ANNUAL AIR QUALITY REPORT | 2022

SLO COUNTY apcd | Air Pollution Control District
San Luis Obispo County

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2022 Annual Air Quality Report
Published November 2023
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Executive Summary

Air quality improved substantially in 2022 relative to record breaking air quality impacts associated with the historic 2020 wildfire season. Additionally, the data shows a decrease in design value and hours above 65ppb indicating improvement in our average ozone air quality:

- **Ozone** overall trends show marked improvement from 2020 and 2021 levels, but a slight increase for the Red Hills station in both hours above 65 ppb (Figure 8) and exceedances of the ozone standard in comparison to 2019 (Figure 9). That said, in SLO County, the federal 8-hour 70 ppb ozone standard was only exceeded on 1 day in 2022, and that exceedance was at Red Hills (Table 3).
- **PM_{10}** on the Nipomo Mesa continued to show improvements relative to 10-year trends (Figures 10 – 12; Appendix A). The overall number of exceedance days slightly increased from 2021 levels by 2 days. Both Mesa2 and CDF saw a slight increase in the number of days exceeding the state 24-hour PM_{10} standard of 50 µg/m^3 as compared to 2021. At Oso Flaco, exceedances increased slightly by 1 day from 2021. No federal PM_{10} standards were exceeded (Table 4).
- **$PM_{2.5}$** annual averages slightly increased at all sites (Figure 13), including those on the Nipomo Mesa, with no exceedances of $PM_{2.5}$ standards (Table 4).

The only ozone exceedance occurred on May 25th and was related to transport from the San Joaquin Valley. The previous days had elevated levels of ozone throughout the valley, and on the 25th winds were more easterly allowing for transport to occur.

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). While the federal PM_{10} standard was not exceeded anywhere in 2022, the more stringent state standard was exceeded on 52 days on the Nipomo Mesa, and most of these exceedances were due to windblown dust. In addition, the Rule 1001 performance standard was violated 30 times. This is an improvement over the previous year when the rule was violated 31 times.

Appendix A presents an analysis of the effects of the ODSVRA dust control projects on downwind PM_{10} concentrations. Using the same methodology as in previous Annual Air Quality Reports, the San Luis Obispo County Air Pollution Control District (APCD) estimates that for 2022 (compared to the baseline year of 2017), the dust controls yielded a 31.6% decrease in event-day PM_{10} at CDF and a 13.8% decrease at Mesa2. The median wind event day PM_{10} concentration at CDF was 51 µg/m^3 in 2022; this analysis predicts this concentration would have been 74 µg/m^3 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. Summary data appear weekly in the Saturday edition of The Tribune, a local newspaper. 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 2022; 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.

The CARB-operated San Luis Obispo – Higuera St. station was shut down and monitoring discontinued in early January 2021. The APCD began operating the San Luis Obispo – Roberto Ct. station as a replacement on January 1, 2021, with PM_{10} and $PM_{2.5}$ monitoring. Ozone monitoring was not continued at this location due to associated costs. Monitoring at the Morro Bay and Nipomo Regional Park station provide data that is highly representative of the region serving as a substitute for the San Luis Obispo station.

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, and equipment and data are audited periodically to ensure data validity. Gaseous pollutant levels are measured every few seconds and averaged to yield hourly values. Particulate matter ($PM_{2.5}$ and PM_{10}) is sampled hourly. All monitoring instruments are Environmental Protection Agency (EPA)-approved Federal Equivalent Methods (FEMs) or Federal Reference Methods (FRMs).

The 2022 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 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

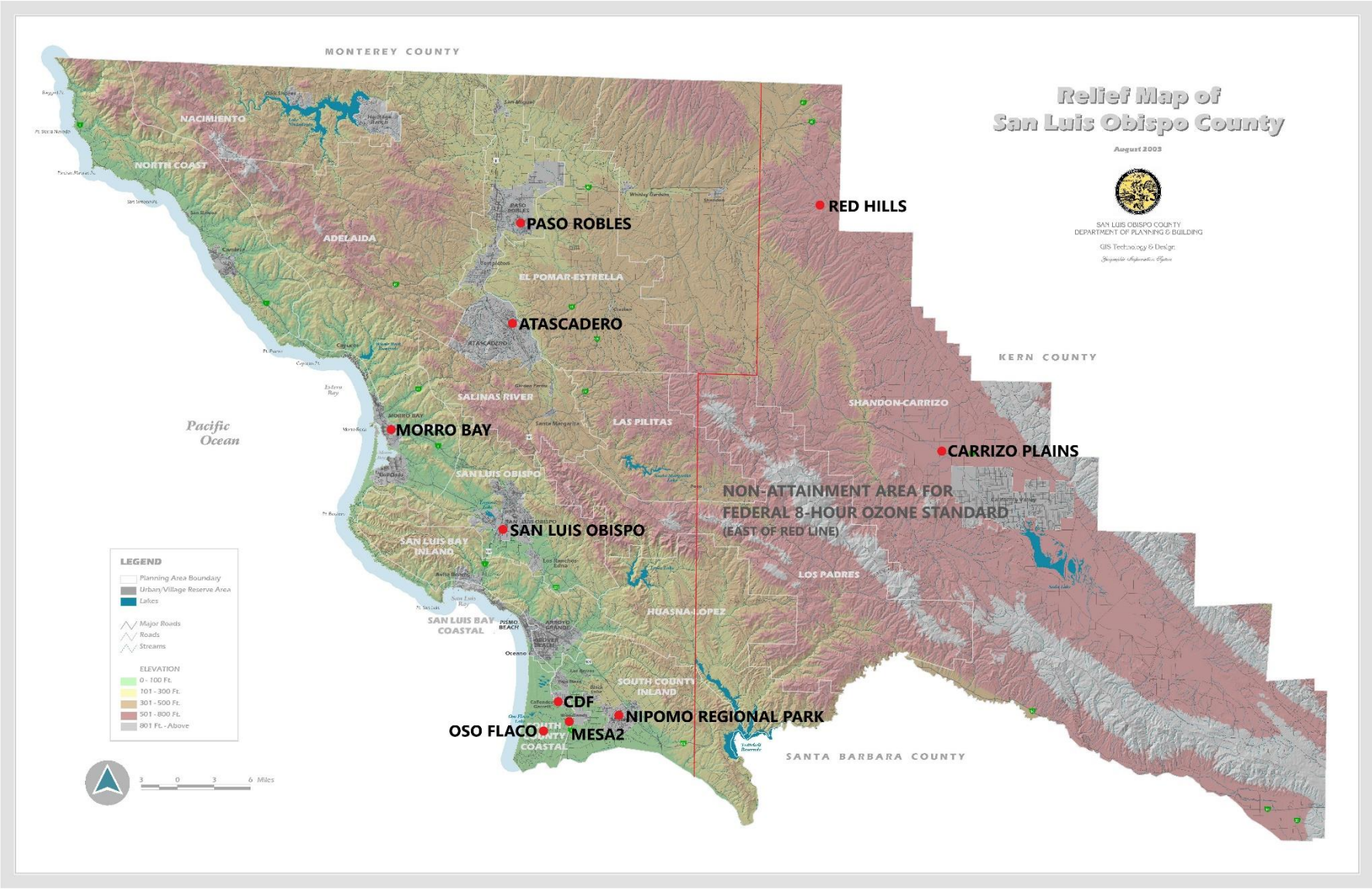


Table 1: Ambient Air Quality Parameters Monitored in San Luis Obispo County in 2022

	O_3	NO	NO_2	NO_x	SO_2	PM_{10}	$PM_{2.5}$	WS	WD	ATM
APCD Permanent Stations										
Atascadero	X	X	X	X		X	X	X	X	X
Morro Bay	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	
San Luis Obispo (Roberto Ct.)						X	X			
CARB Stations										
Paso Robles	X					X		X	X	X
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					ATM	Ambient Temp

Ambient Air Pollutants Of Local Concern

Ozone

Ozone (O_3) 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.

