa2. The median wind event day PM₁₀ concentration at CDF was 45 µg/m³ in 2023; this analysis predicts this concentration would have been 74 µg/m³ if the ODSVRA dust control projects had not been implemented.

Appendix B presents an “infographic” summarizing the main points from this annual report.

The air quality database for San Luis Obispo County is a public record and is available from the APCD office in various forms, including comprehensive records of all hourly or other sample values acquired anywhere in the county. Data summaries are published in *Annual Air Quality Reports*, like this one. Ambient monitoring data is added to separate archives maintained by EPA and CARB. Summary data from San Luis Obispo County can be found in EPA and CARB publications and on the world wide web at the following websites:

www.slocleanair.org

APCD website

www.arb.ca.gov

CARB website

www.epa.gov

US EPA website

www.airnow.gov

Air Quality Index site

Air Quality Monitoring and Data

Air quality in San Luis Obispo County was measured by a network of 10 permanent ambient air monitoring stations in 2023; their locations are depicted in Figure 1, and the parameters measured at each station are shown in Table 1. The San Luis Obispo County Air Pollution Control District (APCD) owned and operated seven permanent stations: Nipomo Regional Park (NRP), Morro Bay, Atascadero, Red Hills, Carrizo Plain, San Luis Obispo – Roberto Ct., and the CDF fire station on the Nipomo Mesa. The California Air Resources Board (CARB) operated the station in Paso Robles. Two stations are owned by third parties but operated by the APCD: Mesa2, located on the Nipomo Mesa and owned by the Phillips 66 refinery, and Oso Flaco, located within the ODSVRA and owned by the California Department of Parks and Recreation.

In February of 2023 the APCD submitted a request to the EPA to relocate the Morro Bay monitoring station under 40 CFR 58.14(c)(6). The EPA approved this relocation, and at the end of June 2023 the station was moved to a new location off Kings Avenue in Morro Bay. This new location is less than a half mile to the southeast of the original Morro Bay monitoring station. While this station has been assigned a new site ID in the EPA's Air Quality System, the two data streams have been combined to create one continuous monitoring record for Morro Bay.

The APCD prepares an *Ambient Air Monitoring Network Plan* every year. This document is an evaluation of the network of air pollution monitoring stations in the county. The annual review is required by 40 CFR 58.10 and helps ensure continued consistency with the monitoring objectives defined in federal regulations. Each report is a directory of existing and proposed monitors in the county network and serves as a progress report on the recommendations and issues raised in earlier network reviews. They are available online at <http://www.slocleanair.org/airquality/monitoringstations.php>.

Air quality monitoring is subject to rigorous federal and state quality assurance and quality control requirements. Gaseous pollutants are measured every few seconds and averaged to yield hourly values. Particulate matter (PM_{2.5} and PM₁₀) is sampled hourly. All monitoring instruments are Environmental Protection Agency (EPA)-approved Federal Equivalent Methods (FEMs) or Federal Reference Methods (FRMs).

The 2023 data reviewed in this report were extracted from the EPA's Air Quality System (AQS) database. Prior to being uploaded to AQS, all data were thoroughly reviewed and validated by the collecting agency (i.e., CARB for data from Paso Robles and the APCD for all other sites). The raw data, AQS reports, and computer code used to compile the statistics and generate the graphs in this report are available upon request.

Figure 1: Map of Monitoring Stations in San Luis Obispo County

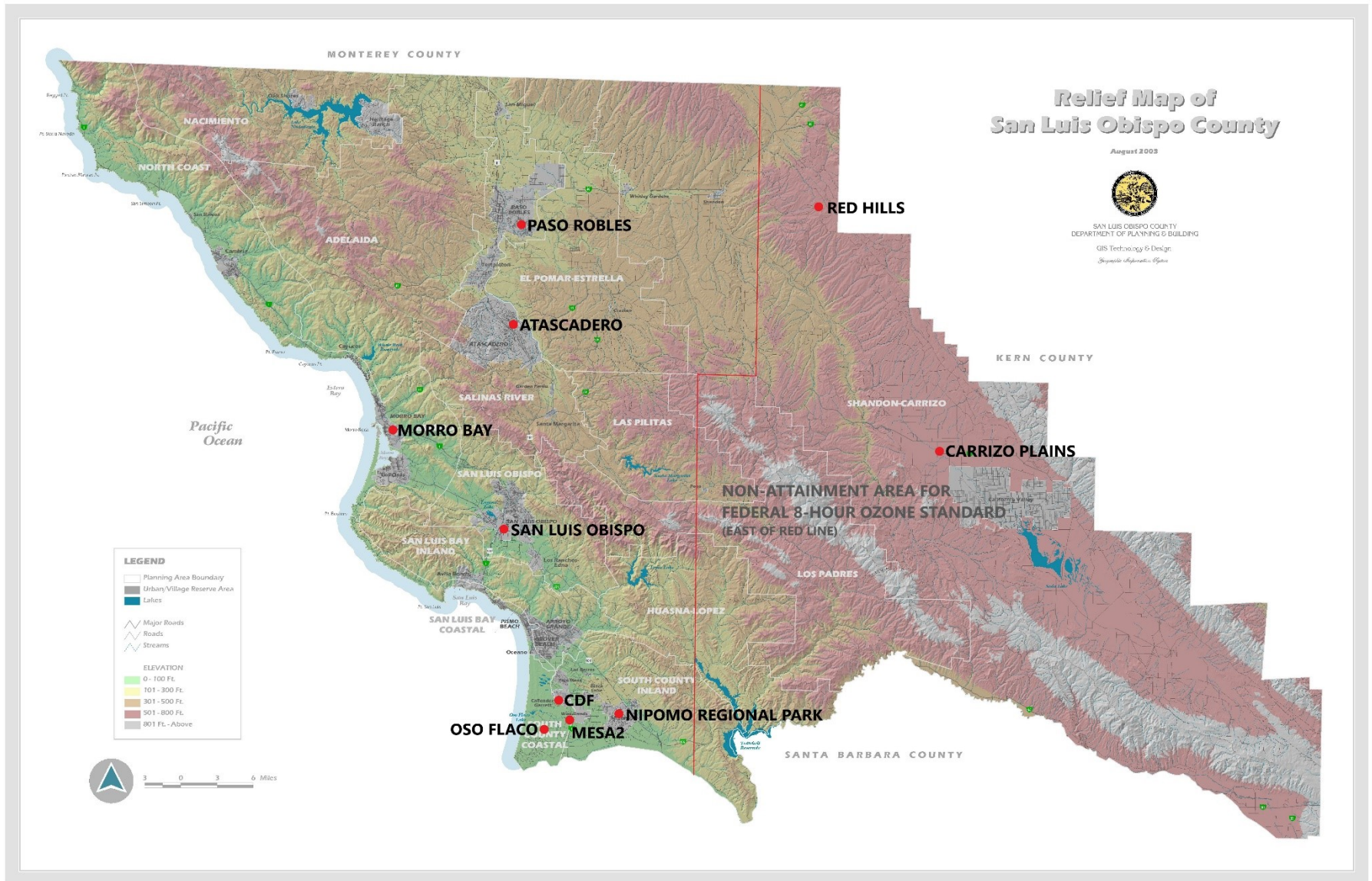


Table 1: Ambient Air Quality Parameters Monitored in San Luis Obispo County in 2023

O ₃	NO	NO ₂	NO _x	SO ₂	PM ₁₀	PM _{2.5}	WS	WD	Vtemp
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APCD Permanent Stations

Atascadero	X	X	X	X		X	X	X	X	X
Morro Bay	X							X	X	X
Nipomo Regional Park	X	X	X	X		X		X	X	X
Red Hills	X							X	X	X
Carrizo Plain	X							X	X	X
CDF						X	X	X	X	X
San Luis Obispo (Roberto Ct.)						X	X			

CARB Stations

Paso Robles	X					X		X	X	X
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Operated by APCD

Mesa2					X	X	X	X	X	X
Oso Flaco						X		X	X	X

Abbreviations and Chemical Formulas:

NO	Nitric Oxide	SO ₂	Sulfur Dioxide	PM ₁₀	Particulates < 10 microns	WS	Wind Speed
NO ₂	Nitrogen Dioxide	O ₃	Ozone	PM _{2.5}	Particulates < 2.5 microns	WD	Wind Direction
NO _x	Oxides of Nitrogen					VTemp	Virtual Temp

Ambient Air Pollutants Of Local Concern

Ozone

Ozone (O₃) is a gas that is naturally found near the earth's surface at low concentrations, typically 10 to 40 parts per billion (ppb). It is also a principal component of photochemical smog, produced when precursor pollutants such as volatile organic compounds and nitrogen oxides react under the influence of sunlight. Ozone precursors are emitted by many human activities, but industrial processes and motor vehicles are primary sources. The chemistry of atmospheric ozone is complex, and in the absence of sunlight, ozone is destroyed by reaction with the same precursor molecules that fuel its formation during the day. As a result, ozone concentrations typically increase as sunlight intensity increases, peaking midday or in the afternoon and gradually declining from there, typically reaching their lowest levels in the early morning hours and just before sunrise, as shown in Figure 2, below.

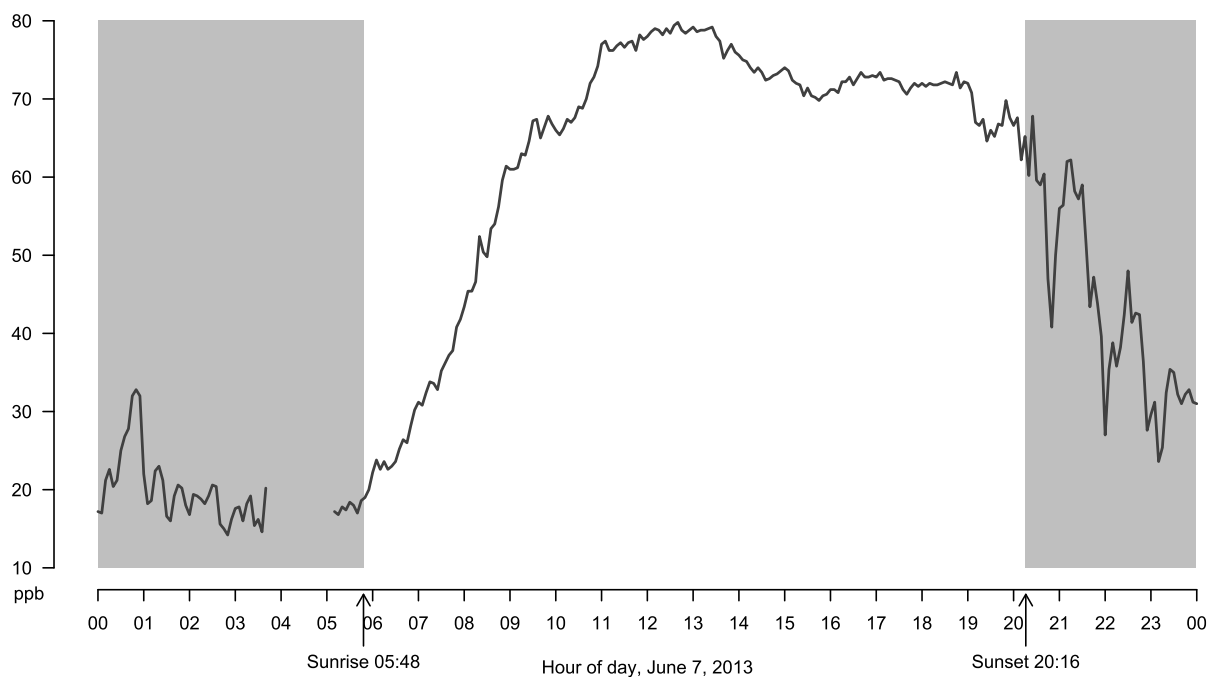


Figure 2: Example of Diurnal Ozone Pattern from Carrizo Plain

As a pollutant, ozone is a strong oxidant gas that attacks plant and animal tissues. It can cause impaired breathing and reduced lung capacity, especially among children, athletes, and persons with compromised respiratory systems; it can also cause significant crop and forest damage. Ozone is a pollutant of particular concern in California where geography, climate, and emissions from industrial and commercial sources and millions of vehicles contribute to frequent violations of health-based air quality standards.

