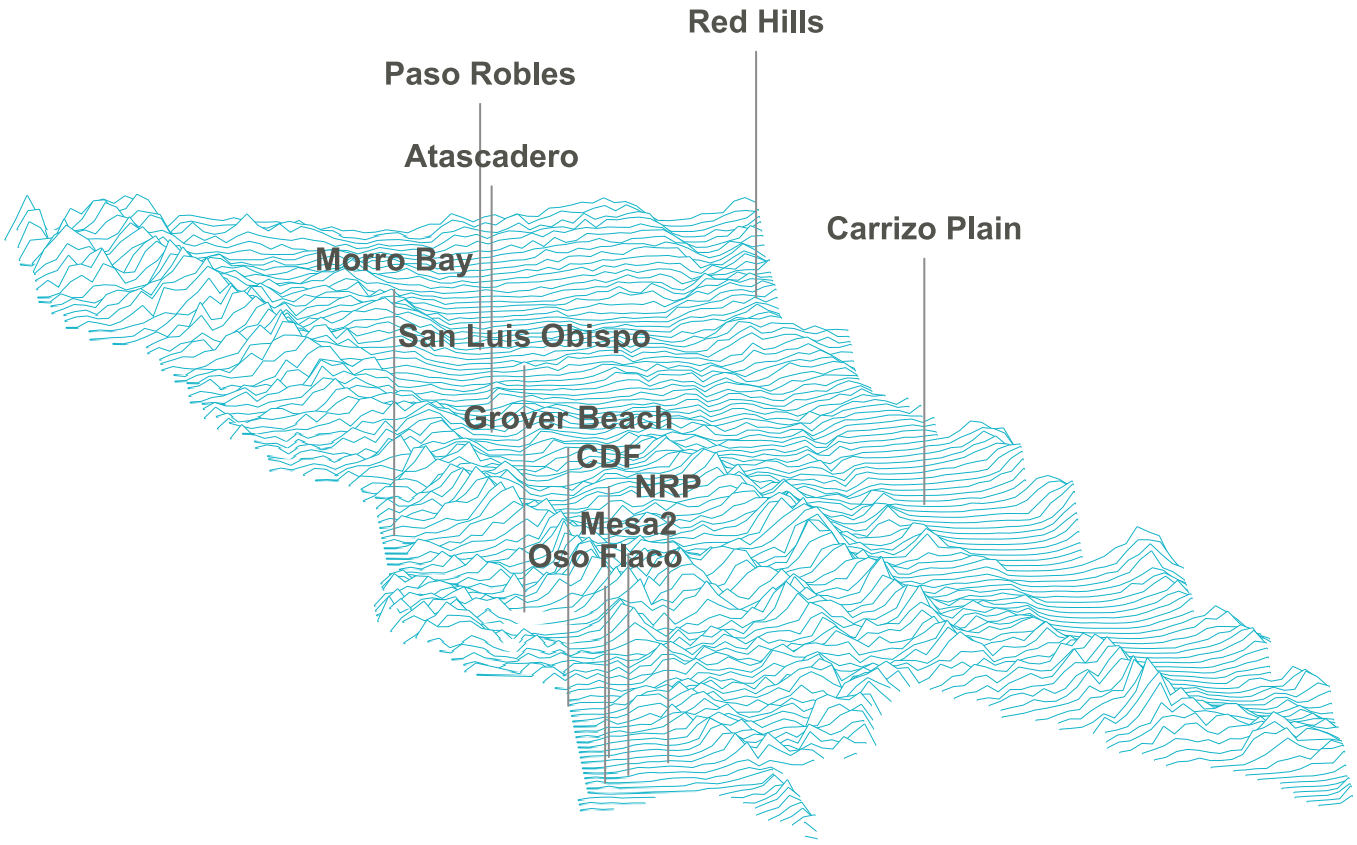
ANNUAL AIR QUALITY REPORT | 2019



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2019 Annual Air Quality Report
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Executive Summary

Air quality in San Luis Obispo County generally improved from 2018 to 2019:

- **Ozone** trends show either continued improvement or leveling off, except for Carrizo Plains, which had a slight increase in hours above 65 ppb but a decrease in design value (Figures 7 & 8). Ozone standards were exceeded on 3 days in 2019, with all of these occurring during wildfire events (Table 3).
- **PM_{10}** on the Nipomo Mesa continued to show signs of improvement (Figures 9 – 11). While there was a slight increase in the number of days exceeding the state standard at CDF and Oso Flaco, both the annual averages and hours above 50 $\mu g/m^3$ decreased.
- **$PM_{2.5}$** annual averages decreased at all sites (Figure 12), including those on the Nipomo Mesa, with no exceedances of any $PM_{2.5}$ standards (Table 4).