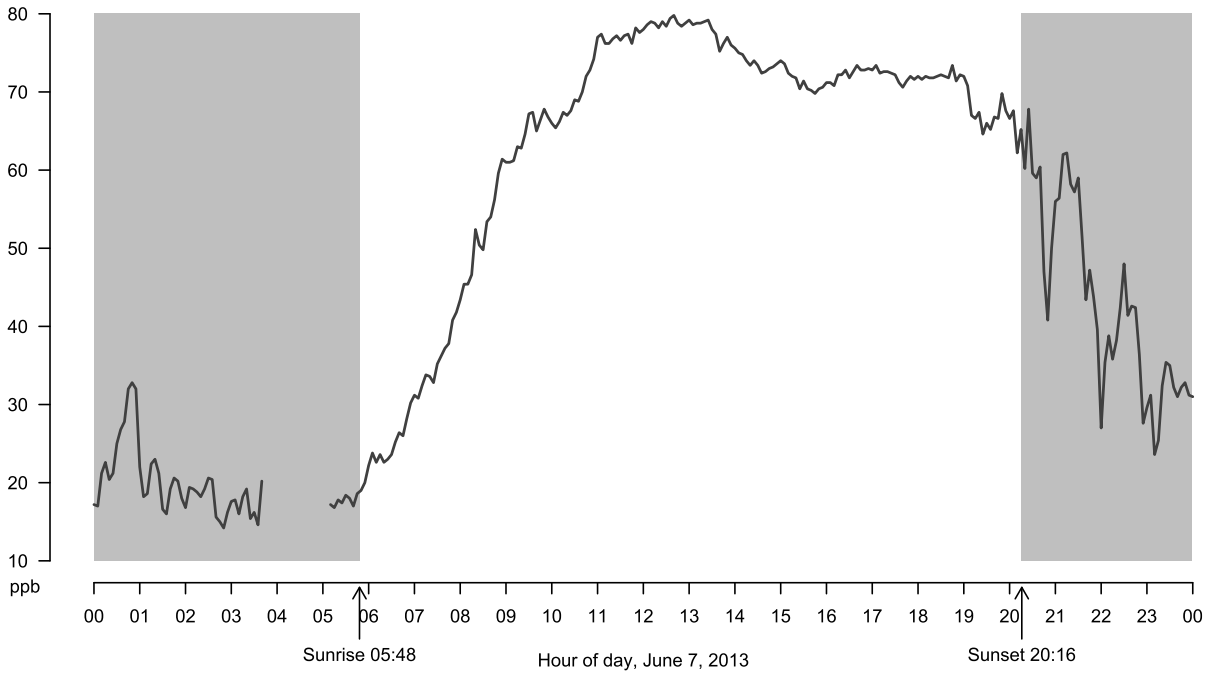


Figure 2: Example of Diurnal Ozone Pattern from Carrizo Plain

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: PM_{10} (inhalable particulate matter less than 10 microns in aerodynamic diameter), and $PM_{2.5}$ (fine particulate matter 2.5 microns or less in aerodynamic diameter). Both consist of many different types of 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. 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-colored component of smog. NO_2 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 (PM_{10} 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 (see below) may be excluded from attainment/nonattainment determinations at the discretion of the EPA.

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 previous 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 be meeting 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."[2] This notice states the county will not be redesignated as "Moderate" at this time. Instead, 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.

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 PM_{10} standards. The county is designated as attaining the state annual $PM_{2.5}$ standard.

State and federal standards for NO_2 have never been exceeded here. The state standard for SO_2 was exceeded periodically on the Nipomo Mesa until 1993. Equipment and processes at the facilities responsible for the emissions were upgraded as a result, and the state SO_2 standard has not been exceeded since that time. The federal SO_2 standard has only been exceeded once, in 2013, when maintenance activities at these facilities resulted in emissions exceeding the 1-hour standard of 75 ppb. (This standard was established in 2011.) State CO standards have not been exceeded in the county since 1975. The county has never been required to conduct lead monitoring.

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

[2] https://www.federalregister.gov/documents/2022/10/20/2022-22192/determinations-of-attainment-by-the-attainment-date-california-areas-classified-as-serious-for-the

Exceptional Events

Exceptional events are unusual or naturally occurring events that can affect air quality but are not reasonably controllable or preventable and are unlikely to reoccur at a particular location. Examples include wildfires and tornadoes. Air quality monitoring data influenced by exceptional events can sometimes be excluded from regulatory determinations related to violations of the NAAQS (e.g., exclusion of some east county ozone data in 2018 and 2020 due to wildfires), if recommended by the APCD and CARB and approved by the EPA. The EPA will only consider exceptional event demonstrations if they have implications for an upcoming attainment determination. The APCD has not submitted any exceptional event documentation for 2022.

Table 2: Ambient Air Quality Standards for 2022 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/m³**	150 μg/m³
	1 Year‡	**20 μg/m³**	
Fine Particulate Matter ($PM_{2.5}$)	24 Hours		35 μg/m³
	1 Year‡	12 μg/m³	12 μg/m³
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/m³
	30 Day	1.5 μg/m³	

* San Luis Obispo County (in whole or in part) is designated as nonattainment for the standards in **boldface print** as of September 2022.

† For clarity, the ozone, SO_2, and NO_2 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 PM_{10} and $PM_{2.5}$ standards, federal regulations state that measurements shall be rounded to the nearest 10 μg/m³ and 1μg/m³, respectively. Thus, for PM_{10}, 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.

Ozone and Gaseous Pollutant Summary

In 2022, exceedances of the 8-hour state and federal standard (70 ppb) occurred on 1 day at the Red Hills monitoring station. No other stations recorded exceedances of the standard, and the state 1-hour standard (90 ppb) was not exceeded anywhere this year. 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 2022 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 2022 (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	74 05/25	67 08/16	67 09/28	68 05/25	61 06/24	61 09/23	59 05/04						
Atascadero	69 09/02	69 09/28	67 10/04	64 10/03	63 09/05	62 08/26	59 04/01				26 11/17	25 02/10	24 02/11
Morro Bay	59 10/19	58 04/07	53 02/09	54 04/07	54 10/18	51 02/08	50 02/27						
Red Hills	80 05/26	75 09/02	72 06/07	**75** 05/25	70 09/01	69 09/28	69 10/05						
Carrizo Plain	76 09/08	69 08/16	69 09/25	66 08/16	64 06/07	63 09/01	63 09/02						
Nipomo Regional Park	65 10/19	63 09/05	61 04/07	58 04/07	58 10/18	56 10/19	54 04/08				19 01/12	19 01/13	19 01/28
Mesa2, Nipomo								3.5 04/07	3.5 11/22	3.1 05/12			

Note: The federal and state O_3 8-hour standard is 70 ppb.

Visual Ozone Summary

Figures 3 and 4 depict the ozone values from each station where it was monitored in 2022. 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.

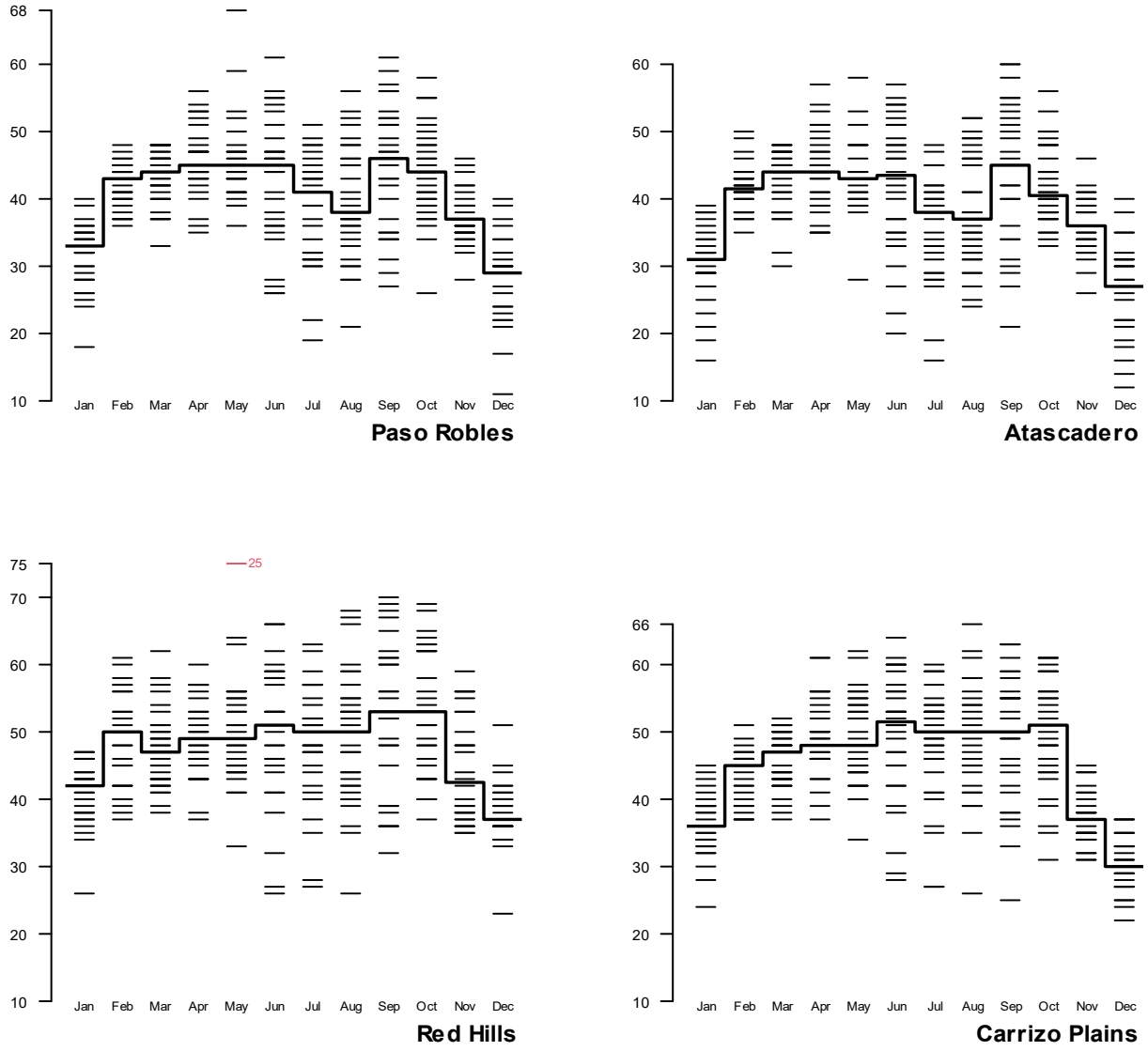


Figure 3: Daily Maximum 8-Hour Ozone Average for 2022 (ppb)