While ground level ozone is harmful to plants and animals and is considered a pollutant, upper level (stratospheric) ozone occurs naturally and protects the earth from harmful ultraviolet energy from the sun.

Particulate Matter

Ambient air quality standards have been established for two classes of particulate matter: PM₁₀ often referred to as "coarse particles" (inhalable particulate matter less than 10 microns in aerodynamic diameter) such as those found in windblown dust; and PM_{2.5} or "fine particles" (particulate matter 2.5

microns or less in aerodynamic diameter) such as those found in smoke and haze. Both consist of many different types of microscopic particles that vary in their composition and toxicity. $PM_{2.5}$ tends to be a greater health risk since these particles can get lodged deep in the lungs or enter the blood stream, causing both short and long-term damage. Exposure to such particles can affect both your lungs and heart with numerous scientific studies linking particle pollution exposure to premature death in people with heart or lung disease, irregular heartbeat, aggravated asthma, decreased lung function, and increased respiratory symptoms. Sources of particulate pollution include diesel exhaust; mineral extraction and production; combustion products from industry and motor vehicles; smoke from open burning; paved and unpaved roads; condensation of gaseous pollutants into liquid or solid particles; and windblown dust from soils disturbed by demolition and construction, agricultural operations, off-road vehicle recreation, and other activities. In addition to its harmful health effects, particulate matter can also greatly reduce visibility.

Nitrogen Dioxide, Sulfur Dioxide, and Carbon Monoxide

Nitrogen dioxide (NO_2) is the brownish component of smog. It irritates the eyes, nose and throat and can damage lung tissue. Sulfur dioxide (SO_2) is a colorless gas with health effects similar to NO_2 . Both pollutants are generated by fossil fuel combustion from mobile sources such as vehicles, ships, and aircraft and at stationary sources such as industry facilities, homes, and businesses. SO_2 is also emitted by petroleum production and refining operations. These pollutants can create aerosols, which may fall as acid rain causing damage to crops, forests, and lakes. They can also exacerbate asthma and harm the human respiratory system.

Carbon monoxide (CO) is a colorless and odorless gas that can interfere with the ability of red blood cells to transport oxygen. Exposure to CO can cause headaches, fatigue, and even death. CO results from fuel combustion of all types, but motor vehicles are by far the chief contributor of CO in outdoor air.

State and National Ambient Air Quality Standards

CARB and the EPA have adopted ambient air quality standards for six common air pollutants of primary public health concern: ozone, particulate matter (PM₁₀ and PM_{2.5}), nitrogen dioxide, sulfur dioxide, carbon monoxide, and lead.¹ These are called “criteria pollutants” because the standards establish permissible airborne pollutant levels based on criteria developed after careful review of medical and scientific studies of the effects of each pollutant on public health and welfare.

The National Ambient Air Quality Standards (NAAQS; see Table 2) are used by EPA to designate a region as either “attainment” or “nonattainment” for each criteria pollutant. A nonattainment designation can trigger additional regulations aimed at reducing pollution levels and bringing the region into attainment. For most pollutants, the NAAQS allow a standard to be exceeded a certain number of times each calendar year without resulting in a nonattainment designation. Additionally, exceedances caused by exceptional events may be excluded from attainment/nonattainment determinations at the discretion of the EPA following the submittal of an exceptional demonstration.

The Clean Air Act requires periodic review of science upon which the standards are based and the standards themselves. These reviews undergo a planning phase, assessment phase, integrated science assessment, risk/exposure analysis, policy assessment, and finally a rule making phase. The EPA recently completed this periodic review for the particulate matter science and standards and announced a strengthened PM_{2.5} annual average standard of 9.0 µg/m³. This decision was informed by a greater understanding of the health risks associated with particulate matter, especially fine particulates. The EPA analysis found that “strengthened standards will result in significant public health net benefits that could be as high as \$46 billion in 2032. Health benefits will include up to 4,500 avoided premature deaths, 800,000 avoided cases of asthma symptoms, and 290,000 avoided lost workdays (in 2032).”²

The attainment designations associated with this new standard will be issued within the next two years. While the standard referenced in this 2023 report will remain 12 µg/m³, it is important to note that the attainment decision for this new standard will likely use data from 2023-2025.

In May 2012, the EPA designated the eastern portion of San Luis Obispo County as marginally nonattainment for the 8-hour ozone standard. This was based on data from enhanced monitoring over the prior decade that revealed previously unrecognized high ozone levels in that region; the western portion of the county retained its attainment status. (See the red line in Figure 1 for the boundary between the attainment and nonattainment areas.) In October 2015, the ozone standard was lowered from 75 to 70 ppb, and in April 2018, the EPA designated the eastern portion of the county as a “Marginal” nonattainment zone for the new standard. Based on the EPA review of data, which included an exceptional events coding being applied to ozone data during the 2018, and 2020 wildfire events, the county was found to meet the NAAQS design value of 70 ppb by the prescribed date. This finding was published on October 20, 2022, by EPA in a Federal Registry notice titled “Determinations of Attainment by the Attainment Date, California Areas Classified as Serious for the 2008 Ozone National Ambient Air Quality Standards and Marginal for the 2015 Ozone National Ambient Air Quality Standards.”³ This notice states the county will remain “Marginal”, and the EPA may address the area in another action. The county is currently designated as attaining all other NAAQS.

¹ In addition to these six pollutants, California also has standards for hydrogen sulfide, sulfate, vinyl chloride, and visibility reducing particles.

² EPA, “Final Rule to Strengthen the National Air Quality Health Standard for Particulate Matter Fact Sheet,” undated. Available online at: <https://www.epa.gov/system/files/documents/2024-02/pm-naaqs-overview.pdf>

³ 87 FR 63698. Available online at: <https://www.federalregister.gov/documents/2022/10/20/2022-22192/determinations-of-attainment-by-the-attainment-date-california-areas-classified-as-serious-for-the>

The California Ambient Air Quality Standards are generally more restrictive (i.e., lower) than the NAAQS, and typically are specified as not to be exceeded. Thus, a single exceedance is a violation of the applicable standard and triggers a nonattainment designation. As a result, San Luis Obispo County is designated as a nonattainment area for the state 1-hour and 8-hour ozone standards, as well as the state 24-hour and annual PM₁₀ standards. The county is designated as attaining the state annual PM_{2.5} standard.

State and federal standards for NO₂ have never been exceeded here. The state standard for SO₂ was exceeded periodically on the Nipomo Mesa until 1993. Equipment and processes at the facilities responsible for the emissions were then upgraded, and the state SO₂ standard has not been exceeded since that time. The federal SO₂ standard, which was established in 2011, has only been exceeded once, in 2013, when maintenance activities at these facilities resulted in emissions exceeding the 1-hour standard of 75 ppb. State CO standards have not been exceeded in the county since 1975. The county has never been required to conduct lead monitoring.

Table 2: Ambient Air Quality Standards for 2023 and Attainment Status*

A standard exceedance occurs when a measured pollutant concentration exceeds (or in some cases, equals) the applicable standard established by state or federal agencies. It does not necessarily constitute a violation. A standard violation may occur following a single or cumulative series of standard exceedances. Criteria constituting a violation are unique for each pollutant. A nonattainment designation occurs when a state or federal agency formally declares an area in violation of a standard. Typically, CARB performs designations annually. Several years often pass between EPA designations.		Averaging Time	California Standard [†]	National Standard [†]
	Ozone (O ₃)	8 Hours	70 ppb	70 ppb
		1 Hour	90 ppb	
	Respirable Particulate Matter (PM ₁₀)	24 Hours	50 µg/m ³	150 µg/m ³
		1 Year [‡]	20 µg/m ³	
	Fine Particulate Matter (PM _{2.5})	24 Hours		35 µg/m ³
		1 Year [‡]	12 µg/m ³	12 µg/m ³ ¶
	Carbon Monoxide (CO)	8 Hours	9.0 ppm	9 ppm
		1 Hours	20 ppm	35 ppm
	Nitrogen Dioxide (NO ₂)	1 Year [‡]	30 ppb	53 ppb
		1 Hour	180 ppb	100 ppb
	Sulfur Dioxide (SO ₂)	3 Hours		500 ppb (secondary)
		1 Hour	250 ppb	75 ppb (primary)
	Lead (Pb)	3 Month		0.15 µg/m ³
		30 Day	1.5 µg/m ³	

* San Luis Obispo County (in whole or in part) is designated as nonattainment for the standards in **boldface print** as of November 2024.

[†] For clarity, the ozone, SO₂, and NO₂ standards are expressed in parts per billion (ppb), however most of these standards were promulgated in parts per million (ppm). When comparing to the national PM₁₀ and PM_{2.5} standards, federal regulations state that measurements shall be rounded to the nearest 10 µg/m³ and 1 µg/m³, respectively. Thus, for PM₁₀, 24-hour averages between 150 and 154 µg/m³ are not considered exceedances of the standard, even though they are greater (or equal to) 150 µg/m³.

[‡] This standard is calculated as a weighted annual arithmetic mean.

¶ On February 7, 2024, the EPA promulgated an updated PM_{2.5} NAAQS annual average standard of 9 µg/m³. Attainment designations based on the updated standard will likely occur in 2025.

Ozone and Gaseous Pollutant Summary

In 2023, exceedances of the 8-hour state and federal standard (70 ppb) occurred on 5 days at the Red Hills monitoring station. Three exceedances occurred in July on the 15th, 20th, and 21st and two exceedances occurred in October on the 18th and 19th. These days were all influenced by a similar weather pattern with high pressure systems in place of the region leading to hot and stagnant conditions over the San Joaquin Valley with little to no dispersion present. These conditions allowed for the formation of high ozone concentrations that were transported from the San Joaquin Valley into the Red Hills region by easterly winds.

No other stations recorded exceedances of the standard, and the state 1-hour standard (90 ppb) was not exceeded anywhere in the county. Standards for nitrogen dioxide and sulfur dioxide were not exceeded this year either.

Table 3 lists the highest hourly (and for ozone, 8-hour) values recorded in 2023 for ozone, sulfur dioxide, and nitrogen dioxide at the stations where they are monitored. Concentrations are in parts per billion (ppb). The sample date appears under each pollutant value in the format "month/day." Values that exceed federal standards are shown in **bold**, and those exceeding state standards are underlined.

Table 3: Highest Measurements for Gaseous Pollutants in 2023 (ppb)

Station	O ₃ 1-hour			O ₃ 8-hour				SO ₂ 1-hour			NO ₂ 1-hour		
	1st	2nd	3rd	1st	2nd	3rd	4th	1st	2nd	3rd	1st	2nd	3rd
Paso Robles	75 10/19	71 07/22	70 07/01	65 07/17	64 08/30	64 10/19	62 07/01						
Atascadero	73 07/21	71 10/19	68 06/30	59 07/21	57 08/30	56 07/17	55 04/24				50.7 11/18	48.4 11/18	39.0 01/31
Morro Bay	58 11/03	56 10/07	55 11/02	55 11/02	54 11/03	53 10/05	51 11/01						
Red Hills	80 10/19	79 07/17	78 07/21	<u>76</u> 07/20	<u>75</u> 07/21	<u>74</u> 10/19	<u>73</u> 10/18						
Carrizo Plain	76 08/26	72 07/21	71 08/30	67 07/21	66 08/26	66 07/22	65 08/30						
Nipomo Regional Park	68 10/06	61 04/20	61 11/03	59 04/20	58 10/06	53 11/12	52 11/02				18.4 12/14	17.7 12/15	17.0 2/25
Mesa2, Nipomo								2.9 01/17	2.3 01/16	2.0 01/15			

Visual Ozone Summary

Figures 3 and 4 depict the ozone values from each station where it was monitored in 2023. The maximum 8-hour average for each day is shown for each site; exceedances of the 70-ppb standard are shown in red with the day of month printed beside them. The heavy “stair step” line marks the monthly median. The vertical axis extends to the annual maximum; units are ppb.