Smoke from wildfires and pollution transport from the San Joaquin Valley had major impacts on air quality in 2019. The District issued press a release on October 28th warning the public of elevated ozone and/or particulate levels related to wildfires. All exceedances of the ozone standards occurred between November 6th and 9th, when several large wildfires were burning in California. These include the Kincade fire in Sonoma county, and the Maria fire and Easy fire in Ventura county.

October 28th saw the highest 24-hour PM_{10} averages across all monitors in the county. These elevated levels were associated with wind-blown dust from in the San Joaquin Valley being transported into the region. This event lingered for a few days and was also responsible for the 2nd an 3rd highest 24-hour PM_{10} averages at Paso Robles, Atascadero and San Luis Obispo.

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 2019, the more stringent state standard was exceeded on 51 days on the Nipomo Mesa, and most of these exceedances were due to windblown dust. In addition, the Rule 1001 performance standard was violated 35 times. This is an improvement over the previous year when Rule 1001 was violated 40 times.

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

Appendix A presents an analysis of the effects of the ODSVRA dust controls on downwind PM_{10} concentrations. Using the same methodology as the previous two Annual Air Quality Reports, it is estimated that in 2019, the ODSVRA dust controls yielded a 7.6% decrease in event-day PM_{10} at CDF compared to the baseline year of 2017. This decrease in 2019 versus 2017 is less than the decrease reported last year for 2018 versus 2017 (22.4%), meaning that event-day PM_{10} at CDF actually increased in 2019 compared to 2018. While 2019 may have been a step backwards, preliminary analysis of 2020 data suggests that the mitigations deployed this year have resulted in further improvements in air quality downwind of the ODSVRA.

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 District 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 11 permanent ambient air monitoring stations in 2019; their locations are depicted in Figure 1. The San Luis Obispo County Air Pollution Control District (District) owned and operated seven permanent stations: Nipomo Regional Park (NRP), Grover Beach, Morro Bay, Atascadero, Red Hills, Carrizo Plain, and the CDF fire station on the Nipomo Mesa. The California Air Resources Board (CARB) operated stations in San Luis Obispo and Paso Robles. Two stations are owned by third parties but operated by the District: 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. See Table 2 for a summary of the pollutants monitored at each station.

The District 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 2019 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 San Luis Obispo and the District 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