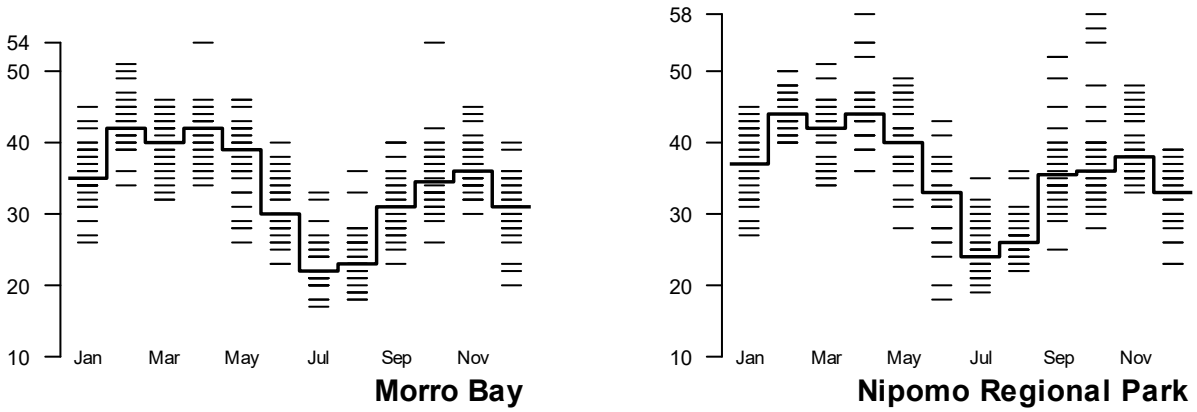


Figure 4: Daily Maximum 8-Hour Ozone Average for 2022 (ppb)

Particulate Matter Summary

In 2022, there were no exceedances of the federal 24-hour PM_{10} standard (150 $\mu g/m^3$) anywhere in the county. Exceedances of the California 24-hour PM_{10} standard (50 $\mu g/m^3$) were observed on 52 days: 48 days at CDF, 40 at Mesa2, 6 at Oso Flaco, 5 at NRP, 1 at San Luis Obispo, and none at Paso Robles and Atascadero.[3] This year, CDF and Mesa2 exceeded the state annual average PM_{10} standard of 20 $\mu g/m^3$.

The San Luis Obispo (Higuera St.) station operated by CARB ceased operations in January of 2021. The APCD began operating the San Luis Obispo (Roberto Ct.) station at the start of January 2021 and all 2022 statistics and analysis is based on data from the new Roberto Ct. location, while historical data prior to 2021 is associated with the Higuera St. location.

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 PM_{10} concentration at the [riding area] Monitor is more than 20% above the 24-hour average PM_{10} concentration at the Control Site Monitor, the 24-hour average PM_{10} concentration at the [riding area] Monitor shall not exceed 55 $\mu g/m^3$." [4] 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 2022 there were 30 days that violated the Rule 1001 standard.

In 2022 no monitoring station in the county recorded exceedances of the federal 24-hour $PM_{2.5}$ standard (35 $\mu g/m^3$) or the federal and state annual average standards (both 12 $\mu g/m^3$).

Table 4 lists the highest 24-hour concentrations recorded in 2022 and the dates on which they occurred, as well as the annual averages for PM_{10} and $PM_{2.5}$. Concentrations are in $\mu g/m^3$. Values exceeding federal standards are shown in **bold**; those exceeding state standards are underlined.

Wind-blown dust, mainly from the ODSVRA, caused PM_{10} and $PM_{2.5}$ this year to be elevated, with PM_{10} concentrations being above the state standard. San Joaquin Valley dust helped raise the annual averages, but not near any exceedance level. In general, elevated particulate levels at CDF, Mesa2, and Nipomo Regional Park are associated with windblown dust events from the ODSVRA, including this year's 1st and 2nd highest 24-hour PM_{10} averages at Mesa 2, CDF, and Nipomo Regional Park.

[3] 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 41 exceedances of the state PM_{10} standard at CDF, 38 at Mesa2, 5 at Nipomo Regional Park, 3 at Paso Robles, 8 at Oso Flaco, 5 at Atascadero, and 1 at San Luis Obispo. 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.

[4] 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: PM_{10} and $PM_{2.5}$ Summary for 2022 ($\mu g/m^3$)

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	46 10/18	44 05/25	42 06/21	19.4				
Atascadero	38 01/26	38 02/10	37 02/11	17.4	24.3 12/17	22.8 01/20	22.4 01/14	6.14
San Luis Obispo Roberto Ct.	52 04/09	45 05/19	45 09/09	16.4	25.5 09/09	20.2 04/09	18.7 05/19	6.51
CDF, Arroyo Grande	103 04/10	100 06/13	96 04/09	29.1	26.8 04/09	26.1 04/10	25.9 06/13	9.12
Nipomo Regional Park	73 04/09	58 09/09	57 05/19	19.9				
Oso Flaco	67 04/09	66 04/10	58 05/08	19.2				
Mesa2, Nipomo	98 06/13	97 04/10	94 05/07	25.8	24.1 04/10	23.9 06/13	22.3 06/14	6.61

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

Note: The state PM_{10} 24-hour standard is 50 $\mu g/m^3$ and the state PM_{10} annual average standard is 20 $\mu g/m^3$. Concentrations exceeding state standards are underlined while concentrations exceeding federal standards are bold.

Visual $PM_{2.5}$ and PM_{10} Summaries

Figure 5 shows the 24-hour $PM_{2.5}$ values and Figures 6 & 7 show PM_{10} values from the stations where these pollutants were measured in 2022. As with the ozone plots in the previous section, these show daily concentrations by month for each site; exceedances of state and federal 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 $\mu g/m^3$.

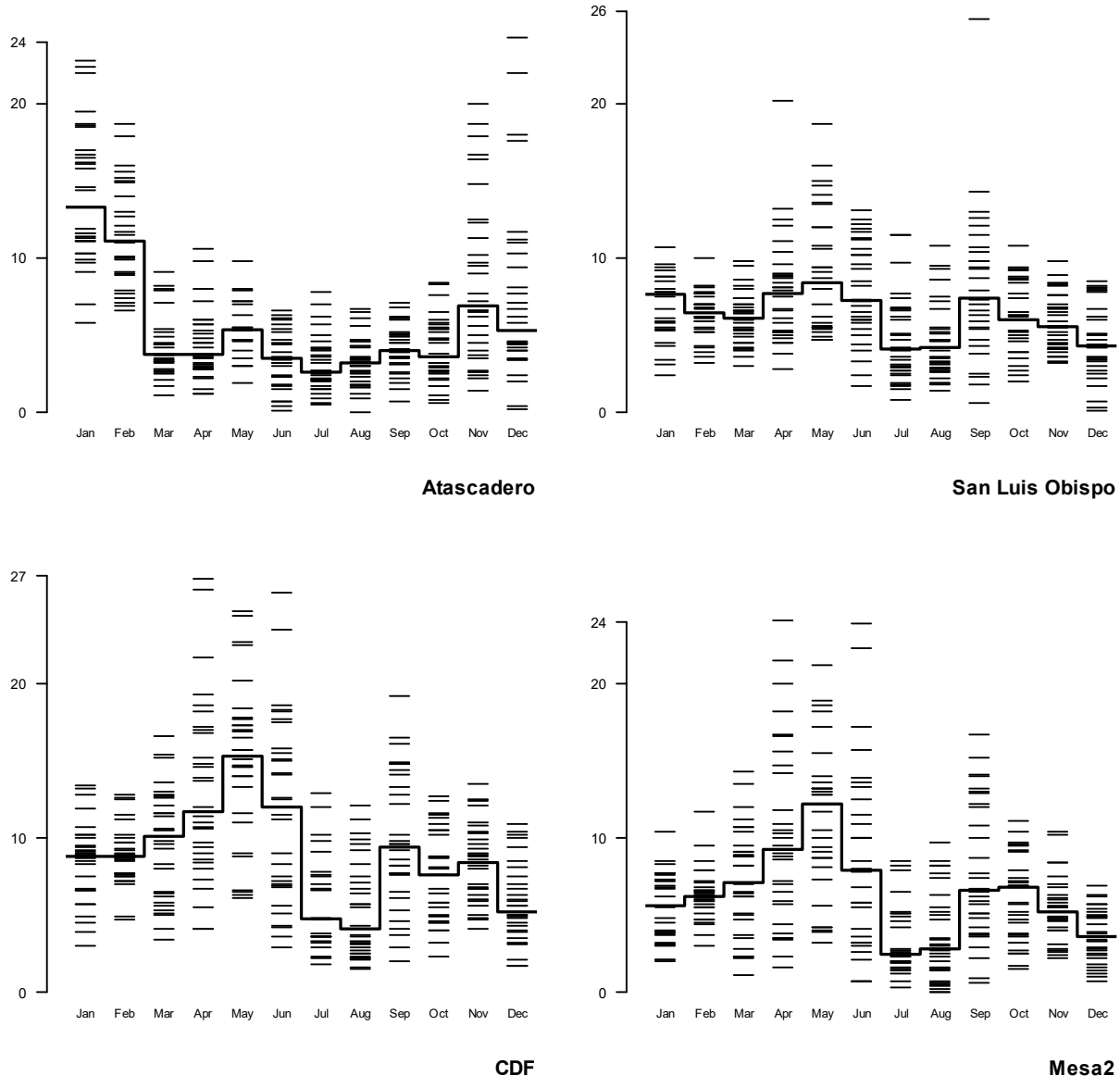


Figure 5: Daily $PM_{2.5}$ Values for 2022 ($\mu g/m^3$)