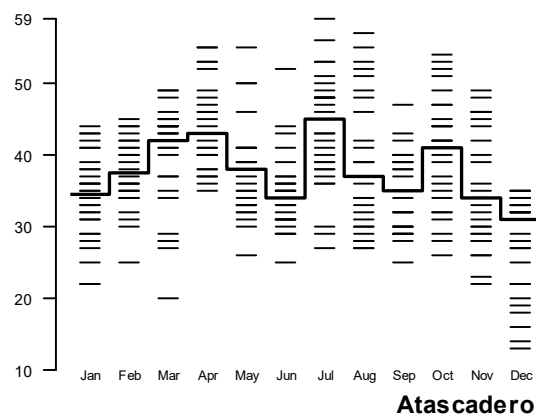
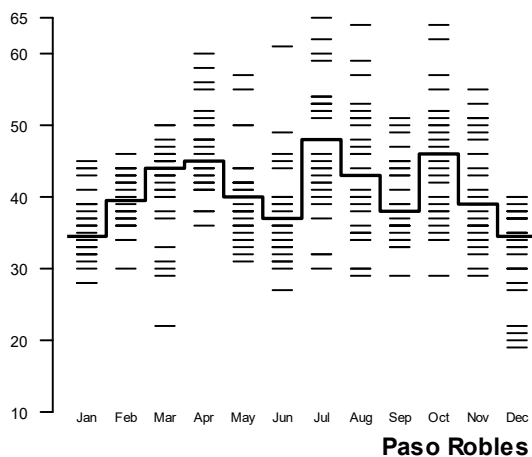
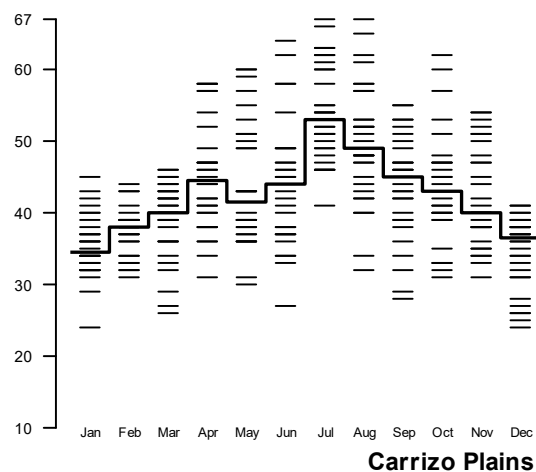
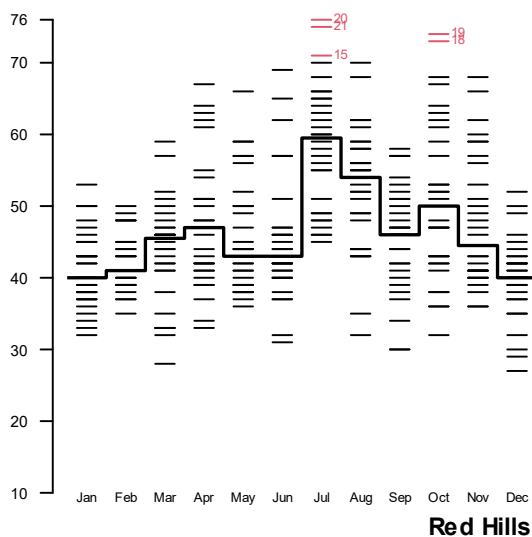


Figure 3: Daily Maximum 8-Hour Ozone Average for 2023 (ppb)

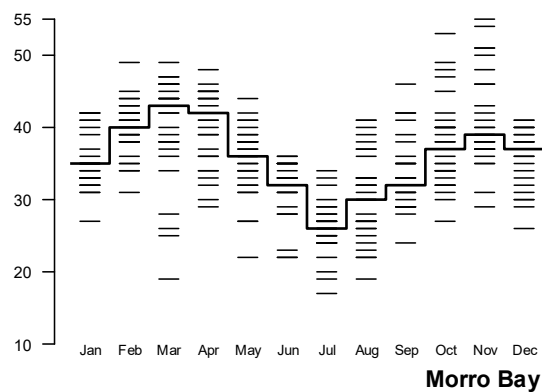
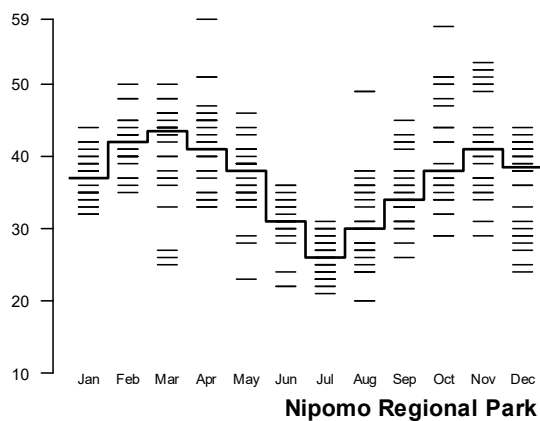


Figure 4: Daily Maximum 8-Hour Ozone Average for 2023 (ppb)

Particulate Matter Summary

Exceedances of the California 24-hour PM₁₀ standard (50 µg/m³) were observed on 25 days in 2023: 23 days at CDF, 19 at Mesa2, 6 at Oso Flaco, 2 at NRP, 2 at Paso Robles, and none at San Luis Obispo and Atascadero.⁴ This year only CDF exceeded the state annual average PM₁₀ standard of 20 µg/m³. Mesa 2 achieved the state annual average PM₁₀ standard for the first time since daily PM₁₀ operations began at the station.

Local Rule 1001, which is intended to address windblown dust emissions and downwind air quality impacts from the Oceano Dunes State Vehicular Recreation Area (ODSVRA), states that the park operator “shall ensure that if the 24-hour average PM₁₀ concentration at the [riding area] Monitor is more than 20% above the 24-hour average PM₁₀ concentration at the Control Site Monitor, the 24-hour average PM₁₀ concentration at the [riding area] Monitor shall not exceed 55 µg/m³.”⁵ For determining compliance with this standard, the CDF and Oso Flaco monitors have been designated as the riding area and control site monitors, respectively. In 2023 there were 11 days that violated the Rule 1001 standard.

In 2023, no monitoring station in the county recorded exceedances of the federal 24-hour PM_{2.5} standard (35 µg/m³) or the federal and state annual average standards (both 12 µg/m³). A new more stringent federal annual average standard of 9 µg/m³ was promulgated in 2024 following the EPA’s NAAQS review process. The new standard will be implemented for data from 2024 onwards.

Table 4 lists the highest 24-hour concentrations recorded in 2023 and the dates on which they occurred, as well as the annual averages for PM₁₀ and PM_{2.5}. Concentrations are in µg/m³. Values exceeding federal standards are shown in **bold**; those exceeding state standards are underlined.

Smoke impacts to the county were much less than in previous years; however, there were minor impacts in mid to late September when smoke from the SRF Lightening Complex Fire in Humboldt County, the Smith River Complex in Del Norte County, and the Anvil Fire in Oregon were transported to the region. These impacts remained below the federal 24-hour PM_{2.5} standard (35 µg/m³) standard but were responsible for the 3 highest PM_{2.5} 24-hour averages at all locations from September 20th to the 22nd.

Wind-blown dust, mainly from the OSDVRA, caused continued periods of elevated PM₁₀ concentrations above the state standard. In general, elevated particulate levels at CDF, Mesa2, and Nipomo Regional Park are associated with windblown dust events from the OSDVRA. Notable exceptions include November 15th, when strong southeasterly winds swept across the area ahead of the first significant rainstorm of the winter season. This resulted in the highest 24-hr PM₁₀ averages of the year at CDF and Nipomo Regional Park as well as the 2nd highest average at Mesa 2. Exceedances of state 24-hr PM₁₀ standard recorded on September 20th and 21st are attributed to the aforementioned wildfire smoke transport from Oregon and Northern California.

⁴ CARB and EPA apply different conventions to the handling of significant digits. The CARB website (<https://www.arb.ca.gov/adam/topfour/topfour1.php>) thus counts 26 exceedances of the state PM₁₀ standard at CDF, 20 at Mesa2, 7 at Oso Flaco, 3 at Nipomo Regional Park, 2 at Paso Robles, 1 at San Luis Obispo and 0 at Atascadero. The CARB database, which is populated in real time with raw data, may also contain values that were later invalidated. EPA data has been fully validated and as such is considered the data of record.

⁵ San Luis Obispo County Air Pollution Control District, “RULE 1001 Coastal Dunes Dust Control Requirements,” Adopted November 16, 2011, Revised by Court Order CV12-0013, March 7, 2016. Available online at <https://ww3.arb.ca.gov/drdb/slo/cur.htm>.

Table 4: PM₁₀ and PM_{2.5} Summary for 2023 (µg/m³)

Station	Highest 24-hour PM ₁₀			Annual Average PM ₁₀ [‡]	Highest 24-hour PM _{2.5}			Annual Average PM _{2.5} [‡]
	1st	2nd	3rd		1st	2nd	3rd	
Paso Robles	<u>53</u> 10/19	<u>51</u> 11/03	48 10/18	17.1				
Atascadero	48 11/03	48 11/15	43 10/18	14.9	28.7 09/21	23.9 09/22	23.7 09/20	4.72
San Luis Obispo Roberto Ct.	49 09/20	44 09/21	43 11/15	12.1	34.8 09/20	29.1 09/21	28.8 09/22	4.15
CDF, Arroyo Grande	<u>108</u> 11/15	<u>106</u> 02/21	<u>94</u> 08/29	<u>23.0</u>	34.3 09/20	32.1 09/21	30.5 09/22	6.79
Nipomo Regional Park	<u>100</u> 11/15	<u>73</u> 08/29	50 09/21	15.8				
Oso Flaco	<u>95</u> 02/21	<u>88</u> 04/03	<u>75</u> 02/14	17.3				
Mesa2, Nipomo	<u>129</u> 02/21	<u>127</u> 11/15	<u>101</u> 08/29	19.6	34.3 09/20	32.0 09/21	29.0 09/22	4.72

[‡] Weighted arithmetic mean as calculated by an AMP450 AQS report.

Note: The state PM₁₀ 24-hour standard is 50 µg/m³ and the state PM₁₀ annual average standard is 20 µg/m³. Concentrations exceeding state standards are underlined while concentrations exceeding federal standards are bold.

Visual PM_{2.5} and PM₁₀ Summaries

Figure 5 shows the 24-hour PM_{2.5} values and **Figures 6 & 7** show PM₁₀ values from the stations where these pollutants were measured in 2023. As with the ozone plots in the previous section, these show daily concentrations by month for each site; exceedances of standards are shown in red with the day of month printed beside them. The heavy “stair step” line marks the monthly median. The vertical axis extends the annual maximum; units are $\mu\text{g}/\text{m}^3$.