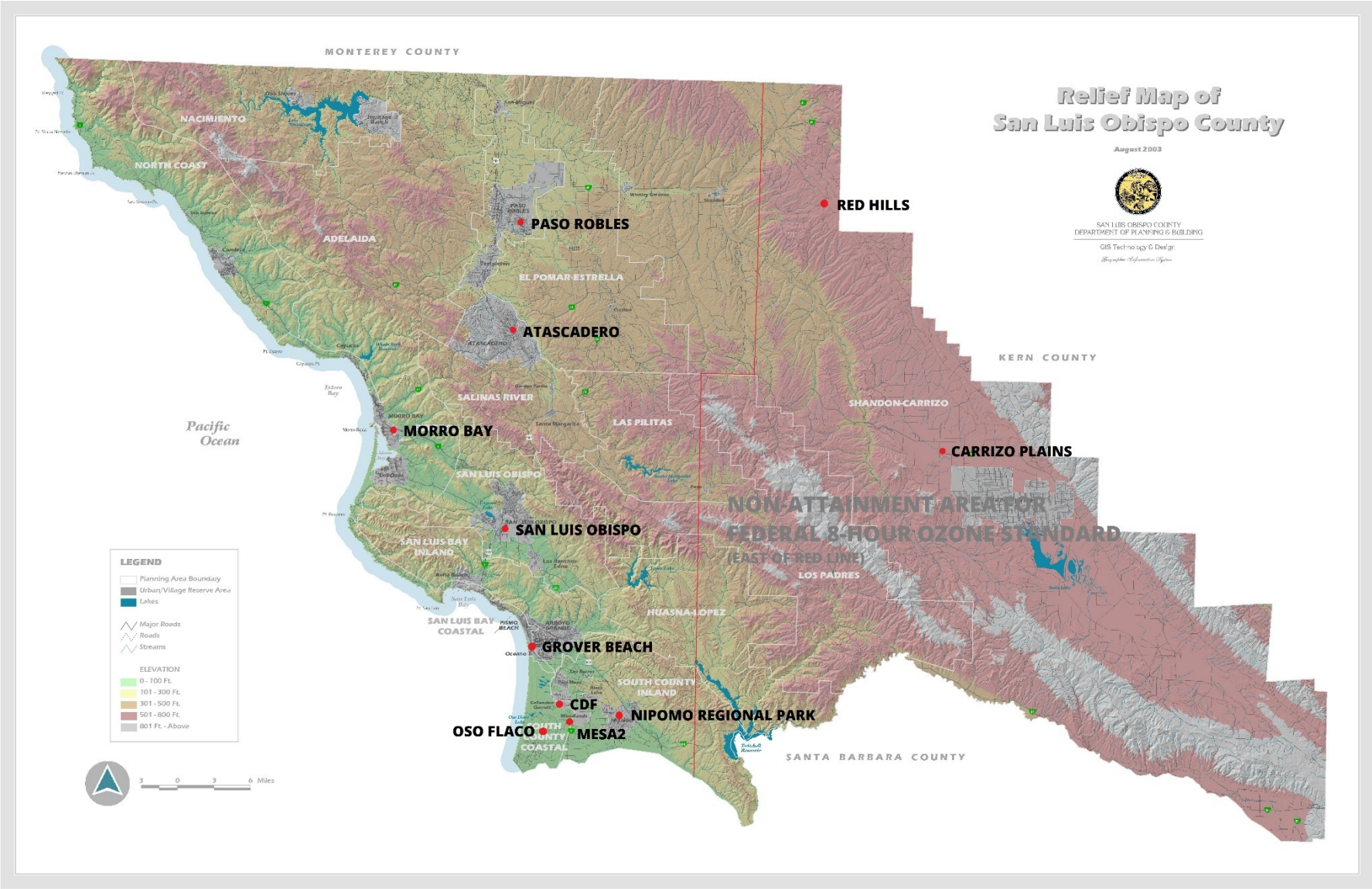


Table 1: Ambient Air Quality Parameters Monitored in San Luis Obispo County in 2019

	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	
Grover Beach*								X	X	
CARB Stations										
San Luis Obispo	X					X	X	X	X	X
Paso Robles	X					X		X	X	X
Operated by APCD										
Mesa2					X	X	X	X	X	X
Oso Flaco						X		X	X	X

*Grover beach was shut down July 2019

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 principle 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.