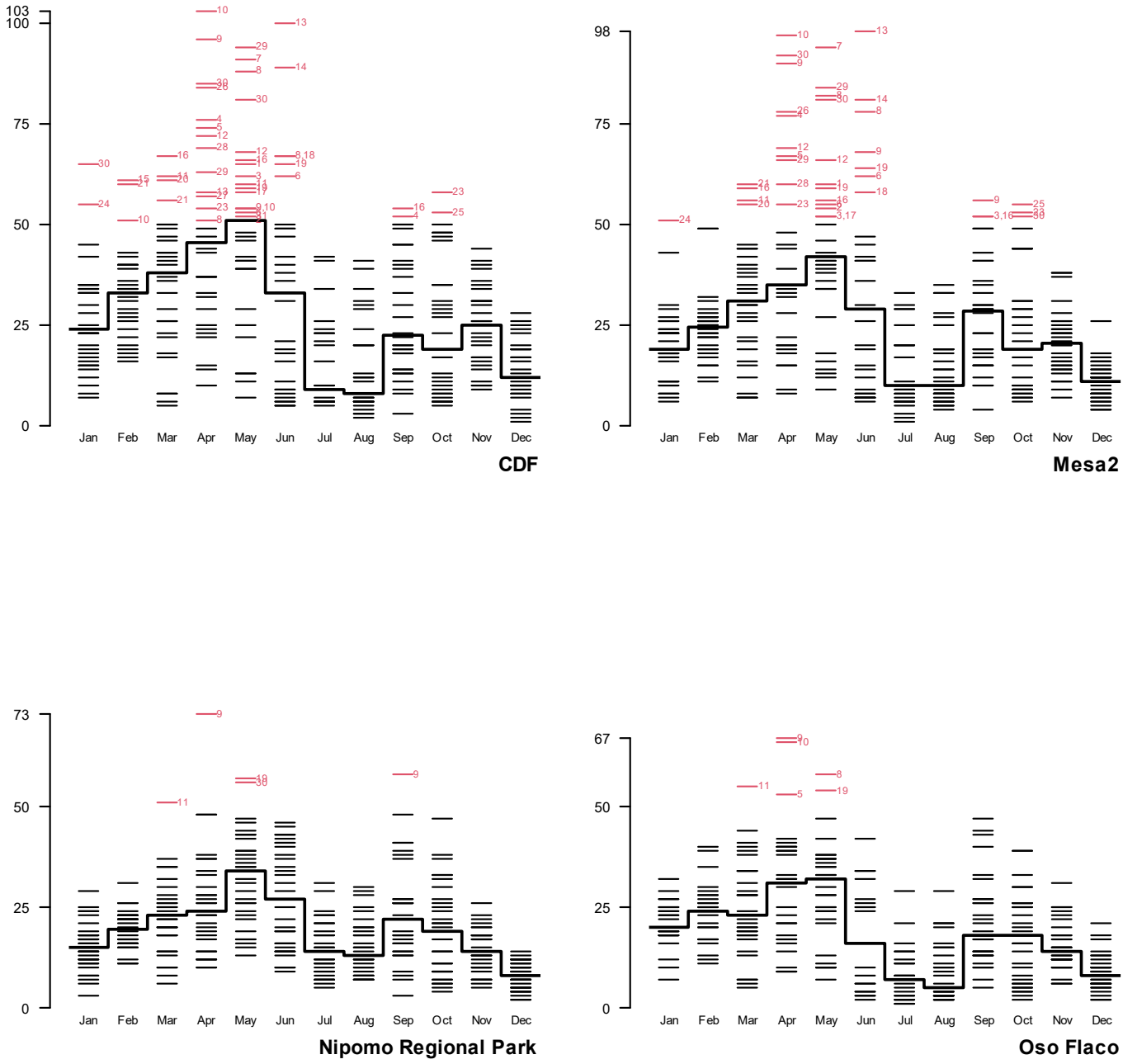


Figure 6: South County Daily PM_{10} Values for 2022 ($\mu g/m^3$)

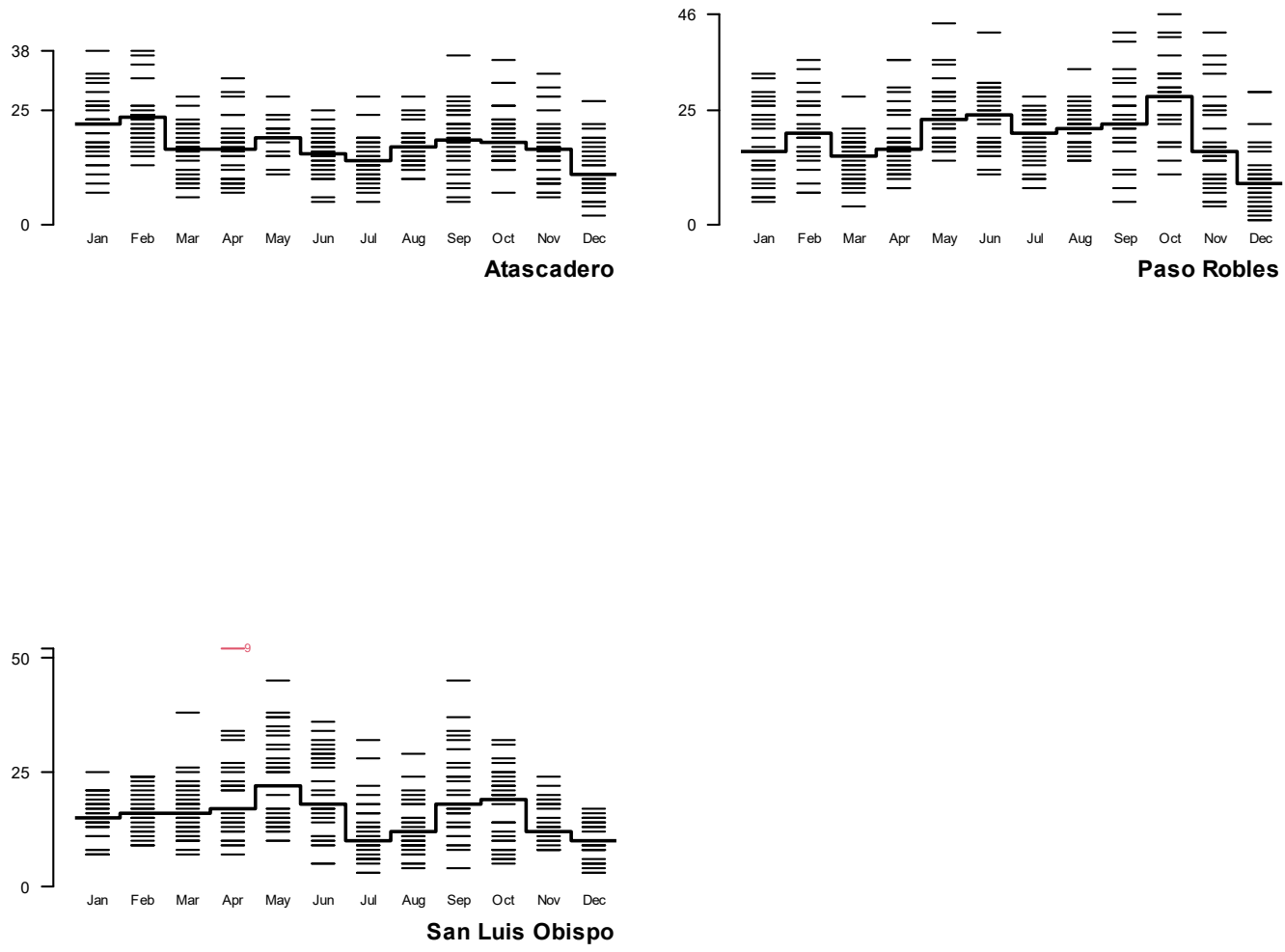


Figure 7: North County and SLO Daily PM_{10} Values for 2022 ($\mu g/m^3$)

10-Year Trends

Ozone

Figure 8, below, depicts the total number of hours each year during which the ozone concentration was at or above 65 ppb. This is a useful indicator for trends, even though there are no health standards for single-hour exposure to this level of ozone. Figure 9 shows ozone design values over the same period. Design values are used by 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 average over three consecutive years. For example, a 2016 design value is the average of the 4th highest 8-hour averages from 2014, 2015, and 2016. 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. Select data can be excluded from design value calculations under the exceptional event rule discussed in the "State and National Ambient Air Quality Standards" section above.

Exceptional event demonstrations associated with wildfire smoke influence on ozone concentrations during 2018 and 2020 wildfire seasons were submitted and concurred upon by the EPA. Under the Exceptional Event rule Red Hill's ozone concentrations on August 3, 4, 6, 7, & 9 of 2018, as well as, August 20, 21; September 30; October 1, 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 or preventable.