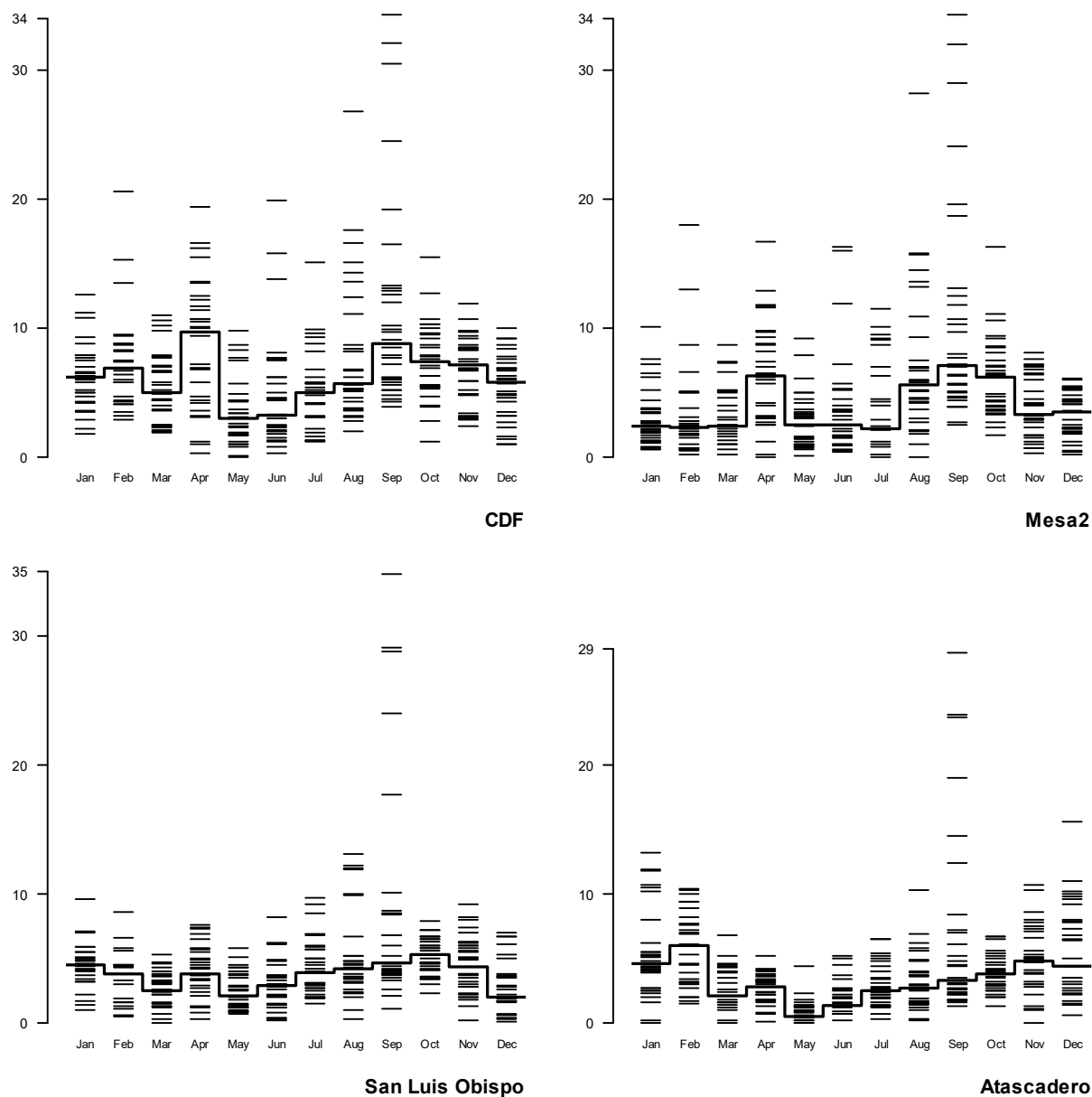


Figure 5: Daily PM_{2.5} Values for 2023 ($\mu\text{g}/\text{m}^3$)

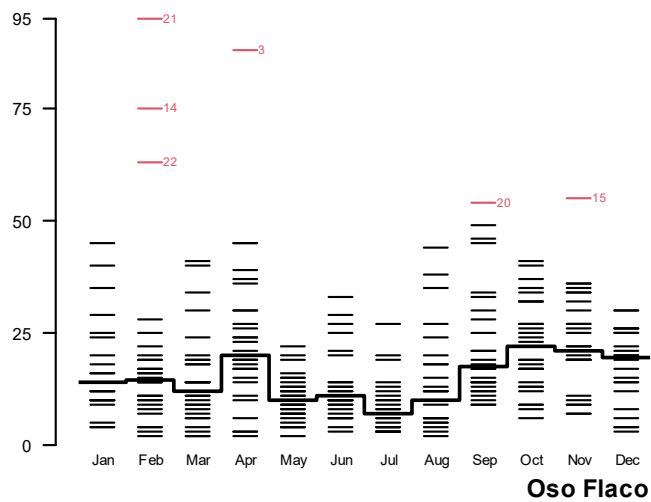
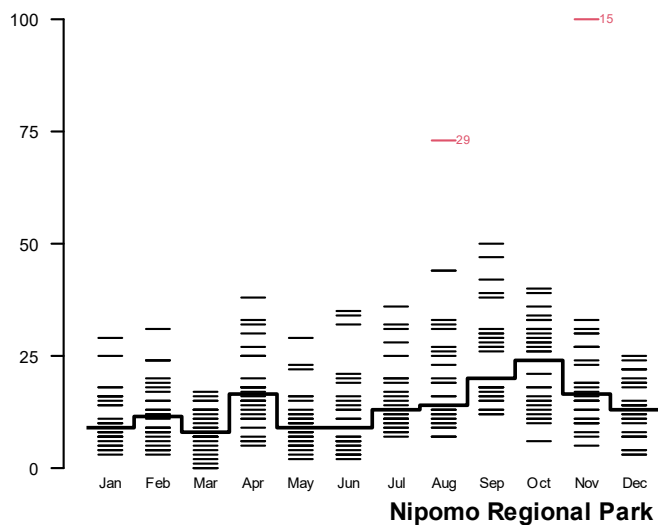
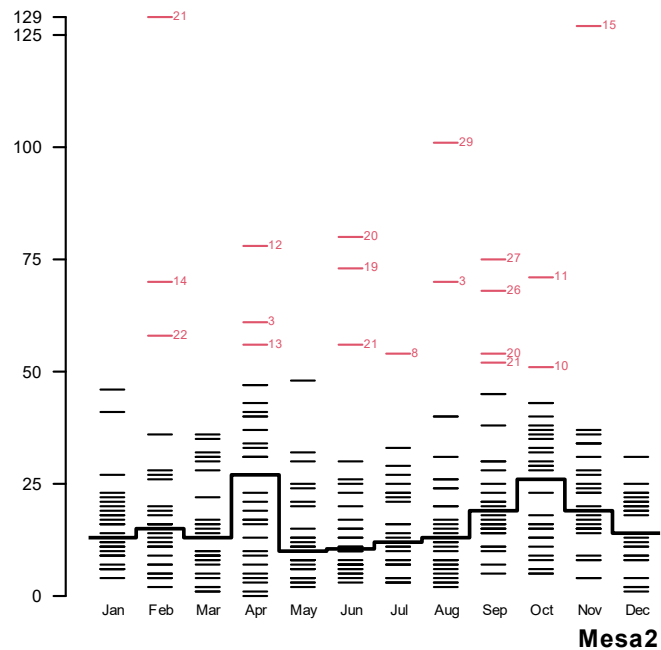
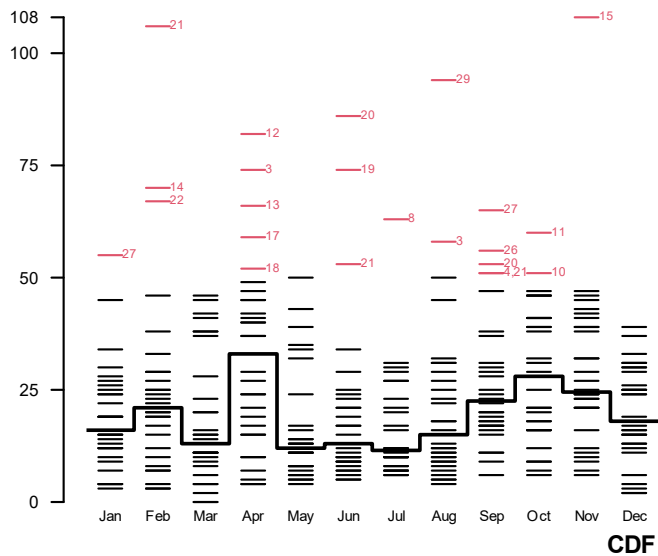


Figure 6: South County Daily PM₁₀ Values for 2023 (µg/m³)

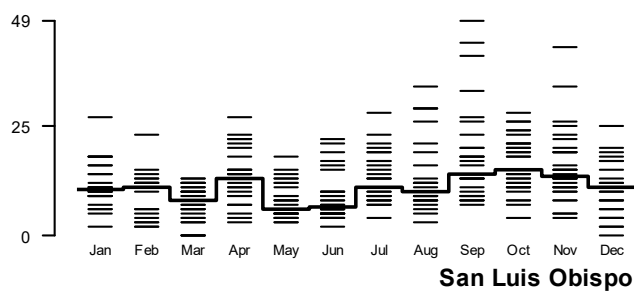
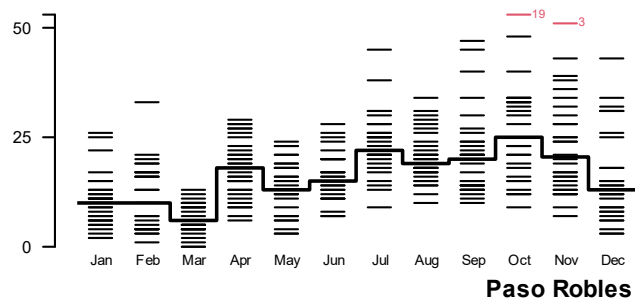
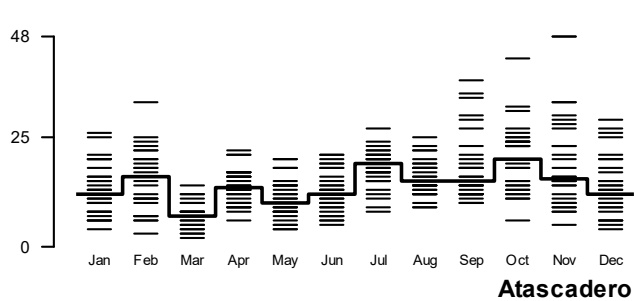


Figure 7: North County and SLO Daily PM₁₀ Values for 2023 ($\mu\text{g}/\text{m}^3$)

10-Year Trends

Ozone

Figure 8, below, depicts the total number of days each year where a station's Air Quality Index (AQI) value was "moderate" or worse. Occasionally the EPA will update the breakpoints associated with different AQI levels. For uniformity, the current AQI breakpoint for moderate ozone was utilized across the entire dataset. This equates to an 8-hour average ozone concentration of 55 ppb or higher for years from 2014 to 2023. Moderate days in the southern portion of the county remain uncommon with these locations averaging less than 5 days of moderate AQI due to ozone over the last 10 years. Locations in the eastern county non-attainment zone (i.e. Carrizo Plains and Red Hills) see the most moderate days in the county although some improvement has been seen over the previous 10 years mostly at the Carrizo Plains station.