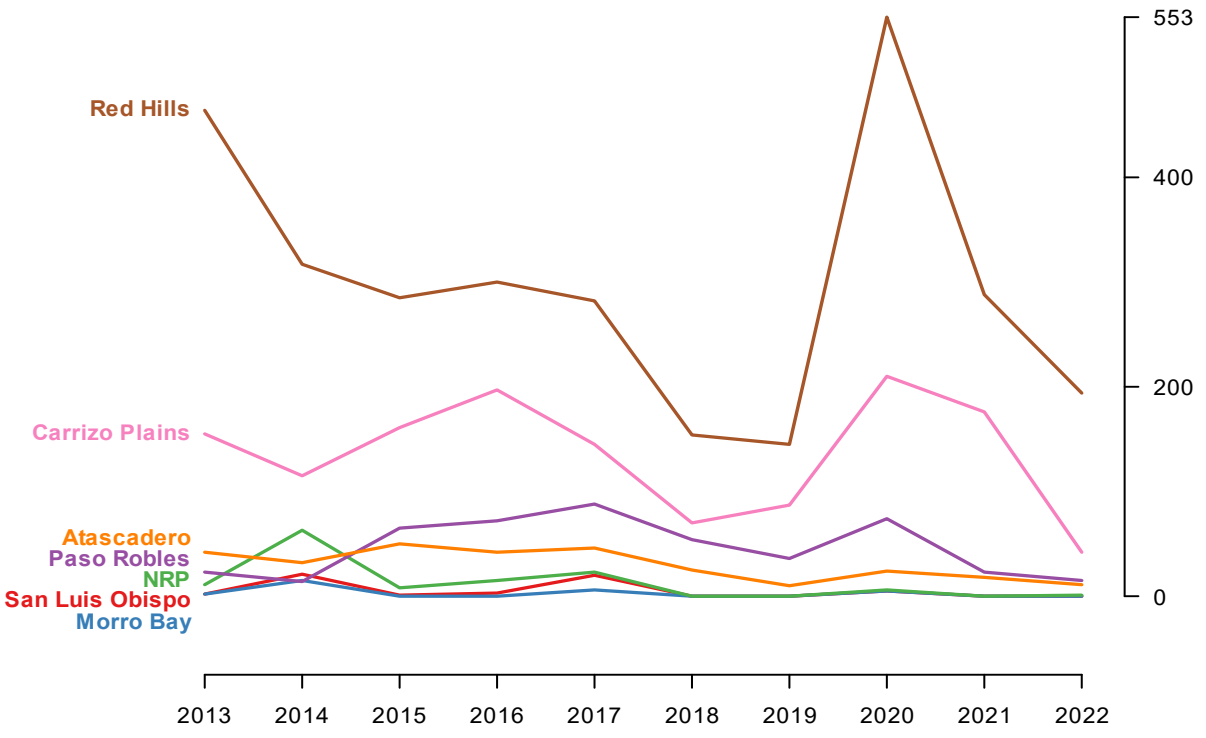


Figure 8: Hours At or Above 65 ppb Ozone, 2013-2022

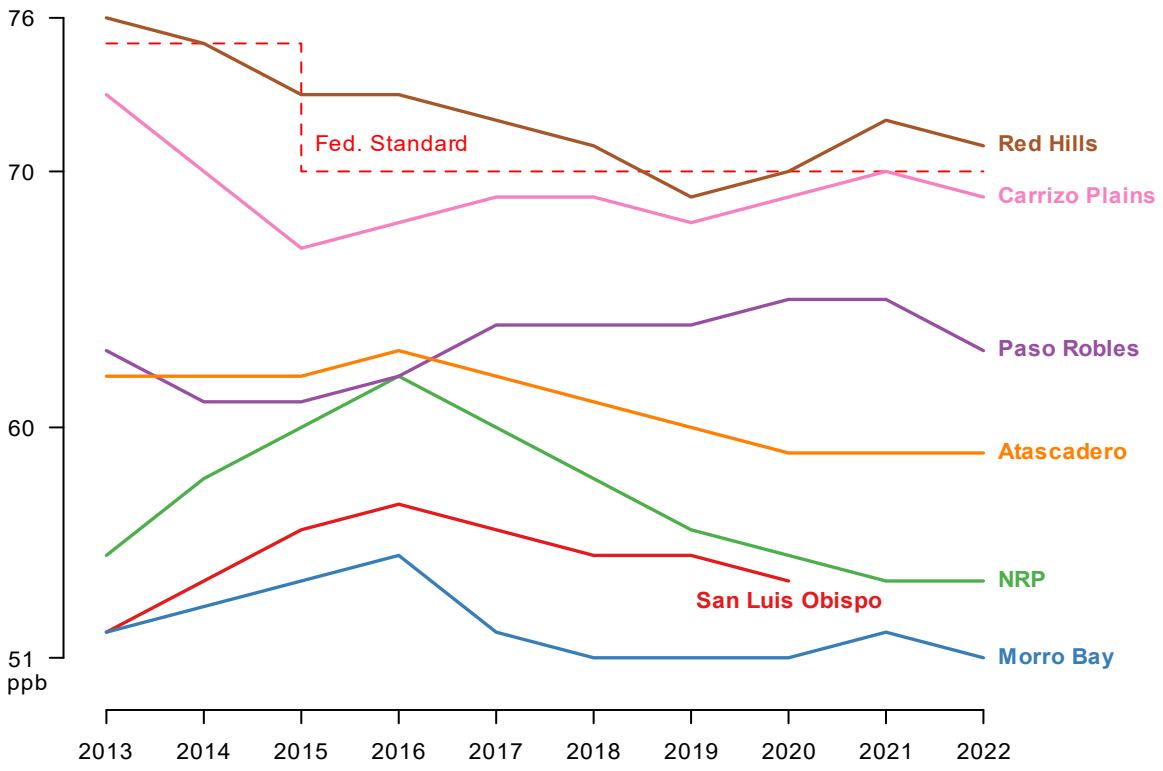


Figure 9: Ozone Design Value Trends, 2013-2022

Particulate Matter

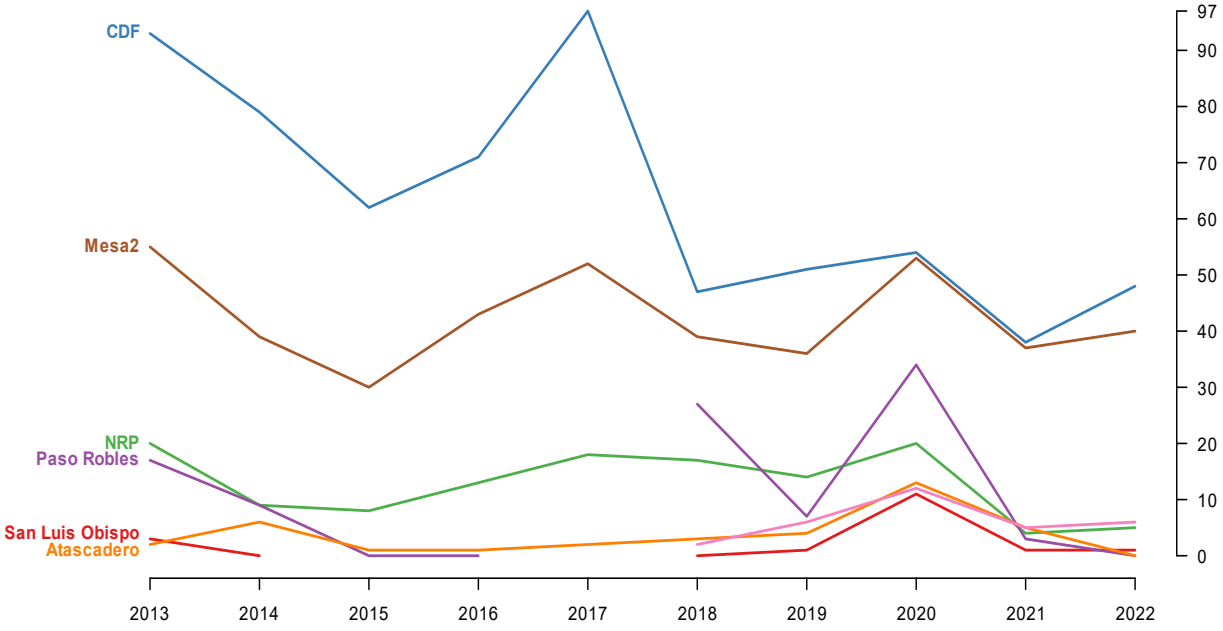


Figure 10: Exceedances of the California 24-hour PM_{10} Standard, 2013–2022

Figure 10 shows the number of exceedances of the state 24-hour PM_{10} standard (50 μg/m^3) at each site by year. Collection of daily data began in mid–2009 for some sites and later for others, and years missing more than 10% of daily values are omitted.

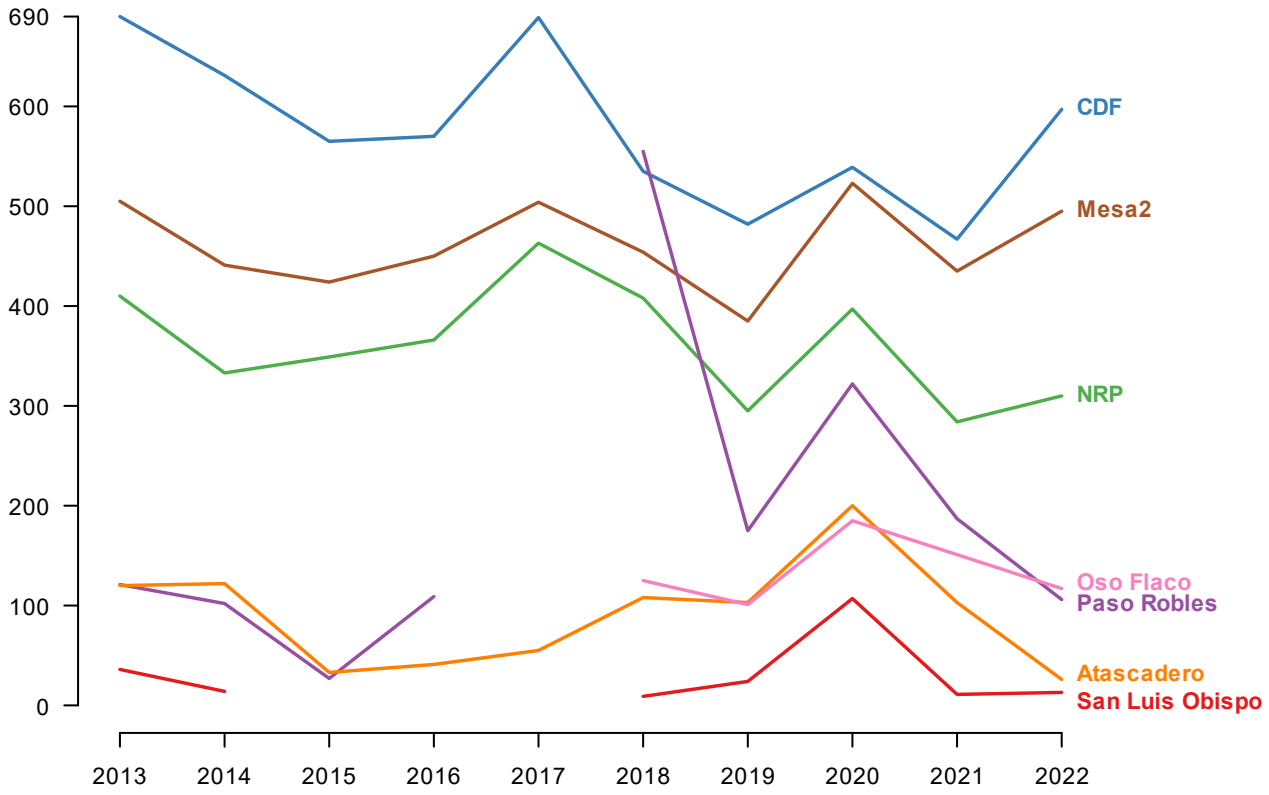


Figure 11: Number of Hours At or Above 50 μg/m³ PM_{10} between 10 a.m. and 4 p.m., 2013–2022

Figure 11 plots the total number of hours each year when PM_{10} 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 PM_{10}. Years missing more than 10% of daily values are omitted.

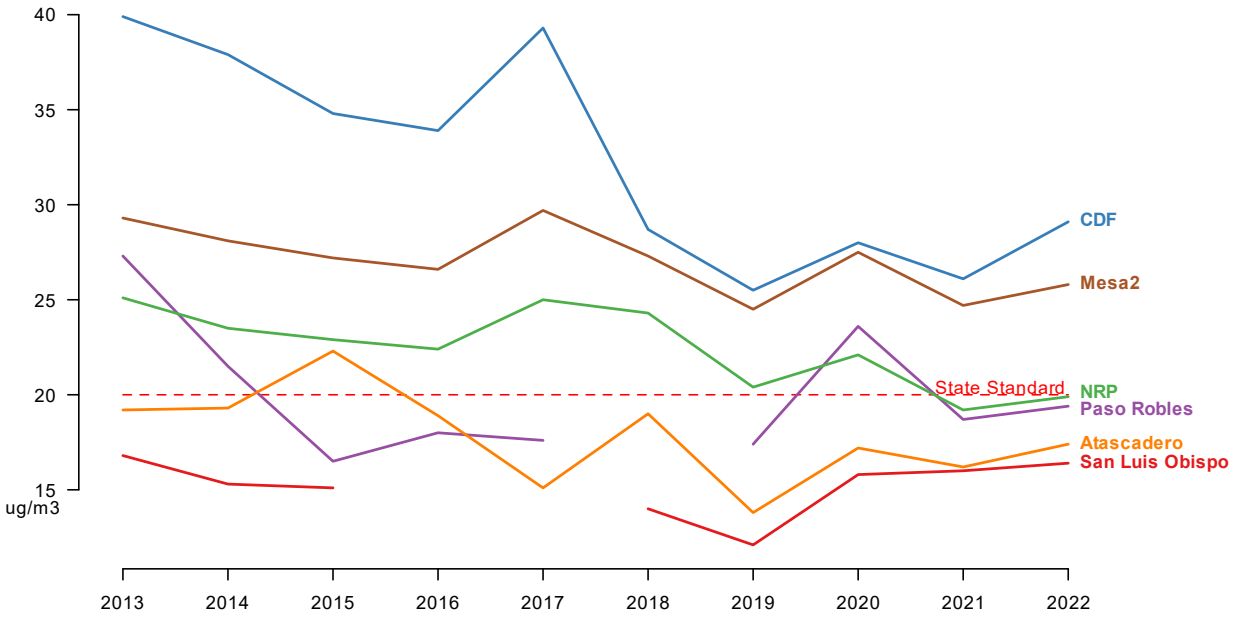


Figure 12: PM_{10} Annual Averages, 2013–2022

Figure 12 depicts annual average PM_{10} concentrations over the past 10 years;[5] years with partial data are omitted. The red dashed line marks the state standard for the annual average (20 μg/m^3).

[5] 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.

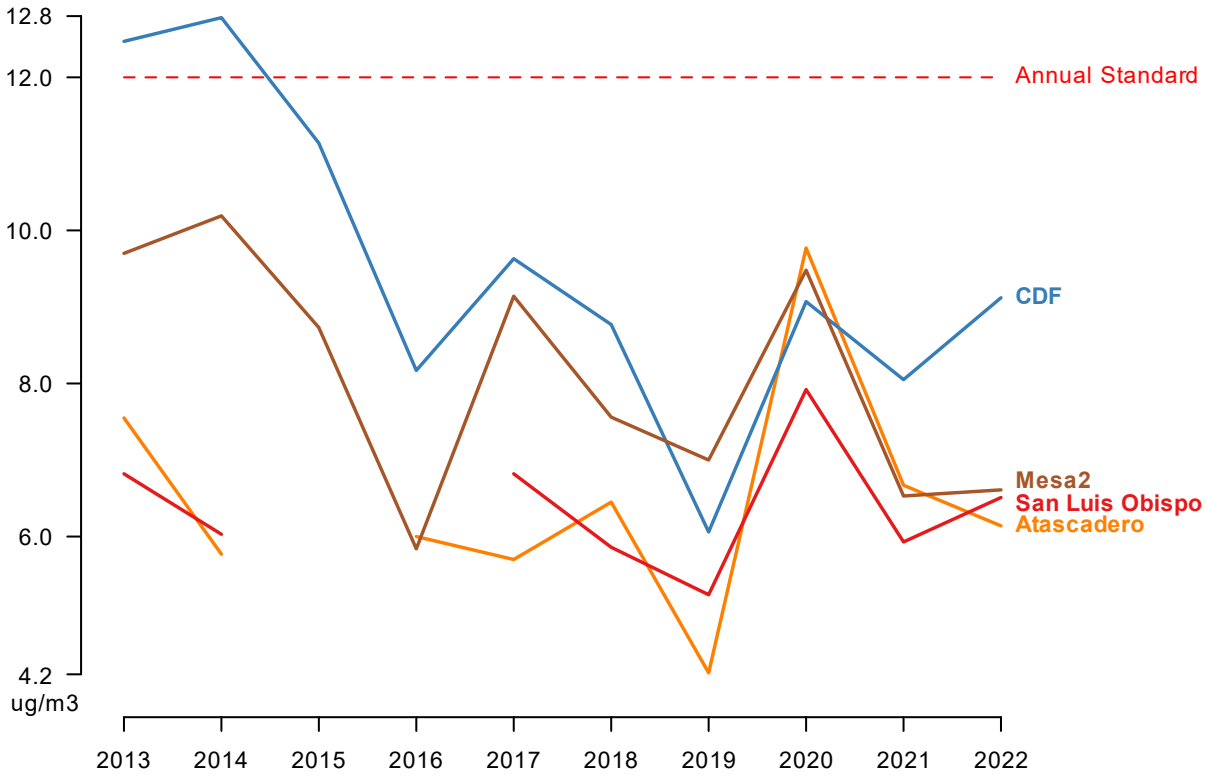


Figure 13: $PM_{2.5}$ Annual Averages, 2013-2022

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 $\mu g/m^3$ state and federal $PM_{2.5}$ standard for the annual average.

Appendix A: Assessing the Effectiveness of ODSVRA Mitigations

Introduction

Windblown dust from the ODSVRA remains an air quality challenge affecting South San Luis Obispo County. For more than a decade, 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.[6] From 2011 to 2022, the annual number of exceedances of the California PM_{10} standard at CDF varied from as few as 38 to as many as 97, with most related to ODSVRA dust. Over this period, State Parks has implemented various mitigation projects, with the total areal extent of dust controls ranging from 1 to 740.1 acres.[7] It would be overly simplistic to attribute the year-to-year changes in the number of exceedances solely to changes in the extent of State Parks' mitigation efforts. This is because downwind PM_{10} concentrations are potentially influenced not only by the mitigations, but also by non-ODSVRA sources (notably wildfire smoke and dust transported from the San Joaquin Valley), and—most importantly—meteorology, especially the strength and direction of onshore winds. It is the wind that drives the actual dust emissions, so, all else being equal, windier years are expected to be dustier and have more PM_{10} exceedances than less windy years.

To quantify the effectiveness of these dust controls, recent Annual Air Quality Reports[8] 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 PM_{10} 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 PM_{10} sources. This is because the mitigation measures are upwind of CDF but not Oso Flaco, so changes in the mitigations should affect CDF but not 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 is thus the closest possible scenario to 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 San Joaquin Valley dust transport was excluded from the analysis. While there have been numerous 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 for a more complete description of the methodology.[9]

The methodology of the 2017 Annual Air Quality Report has been used in subsequent Annual Air Quality Reports and presentations to the Hearing Board. Here, the methodology is applied to data from 2022. This

[6] https://www.slocleanair.org/air-quality/oceano-dunes-efforts.php;
[7] State of California, Department of Parks and Recreation, Provisional Final 2023 Annual Report and Work Plan, October 4, 2023. Available online at https://storage.googleapis.com/slocleanair-org/images/cms/upload/files/2023ARWP_ProvFinal_20231004_lowres.pdf.
[8] San Luis Obispo County Air Pollution Control District, Annual Air Quality Reports for 2015-2021, all available at https://www.slocleanair.org/library/air-quality-reports.php.
[9] 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.

year, the methodology is also applied to Mesa2 to quantify the response of PM_{10} levels at that site to the mitigations at the ODSVRA.