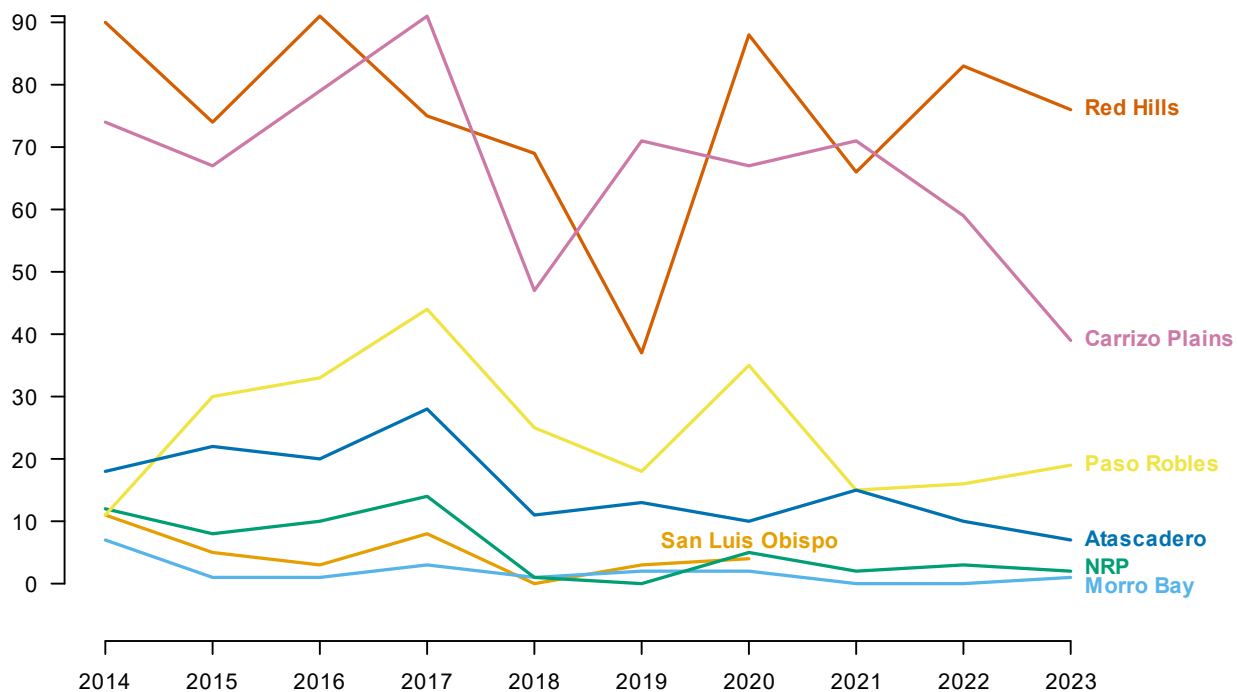


Figure 8: Number of Day with Moderate or greater AQI due to Ozone (8hr Avg. above 55ppb)

Figure 9, below, shows ozone design values over the same period. Design values are used by the EPA to determine whether an area attains a federal standard. For ozone, the design value is calculated by averaging the 4th highest annual 8-hour averages from three consecutive years. For example, the 2023 design value is the average of the 4th highest 8-hour averages from 2021, 2022, and 2023. Only design values meeting data completeness requirements are included; the dashed red line indicates the federal 8-hour standard, which changed from 75 to 70 ppb in 2015.

Exceptional event demonstrations associated with wildfire smoke influence on ozone concentrations during 2018 and 2020 wildfire seasons were submitted to and concurred upon by the EPA. Under the Exceptional Event rule, Red Hill’s ozone concentrations on August 3, 4, 6, 7, and 9 of 2018 as well as August 20 and 21, September 30, and October 1 and 2 of 2020 are excluded from design value calculations including the values depicted in Figure 9. These elevated concentrations were demonstrated to be directly influenced by wildfire smoke and were neither reasonably controllable nor preventable.

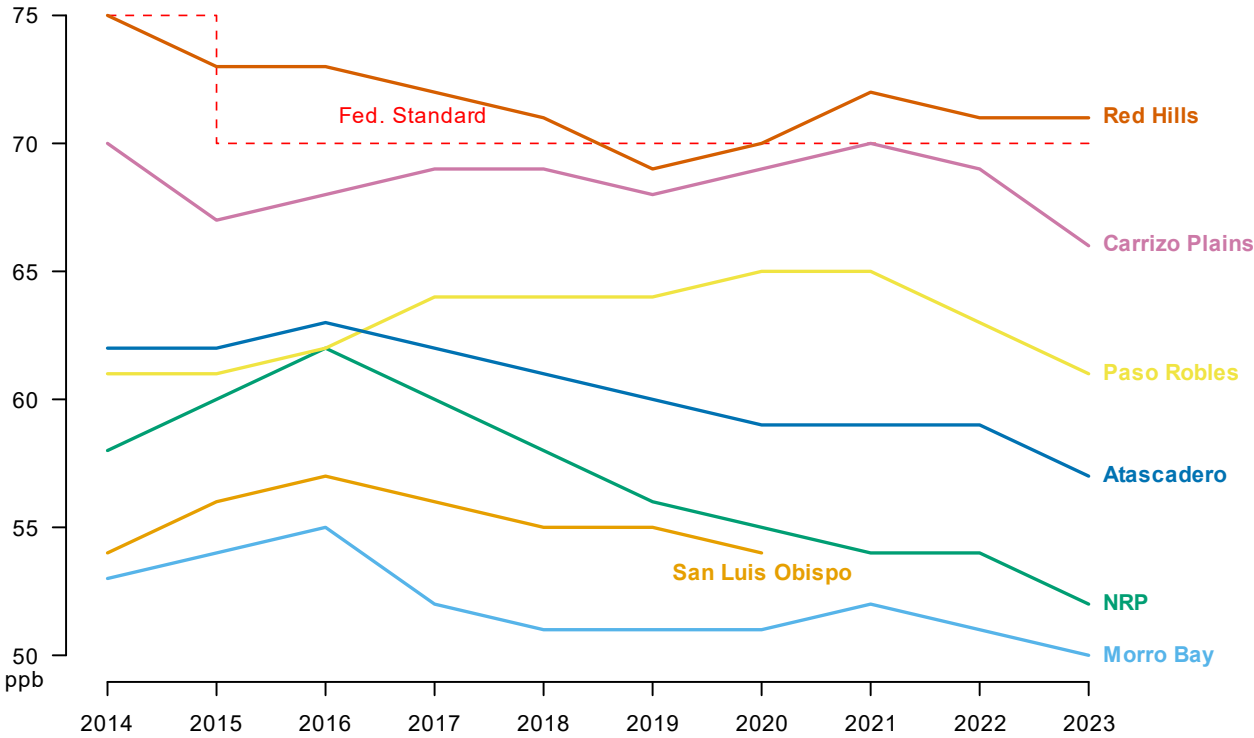


Figure 9: Ozone Design Value Trends, 2014-2023

Particulate Matter

Figure 10 shows the number of exceedances of the state 24-hour PM₁₀ standard (50 µg/m³) at each site by year. Years missing more than 10% of daily values are omitted.

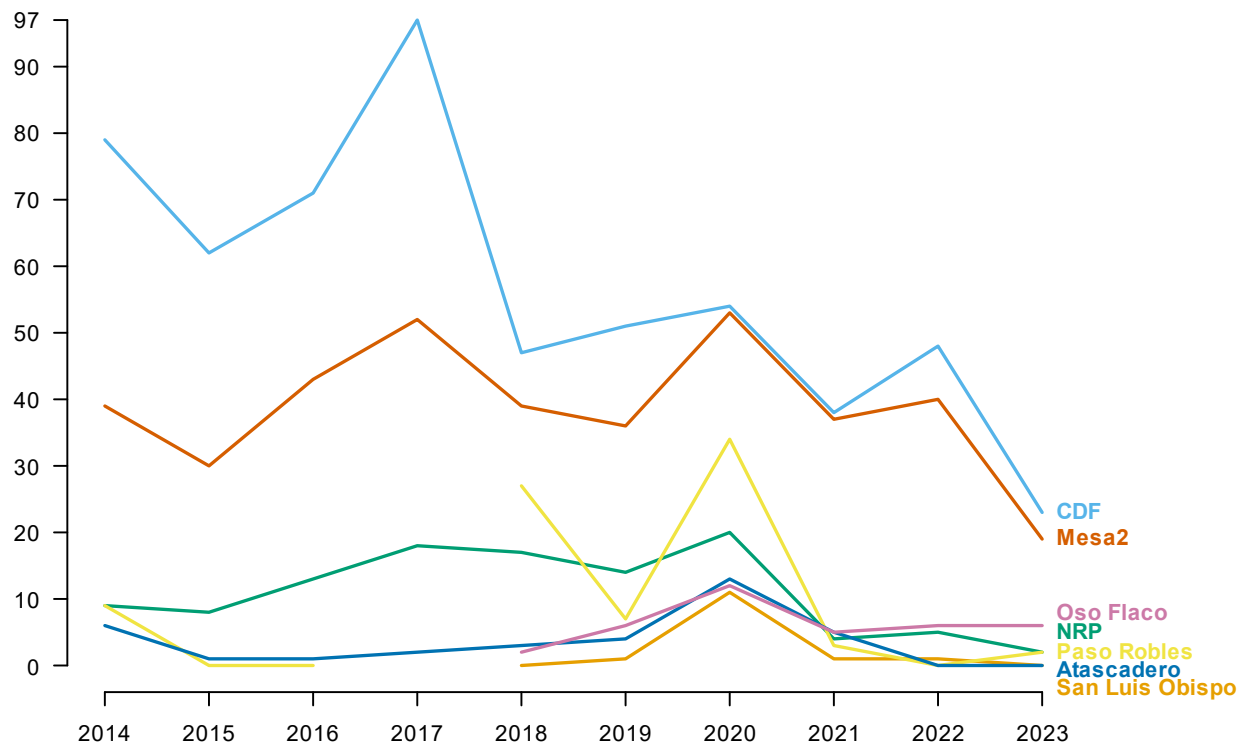


Figure 10: Exceedances of the California 24-hour PM₁₀ Standard, 2014–2023

Figure 11 plots the total number of hours each year when PM₁₀ was at or above 50 µg/m³ during the hours when people are most likely to be active (10 am to 4 pm). This metric is intended to illustrate trends in population exposure, even though there are no health standards for single-hour exposure to this level of PM₁₀. Years missing more than 10% of daily values are omitted.

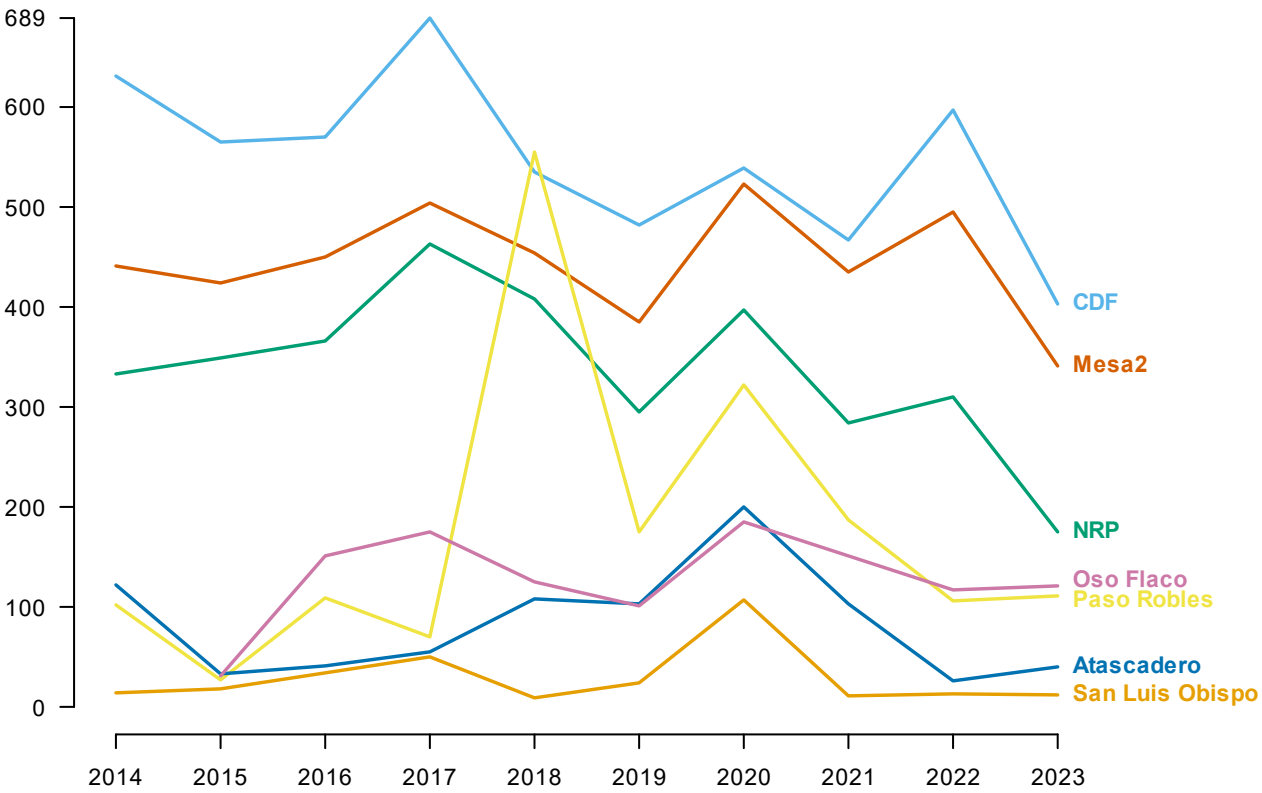


Figure 11: Number of Hours At or Above 50 µg/m³ PM₁₀ between 10 a.m. and 4 p.m., 2014–2023

Figure 12 depicts annual average PM₁₀ concentrations over the past 10 years;⁶ years with partial data are omitted. The red dashed line marks the state standard for the annual average (20 µg/m³). Notably Mesa 2 achieved this standard in 2023.