Results

The results for 2022 along with earlier years are summarized in Tables A1 and A2, below. Applying the methodology to the 2022 data yields a statistically significant 31.6% improvement in event-day PM_{10} at CDF compared to the baseline year of 2017 (95% CI: 18.5 to 42.6%; p-value: 4.6E-5). In concrete terms, the median wind event day PM_{10} at CDF was 51 $\mu g/m^3$ in 2022; this analysis predicts it would have been 74 $\mu g/m^3$ if these mitigation projects had not been implemented.

For Mesa2, the methodology yields a 13.8% improvement in event-day PM_{10} compared to the baseline year (95% CI: -1.4 to 26.7%; p-value: 0.074). In concrete terms, the median wind event day PM_{10} at this site was 44 $\mu g/m^3$ in 2022, and the analysis predicts it would have been 52 $\mu g/m^3$ without the mitigation projects.

Table A1: Summary of Change in Event-Day PM_{10} Ratio at CDF

Year	Total Dust Mitigation Extent (approx. acres)[7]	Change, vs 2017 baseline, in Event-Day PM_{10} Ratio (CDF vs Oso Flaco)		
		Percent Change	95% Confidence Interval	P-value
2022	740.1	- 31.6%	-18.5% to -42.6%	0.00005
2021	322.5	- 33.5%	-16.1% to -47.3%	0.0009
2020	230.2	- 28.4%	-13.9% to -40.4%	0.0007
2019	137.8	- 7.6%	+23.2% to -30.7%	0.593
2018	146.9	- 22.4%	-7.4% to -34.9%	0.006
2017	55.3	0 %	n. a.	n. a.
2016	76.8	- 12.7%	+16.8% to -38.4%	0.363

Table A2: Summary of Change in Event-Day PM_{10} Ratio at Mesa2

Year	Total Dust Mitigation Extent (approx. acres)[7]	Change, vs 2017 baseline, in Event-Day PM_{10} Ratio (Mesa2 vs Oso Flaco)		
		Percent Change	95% Confidence Interval	P-value
2022	740.1	- 13.8%	+1.4% to -26.7%	0.074
2021	322.5	- 7.0%	+11.8% to -22.6%	0.442
2020	230.2	+ 4.6%	+25.4% to -12.9%	0.193
2019	137.8	+ 14.9%	+41.4% to -6.7%	0.593
2018	146.9	- 2.3%	+14.3% to -16.4%	0.774
2017	55.3	0 %	n. a.	n. a.
2016	76.8	- 4.2%	+17.8% to -22.0%	0.685

Discussion

As shown in Table A1, the result for CDF for 2022—a 31.6% improvement relative to 2017—is about the same as the result for the previous year, namely the 33.5% improvement for 2021. While 2022 saw no incremental improvement over 2021, this is consistent with most of new mitigation acreage being too far south to influence CDF.

Of the 417.6 acres of mitigation installed in 2022, 90 acres are wind fencing and vegetation projects that were planned for in State Parks' 2021 Annual Report and Work Plan (ARWP).[10] The ARWP estimated that these 90 acres of dust controls would result in an incremental reduction in CDF PM_{10} levels by only 4.7%. In 2022, State Parks decided to permanently close the 293-acre Plover Exclosure and take credit for the resulting dust control benefit. Most of this area is also too far south to be expected to influence PM_{10} at CDF. Lastly, in 2022, an additional 34.6 acres was temporarily closed around the foredune restoration area to protect nesting birds. While this area is upwind of CDF, it is relatively small and closed for only part of the year, so it is not expected to have a large influence on PM_{10} levels at CDF. In short, the lack of an observable incremental improvement in PM_{10} at CDF is consistent with most of the new mitigation being too far south to influence the site.

In contrast to the situation with CDF, Mesa2 *is* downwind of most of the mitigation areas installed in 2022. As shown in Table A2, PM_{10} levels at Mesa2 improved in 2022 by 13.8% relative to 2017 levels, while for 2021, the improvement was only 7.0%. Thus, as expected, there was an incremental improvement in Mesa2 PM_{10} levels from 2021 to 2022. Note that none of the changes in Mesa2 PM_{10} levels in Table A2 are statistically significant at the 95% level, so these results must be interpreted cautiously.

Prior to 2021, the dust control projects were placed almost exclusively upwind of CDF, so it is expected that the changes in PM_{10} at Mesa2 are small and non-statistically significant for 2018 through 2020 (see Table A2). That the analysis shows an incremental improvement from 2020 to 2021 and again from 2021 to 2022 is further evidence that the dust control program is effective (though as noted above these results should be interpreted cautiously since the estimates are not statistically significant). That the estimated changes in Mesa2 PM_{10} are smaller than those for CDF is also expected, since PM_{10} concentrations at Mesa2 are generally lower than those at CDF, as shown in Figures 10-12, above.

The results of these analyses can be compared with the numbers of hours with PM_{10} greater than 300 $\mu g/m^3$ at each site. As shown in Figure A1 and A2, the number of such hours has steadily decreased as the extent of the dust control program has increased. As noted in last year's Annual Air Quality Report, the results for 2020 are particularly interesting. That year had the fewest such hours at CDF, despite it having the worst wildfire smoke impacts of any year on record. Also, that year, the ODSVRA 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 $\mu g/m^3$ in 2020, 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 ODSVRA is in violation of section C.3 of the rule every day in which the 24-hr average PM_{10} concentration at CDF exceeds 55 $\mu g/m^3$ and is more than 20% higher than the 24-hr average PM_{10} concentration at Oso Flaco.[11]

[10] State of California, Department of Parks and Recreation, Conditional Approval Draft 2021 Annual Report and Work Plan, October 1, 2021. Available online at https://storage.googleapis.com/slocleanair-org/images/cms/upload/files/2021ARWP_CondAppDraft_withAttach_20211001.pdf.

[11] 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.

As shown in Figure A3, below, the annual number of violations has generally decreased since the Oso Flaco monitor was established.[12] 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 PM_{10} exceeded 55 µg/m^3 but the Oso Flaco monitor was offline, and thus compliance with Rule 1001.C.3 could not be determined.

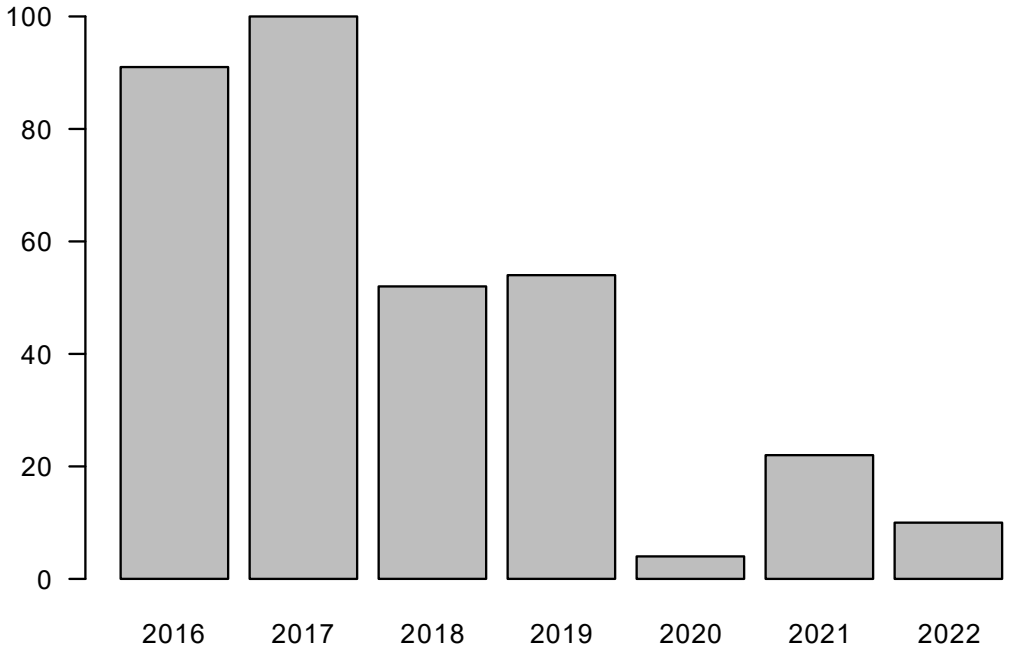


Figure A1: Annual Hours at CDF Greater than 300 µg/m^3

[12] The Oso Flaco monitor was established in 2015. Data from that year is omitted from Figure 3, since it operated for only half of the year, not including the spring windy season when most exceedances of the state PM_{10} standard and Rule 1001 are typically observed.

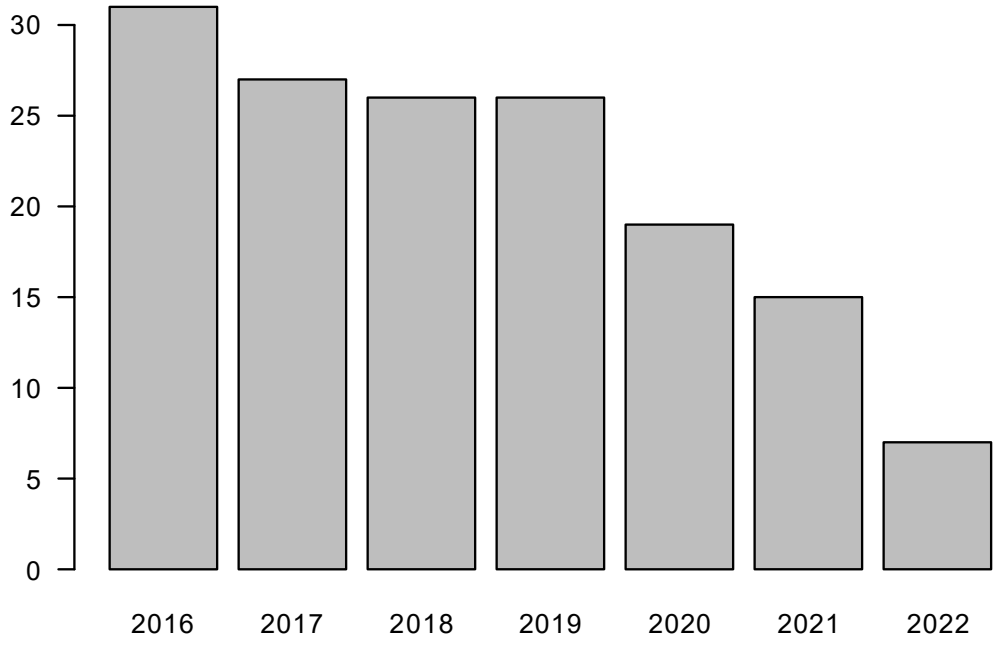


Figure A2: Annual Hours at Mesa2 Greater than 300 µg/m³

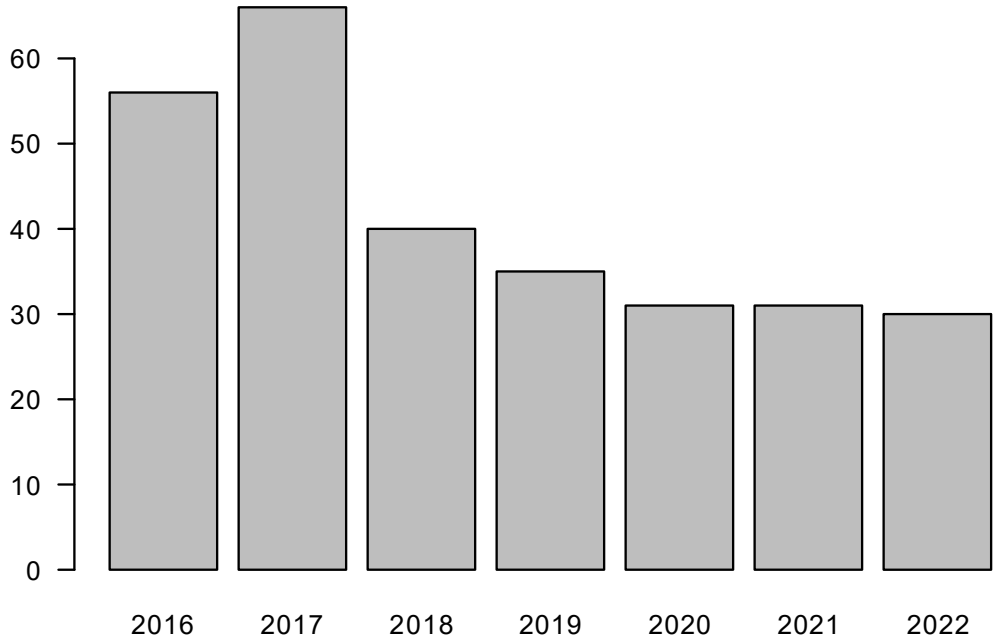
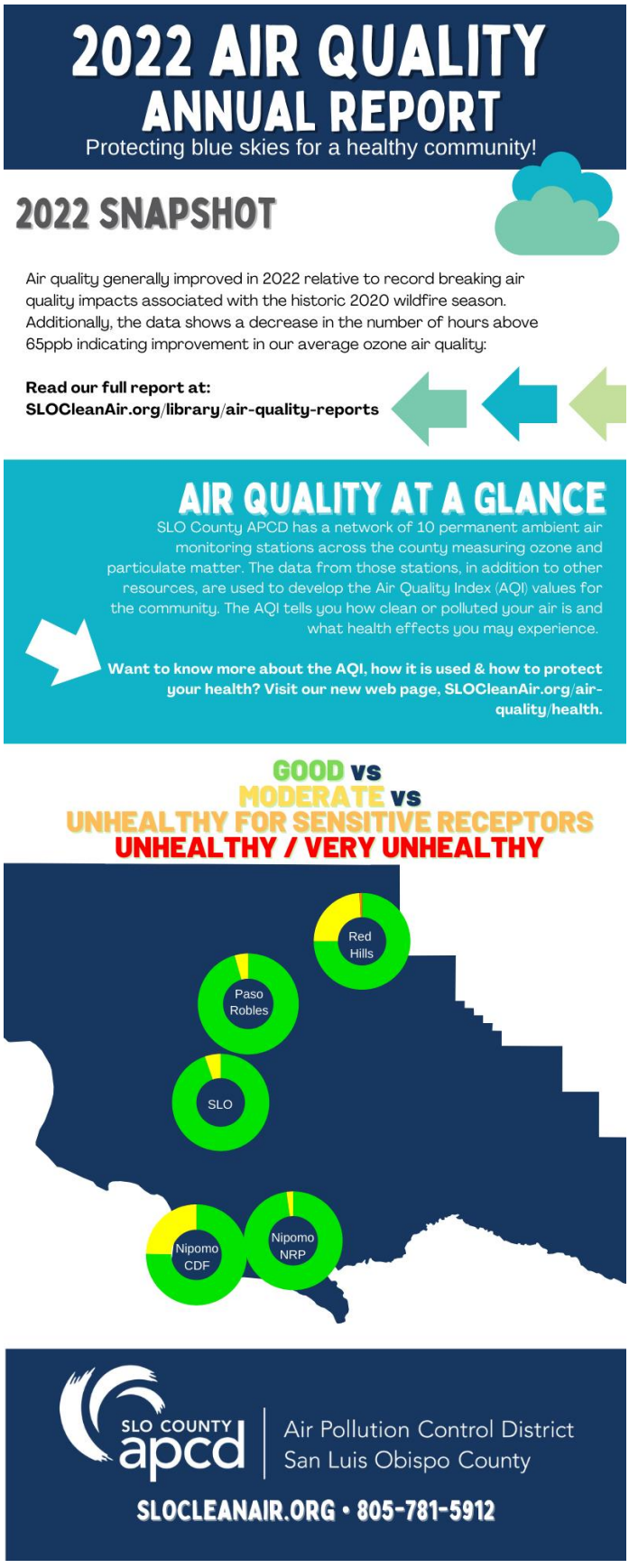


Figure A3: Annual Violations of District Rule 1001

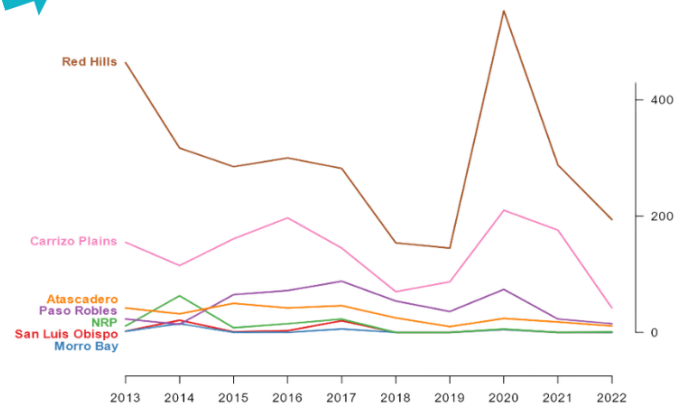
Appendix B: Infographic Summarizing 2022 Air Quality



OZONE TRENDS

Overall trends show marked improvement from 2020 and 2021 levels, but a slight increase for the Red Hills station in both hours above 65 ppb and exceedances of the ozone standard in comparison to 2019. That said, in SLO County, the federal 8-hour 70 ppb ozone standard was only exceeded on 1 day in 2022.

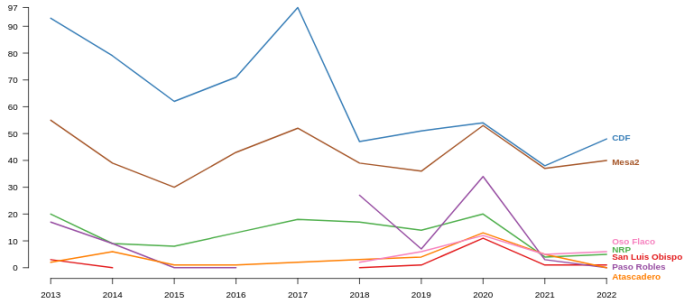
HOURS AT OR ABOVE 65PPM OZONE



PARTICULATE MATTER TRENDS

PM10 on the Nipomo Mesa continued to show improvements relative to 10-year trends. The overall number of exceedance days slightly increased from 2021 levels by 2 days. Both Mesa2 and CDF saw a slight increase in the number of days exceeding the state 24-hour PM10 standard of 50 µg/m3 as compared to 2021. At Oso Flaco, exceedances increased slightly by 1 day from 2021. See the chart below to see the exceedance of the state 24-hour PM10 standard.

PM10 EXCEEDANCES



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