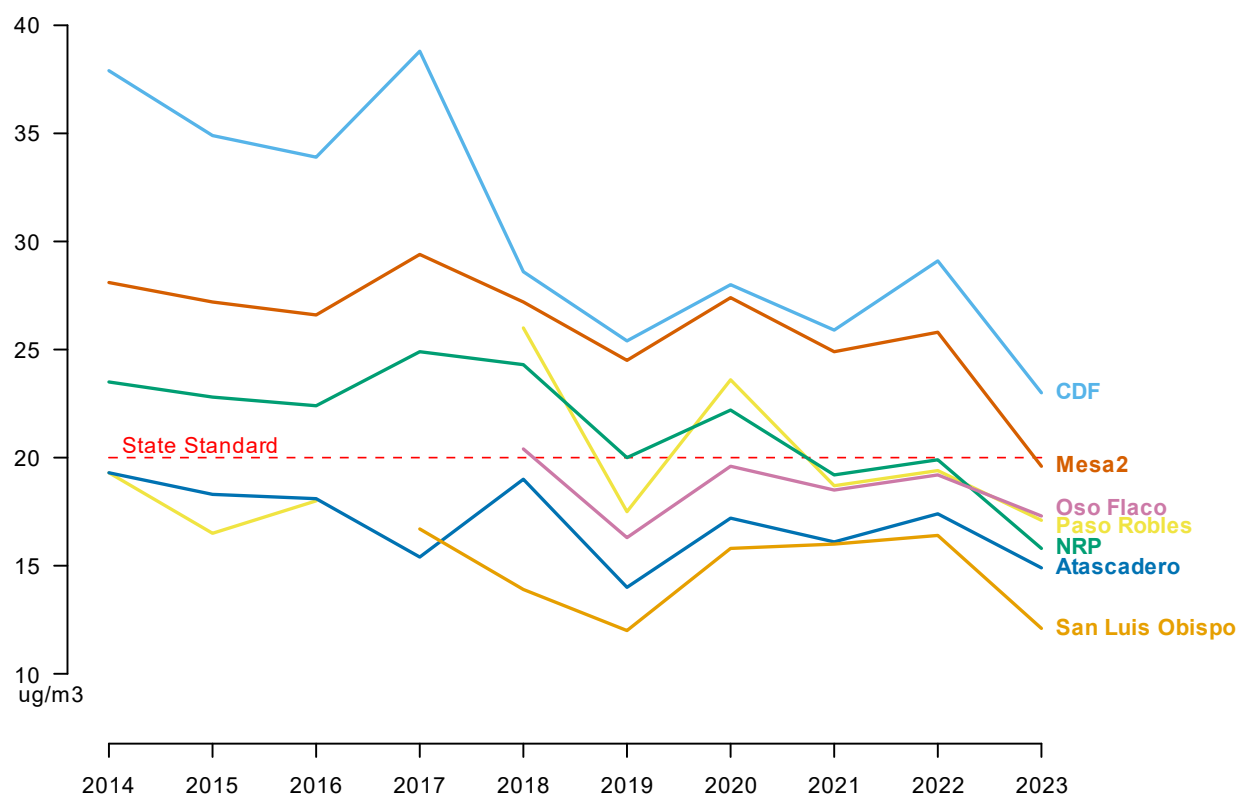


Figure 12: PM₁₀ Annual Averages, 2014–2023

⁶ In general, these are seasonally weighted averages as calculated by AQS. For years when sampling methodology changed or a site was moved, the average depicted is the time-weighted average of the methodologies or locations.

Figure 13 shows trends in PM_{2.5} annual averages for the four sites where it is measured. Data for the past 10 years are shown, and years with partial data are omitted. The red dashed line marks the 12 µg/m³ state and federal PM_{2.5} standard for the annual average. The green dashed line shows the updated standard of 9 µg/m³ which was promulgated on February 7th of 2024.

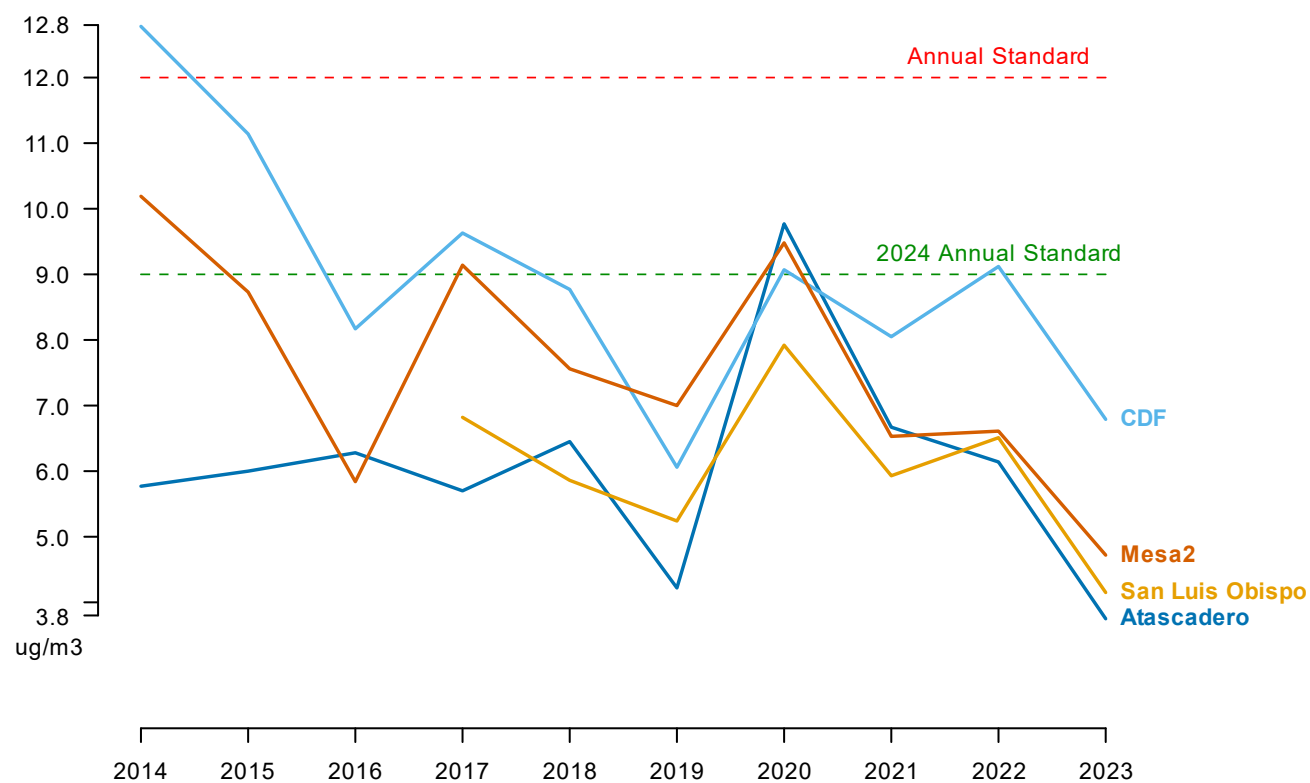


Figure 13: PM_{2.5} Annual Averages, 2014-2023

Appendix A: Assessing the Effectiveness of ODSVRA Mitigations

Introduction

Windblown dust from the ODSVRA continues to affect air quality in southern San Luis Obispo County. For two decades, the APCD has been engaged with the California Department of Parks and Recreation (State Parks) in an effort to resolve the issue and improve the region's air quality; these actions are chronicled on the APCD's website.⁷ Since daily monitoring began at CDF in 2010, the annual number of exceedances of the California PM₁₀ standard there has varied from many as 97 (in 2017) to as few as 23 (in 2023), with most related to ODSVRA dust. Over this period, State Parks has implemented various mitigation projects, with the total area of dust controls ranging from 1 to 740.1 acres.⁸

It would be overly simplistic to attribute year-to-year changes in the number of exceedances solely to changes in the extent of State Parks' mitigation efforts. This is because downwind PM₁₀ concentrations are influenced not only by the mitigations, but also by non-ODSVRA sources including wildfire smoke and dust transported from the San Joaquin Valley (SJV), and—most importantly—by variations in meteorology, especially the strength and direction of onshore winds. It is the wind that drives dust emissions, so, all else being equal, windier years are expected to be dustier and to have more PM₁₀ exceedances than less windy years.

To quantify the effectiveness of these dust controls, recent Annual Air Quality Reports⁹ have analyzed trends in particulate matter on the Nipomo Mesa. Appendix A of the 2017 Annual Air Quality Report proposed a "Difference-in-Differences" approach to disentangling the potential effects of the mitigations from meteorology and other factors. In a nutshell, this method looks at the ratio of PM₁₀ concentrations between CDF and Oso Flaco on wind event days, and then asks whether that ratio changes from one year to the next. Comparing to Oso Flaco implicitly controls for inter-annual variations in meteorology and non-ODSVRA PM₁₀ sources. This is because the mitigation measures are upwind of CDF but not Oso Flaco, so changes in the mitigations should affect dust levels at CDF but not at Oso Flaco. Meanwhile, both sites should experience the same trends in meteorology, and they should be similarly influenced by wildfires and regional particulate matter events. The Oso Flaco station was installed in mid-2015, so this analysis is only possible for 2016 and later years. 2017 is used as the baseline to compare other years to because it had the least amount of mitigation and thus is the best approximation of a fully unmitigated baseline.

For this analysis, a wind event day is defined as any day when the hourly wind speed at 15:00 at the S1 Tower within the ODSVRA exceeds 9.445 m/s and the hourly wind direction at 13:00 at CDF is between 289.5 and 360 degrees. Any day that was obviously influenced by wildfire smoke or SJV dust transport was excluded from the analysis. While there have been many wildfire days and SJV dust days over the years, only two—October 11, 2021, and July 6, 2020—also met the criteria for being wind event days and were thus excluded from the analysis. See the 2017 Annual Air Quality Report further description of the methodology.¹⁰

The difference-in-differences methodology has been used in subsequent Annual Air Quality Reports and presentations to the Hearing Board. Here, the methodology is applied to data from 2023. This year, the

⁷ <https://www.slocleanair.org/air-quality/oceano-dunes-efforts.php>;

⁸ State of California, Department of Parks and Recreation, Provisional Final 2024 Annual Report and Work Plan, September 11, 2024. Available online at https://storage.googleapis.com/slocleanair-org/images/cms/upload/files/2024ARWP_ProvFinal_20240911_reduced.pdf

⁹ San Luis Obispo County Air Pollution Control District, Annual Air Quality Reports for 2015-2022, all available at <https://www.slocleanair.org/library/air-quality-reports.php>.

¹⁰ San Luis Obispo County Air Pollution Control District, Annual Air Quality Reports for 2017, November 2018. Available online at <https://storage.googleapis.com/slocleanair-org/images/cms/upload/files/2017aqrt-FINAL2.pdf>.

methodology is also applied to Mesa2 to quantify the response of PM₁₀ levels at that site to the mitigations at the ODSVRA.

Results

The results for 2023 along with earlier years are summarized in Table A1, below.¹¹ Applying the methodology to the 2023 data yields a statistically significant 38.1% improvement in event-day PM₁₀ at CDF compared to the baseline year of 2017 (95% CI: 24.9 to 48.9%; p-value: 7.8E-6). In concrete terms, the median wind event day PM₁₀ concentration at CDF was 45 µg/m³ in 2023; this analysis predicts it would have been 73 µg/m³ if these mitigation projects had not been implemented.

For Mesa2, the methodology yields a statistically significant 22.2% improvement in event-day PM₁₀ compared to the baseline year (95% CI: 6.8 to 35.0%; p-value: 6.8E-3). In concrete terms, the median wind event day PM₁₀ concentration at this site was 37 µg/m³ in 2023, and the analysis predicts it would have been 48 µg/m³ without the mitigation projects.

Table A1: Summary of Change in Event-Day PM₁₀ Ratio at CDF & Mesa2

Table 1: Difference-in-differences results, 2016-2023					
Year	Total Dust Mitigation Extent (approx. acres)	Change, vs 2017 baseline, in Event-Day PM₁₀ Ratio			
		CDF vs Oso Flaco		Mesa2 vs Oso Flaco	
		Percent Change	95% Confidence Interval	Percent Change	95% Confidence Interval
2023	740.1	- 38.1 %	-24.9% to -48.9%	- 22.2%	-6.8% to -35.0%
2022	740.1	- 31.6%	-18.5% to -42.6%	- 13.8%	+1.4% to -26.7%
2021	322.5	- 33.5%	-16.1% to -47.3%	- 7.0%	+11.8% to -22.6%
2020	230.2	- 28.4%	-13.9% to -40.4%	+ 4.6%	+25.4% to -12.9%
2019	137.8	- 7.6%	+23.2% to -30.7%	+ 14.9%	+41.4% to -6.7%
2018	146.9	- 22.4%	-7.4% to -34.9%	- 2.3%	+14.3% to -16.4%
2017	55.3	0 %	n. a.	0 %	n. a.
2016	76.8	- 12.7%	+16.8% to -38.4%	- 4.2%	+17.8% to -22.0%

¹¹ On February 9, 2024, District published a preliminary version of this analysis online as part of the document “Frequently Asked Questions: Air Quality and ODSVRA Mitigations,” available at https://storage.googleapis.com/slocleanair-org/images/cms/upload/files/SOA_FAQ_Jan%202024v3.pdf. That analysis used data for 2023 which at that time was unofficial, so the analysis was deemed unofficial. Since then, the 2023 data has been fully validated and certified. There were no significant changes, and the official results reported here are identical to the unofficial results reported in February.

Discussion

As shown in Table A1, CDF and Mesa2 show continued year-over-over improvement, even as the footprint of the mitigations remained unchanged in 2023. This is likely due to the continued growth and maturation of previously installed dune restoration projects and the conversion of wind fencing and straw treatments to permanent dust controls. The overall improvement at Mesa2 is less than that for CDF (22.2% vs 38.1%), but this is expected as dust levels have traditionally been lower there than at CDF, so smaller reductions are needed at Mesa2 than at CDF to achieve pre-disturbance levels. While the observed percent reduction is larger at CDF than at Mesa2, CDF still exceeds the PM₁₀ standard more frequently and has a higher annual average than Mesa2, as shown in Figures 10 and 12, above.

The results of these analyses can be compared with the numbers of hours with PM₁₀ greater than 300 µg/m³ at each site. Unlike the difference-in-differences methodology, this metric does not account for the impacts of wildfires and non-ODSVRA dust sources, but it does illustrate how peak concentrations have been affected by the dust mitigations. As shown in Figures A1 and A2, the number of such hours has generally decreased as the extent of the dust control program has increased. An exception to this trend is Mesa2 in 2023. Through October 2023, Mesa2 was on track to have the fewest such hours, but a storm in November resulted in 2023 having slightly more hours than 2022. The winds associated with the November storm were from the southeast, so the source of the elevated PM₁₀ was likely not the OSDVRA. Another exception is CDF in 2020. There were substantially fewer hours over 300 µg/m³ that year than in 2019 or 2021, despite it having the worst wildfire smoke impacts of any year on record. That year the OSDVRA was closed to public vehicular traffic from March 27 through October 30, coinciding with most of the spring and fall windy seasons. Of the 4 hours that exceeded 300 µg/m³, only one occurred during the period when the park was closed to vehicles. At Mesa2, this “COVID effect” is not apparent.

The results can also be compared to the annual number of violations of District Rule 1001. The OSDVRA is in violation of section C.3 of the rule every day for which the 24-hr average PM₁₀ concentration at CDF exceeds 55 µg/m³ and is more than 20% higher than the 24-hr average PM₁₀ concentration at Oso Flaco.¹² As shown in Figure A3, below, with eleven violations, 2023 has the fewest annual violations on record.¹³ This trend parallels the improvement in CDF levels revealed by the difference-in-differences analysis. Note, however, that comparing the number of Rule 1001 violations from one year to the next is complicated by the fact that the Oso Flaco monitor was offline for significant periods of certain years. For example, there were 10 days in 2017 when CDF PM₁₀ exceeded 55 µg/m³ but the Oso Flaco monitor was offline, and thus compliance with Rule 1001.C.3 could not be determined.

Finally, the results of this difference-in-differences analysis can be compared with the analysis of the Total PM₁₀ to Total Wind Power Density (TPM₁₀:TWPDP) ratio reported in State Parks’ 2024 Annual Report and Workplan (ARWP).⁸ The TPM₁₀:TWPDP ratio is a metric developed by State Parks and Desert Research Institute to assess how emissions of wind-blown dust change from year to year. Like the difference-in-differences methodology, it aims to control for interannual changes in meteorology, albeit by a completely different method. According to the 2024 ARWP, the TPM₁₀:TWPDP ratios for both CDF and Mesa2 have decreased as dust controls have expanded and matured. As with the other metrics discussed above, the TPM₁₀:TWPDP ratios for CDF and Mesa2 continued to decrease in 2023 even as there was no change in the footprint of the dust controls from 2022 to 2023. See Figures A4 and A5, below, which are copied from the ARWP.

¹² San Luis Obispo County Air Pollution Control District, Rule 1001 Coastal Dunes Dust Control Requirements, Adopted November 16, 2011, Revised by Court Order CV12-0013, March 7, 2016. Available online at https://storage.googleapis.com/slocleanair-org/images/cms/upload/files/Rule_1001.pdf.

¹³ The Oso Flaco monitor was established in 2015. Data from that year is omitted from Figure A3, since it operated for only half of the year, not including the spring windy season when most exceedances of the state PM₁₀ standard and Rule 1001 are typically observed.

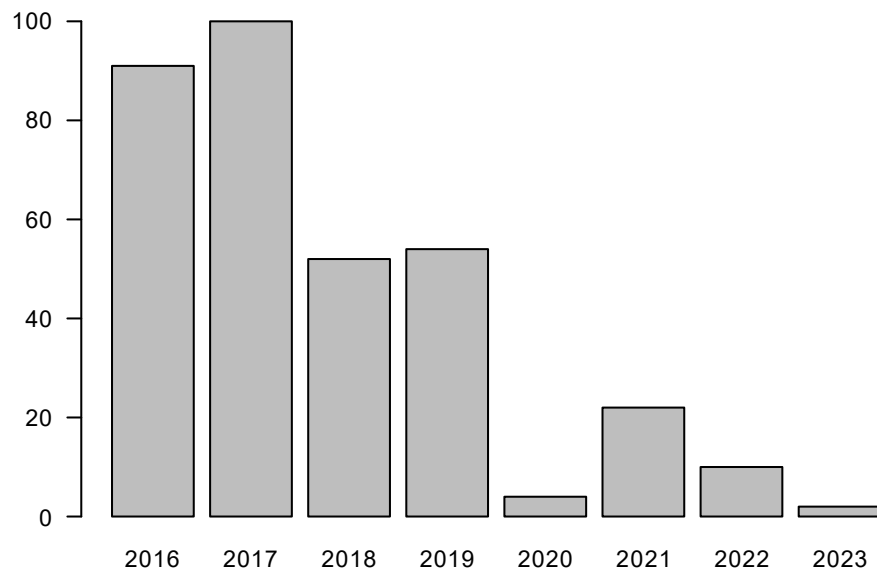


Figure A1: Annual Hours at CDF Greater than 300 µg/m³

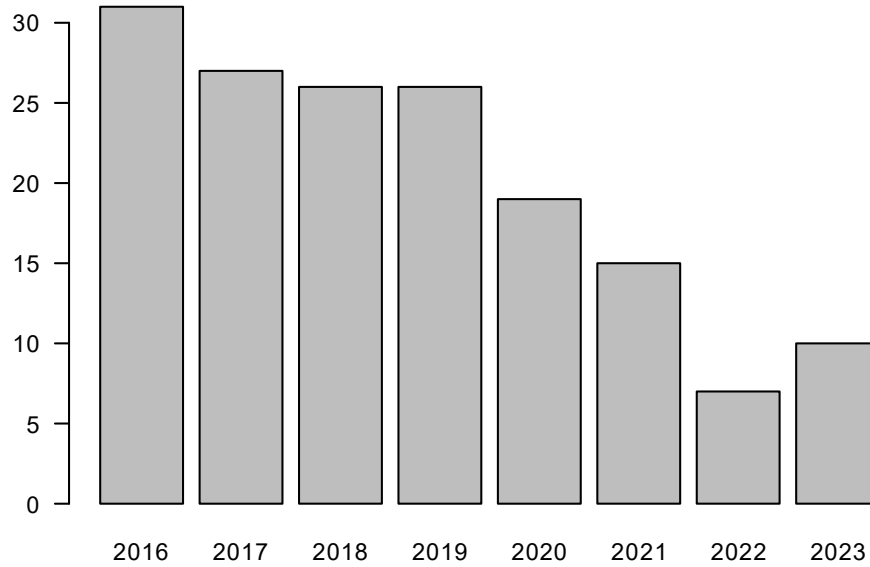


Figure A2: Annual Hours at Mesa2 Greater than 300 µg/m³

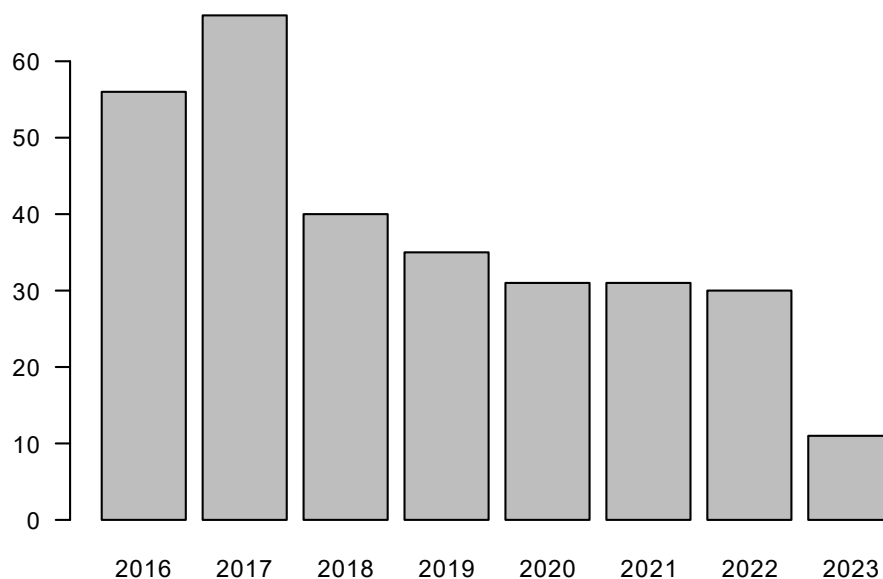


Figure A3: Annual Violations of District Rule 1001

Furthermore, according to the ARWP the “metric indicates that the PM_{10} originating from the ODSVRA has been reduced by approximately 44.5% at CDF using the two-year (2022 and 2023) mean value of 0.16 for equivalent WPD conditions compared with the baseline year of 2013 when there were few acres of dust control upwind of the CDF station. For Mesa2, the TWPD and TPM_{10} measurement-based metric indicates that the PM_{10} originating from the ODSVRA has been reduced by approximately 21% using the two-year (2022 and 2023) mean value of 0.14 for equivalent WPD conditions compared with the baseline year of 2013 (0.18) when there were few dust controls in place at the ODSVRA.” These estimated reductions in ODSVRA-related ambient PM_{10} at CDF and Mesa2 compare very favorably with the reductions derived from the difference-in-differences analysis presented in Table A1.

Conclusion

The dust controls deployed at the ODSVRA since 2017 have resulted in large, statistically significant reductions in downwind PM_{10} concentrations on days when strong winds blow across the ODSVRA. Specifically, compared to 2017, there has been an estimated 38.1% improvement in wind event day PM_{10} at CDF (95% CI: 24.9 to 48.9%; p-value: 7.8E-6) and 22.2% improvement at Mesa2 (95% CI: 6.8 to 35.0%; p-value: 6.8E-3). In concrete terms, the median wind event day PM_{10} at CDF was 45 $\mu g/m^3$ in 2023; this analysis predicts it would have been 73 $\mu g/m^3$ if these mitigation projects had not been implemented.

These estimates are corroborated by the TPM_{10} :TWPD ratio analysis in State Parks’ 2024 ARWP, and by annual trends in hours over 300 $\mu g/m^3$ and violations of Rule 1001.

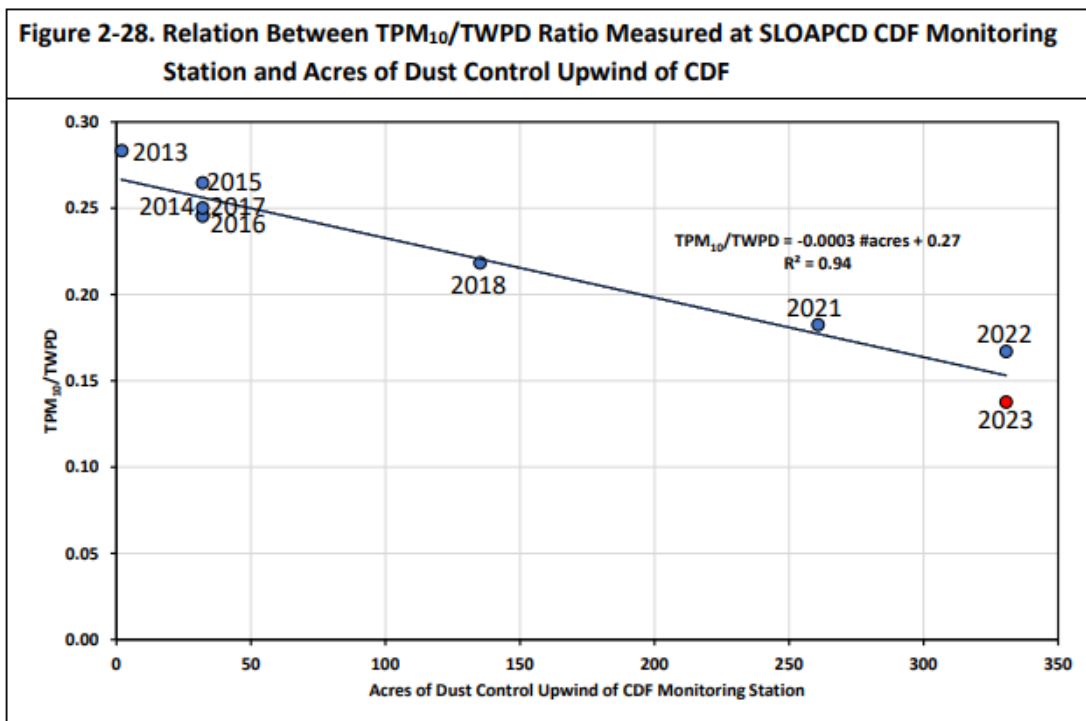


Figure A4: TPM₁₀/TSP Ratio for CDF. Reproduced from Reference 8, State Park's 2024 ARWP.

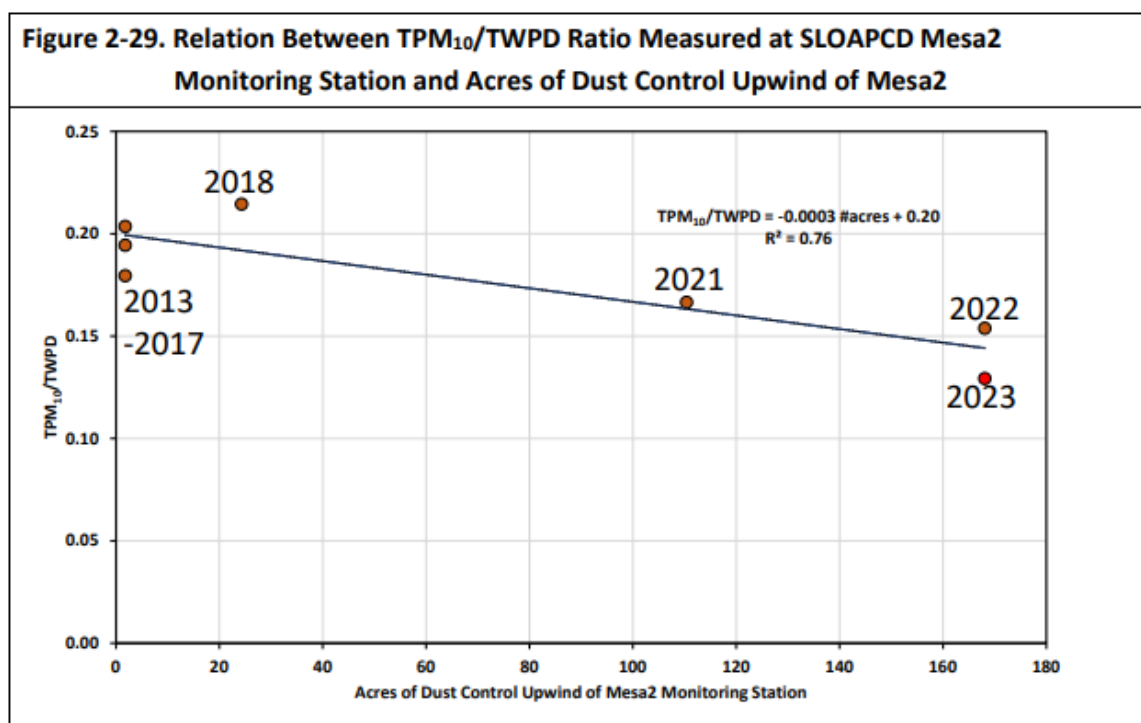


Figure A5: TPM₁₀/TSP Ratio for Mesa. Reproduced from Reference 8, State Park's 2024 ARWP.

2023 AIR QUALITY ANNUAL REPORT

Protecting blue skies for a healthy community!

2023 SNAPSHOT



Air quality continues to show overall steady long-term trends of decreasing pollutant concentrations and improving air quality with some year-to-year variability. Ozone trends showed improvement from 2022 (with exception of Red Hills which remained unchanged), and PM10 and 2.5 continued to show marked improvement relative to trends.

Read our full report at:
SLOCleanAir.org/library/air-quality-reports



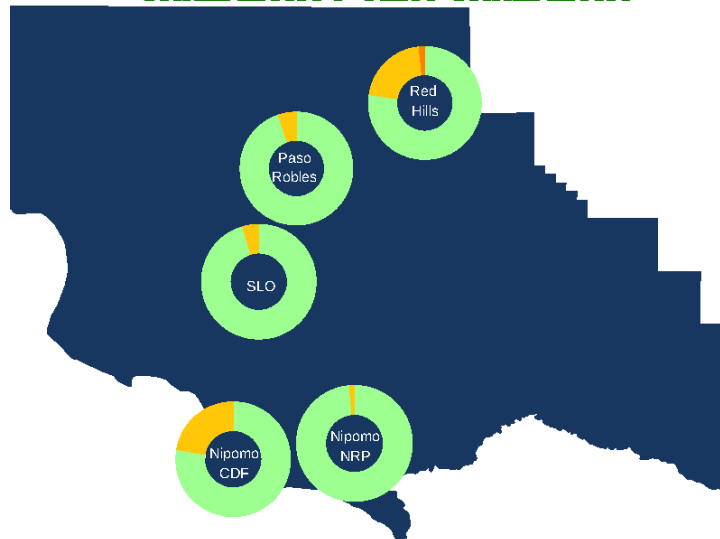
AIR QUALITY AT A GLANCE

SLO County APCD has a network of 10 permanent ambient air monitoring stations across the county measuring ozone and particulate matter. The data from those stations, in addition to other resources, are used to develop the Air Quality Index (AQI) values for the community. The AQI tells you how clean or polluted your air is and what health effects you may experience.



Want to know more about the AQI, how it is used & how to protect your health? Visit our new web page, SLOCleanAir.org/air-quality/health.

GOOD vs
MODERATE vs
UNHEALTHY FOR SENSITIVE RECEPTORS
UNHEALTHY / VERY UNHEALTHY



Air Pollution Control District
San Luis Obispo County

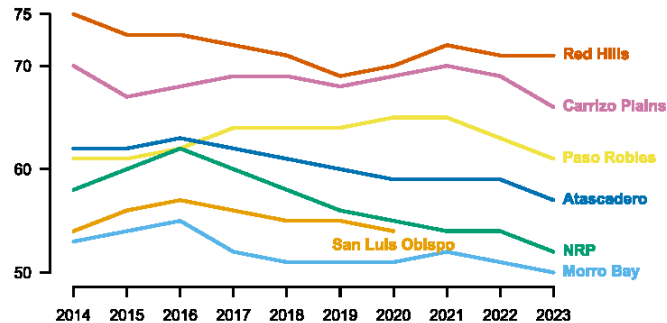
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OZONE TRENDS

Overall trends show continued improvements with decreasing design values at all locations except for Red Hills whose design value remained unchanged in 2023. Most stations saw a decrease in the number of days with ozone levels in the Moderate AQI range. There were five exceedances of the state and federal 8-hr ozone standard of 70ppb at the Red Hills monitoring station in the Eastern County non-attainment zone. These exceedances all occurred under high pressure systems with hot stagnant conditions over the San Joaquin Valley leading to high ozone concentrations that were transported into the Red Hills region by easterly winds.

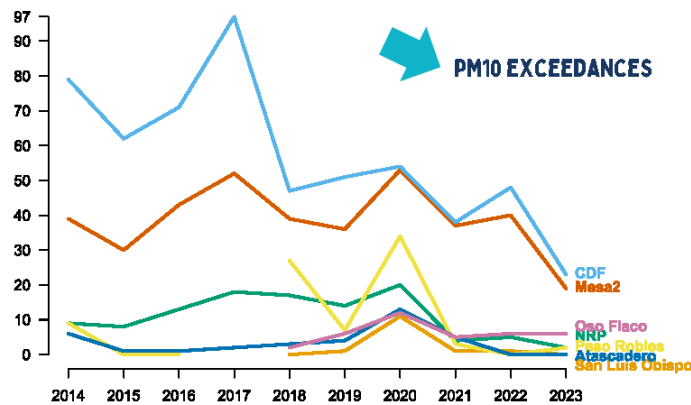


OZONE DESIGN VALUES



PARTICULATE MATTER TRENDS

PM10 on the Nipomo Mesa continued to show improvements relative to 10-year trends. The state 24-hour PM10 standard of 50 $\mu\text{g}/\text{m}^3$ was exceeded 23 times at CDF and 19 times at Mesa 2 the least number of exceedances since daily monitoring began in 2010. Similarly annual averages at all stations decreased with Mesa 2 attaining the state annual average standard of 20 $\mu\text{g}/\text{m}^3$. For PM2.5 annual averages decreased across the county with many sites near the lowest annual averages they have recorded. Notably at current levels all sites will meet the new more stringent federal PM2.5 annual average standard of 9 $\mu\text{g}/\text{m}^3$ that was implemented on February 7th, 2024.



PM10 EXCEEDANCES



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