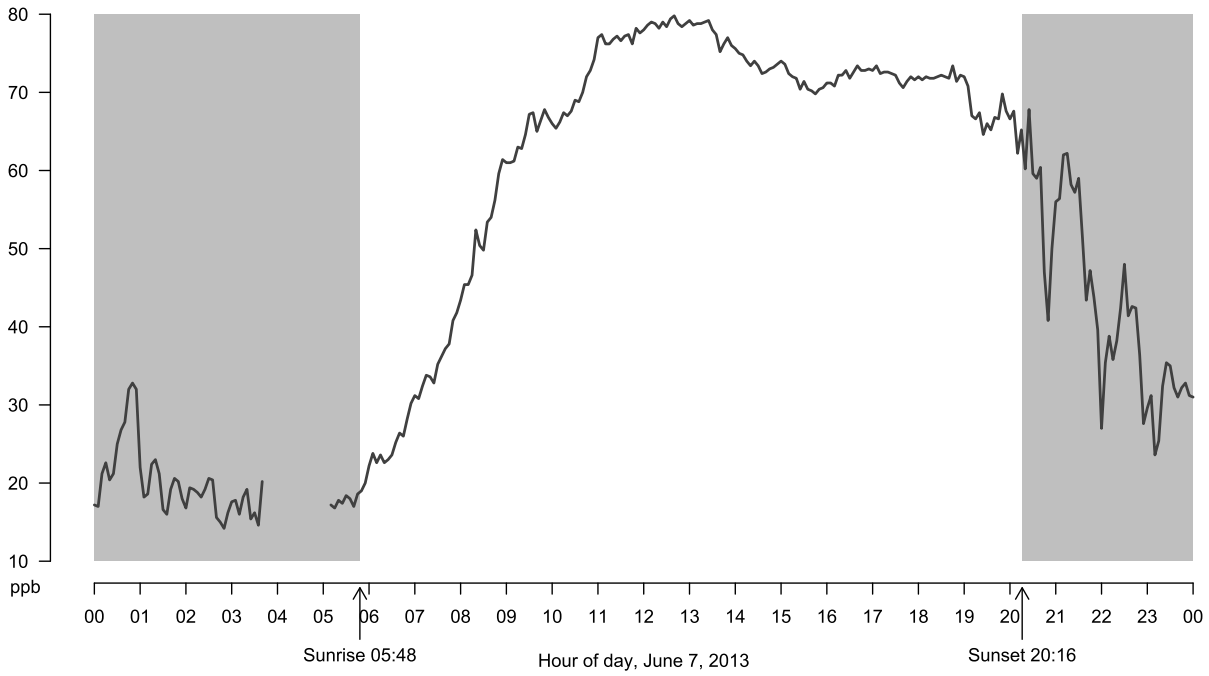


Figure 2: Example of Diurnal Ozone Pattern from Carrizo Plain

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 ultra-violet 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 non-attainment zone for the new standard. 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 one-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.

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, if recommended by the District and CARB and approved by the EPA. The District has not submitted any exceptional event documentation for 2019 and does not expect any data compiled in this report to be excluded from future attainment determinations.

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

Table 2: Ambient Air Quality Standards for 2019 and Attainment Status*

A standard exceedance *occurs when a measured pollutant concentration exceeds (or in some cases, equals) the applicable standard prescribed 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 November 2019.

† 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 2019, exceedances of the 8-hour state and federal standard (70 ppb) occurred on 3 days 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[2]) values recorded in 2019 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.

All exceedances of the 8-hour federal standard occurred in early November, when multiple wildfires were burning across the state. The fires with the most direct impacts on San Luis Obispo county include the Kincade fire, which began in Sonoma County on October 23rd and grew to 77,758 acres before reaching full containment on November 6th, and the Easy and Maria Fires, both in Ventura County, which began on October 30th and 31st, respectively. The Easy fire scorched 1,806 acres before reaching full containment on November 2nd. The Maria fire burned nearly 10,000 acres before reaching full containment on November 6th. Other fires may have also contributed to the federal exceedances at Red Hills in early November as well as increased ozone levels in October and November.

Table 3: Highest Measurements for Gaseous Pollutants in 2019 (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	77 08/15	74 06/11	72 11/08	64 08/05	64 10/06	63 09/14	63 10/15						
Atascadero	72 08/15	68 06/10	67 04/29	62 08/15	60 09/13	59 09/14	58 04/24				34 11/18	33 11/12	33 11/18
Morro Bay	64 09/13	62 10/06	59 10/25	55 09/13	55 10/06	54 10/25	53 10/24						
San Luis Obispo	64 09/13	62 10/06	61 10/23	60 09/13	58 10/06	56 03/19	54 03/16						
Red Hills	74 11/07	74 11/09	73 11/06	**73** 11/06	**73** 11/07	**71** 11/09	70 11/08						
Carrizo Plain	72 08/15	71 09/14	70 08/14	70 08/15	69 09/14	68 08/14	66 06/04						
Nipomo Regional Park	64 10/06	63 10/23	60 03/19	54 03/17	54 03/19	54 10/06	54 10/12				25 12/20	23 01/03	22 01/02
Mesa2, Nipomo								2 07/06	2 07/07	1 01/31			

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

[2] The daily maximum 8-hour averages in Table 3 and Figures 3 and 4 are calculated according to the 2015 revisions to the 8-hr ozone standard specified in 40 CFR 50 Appendix U, Section 3(c). Specifically, "[t]he daily maximum 8-hour average O_3 concentration for a given day is the highest of the 17 consecutive 8-hour averages beginning with the 8-hour period from 7:00 a.m. to 3:00 p.m. and ending with the 8-hour period from 11:00 p.m. to 7:00 a.m. the following day (i.e., the 8-hour averages for 7:00 a.m. to 11:00 p.m.)."

Visual Ozone Summary

Figures 3 and 4 depict the ozone values from each station where it was monitored in 2019. 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.

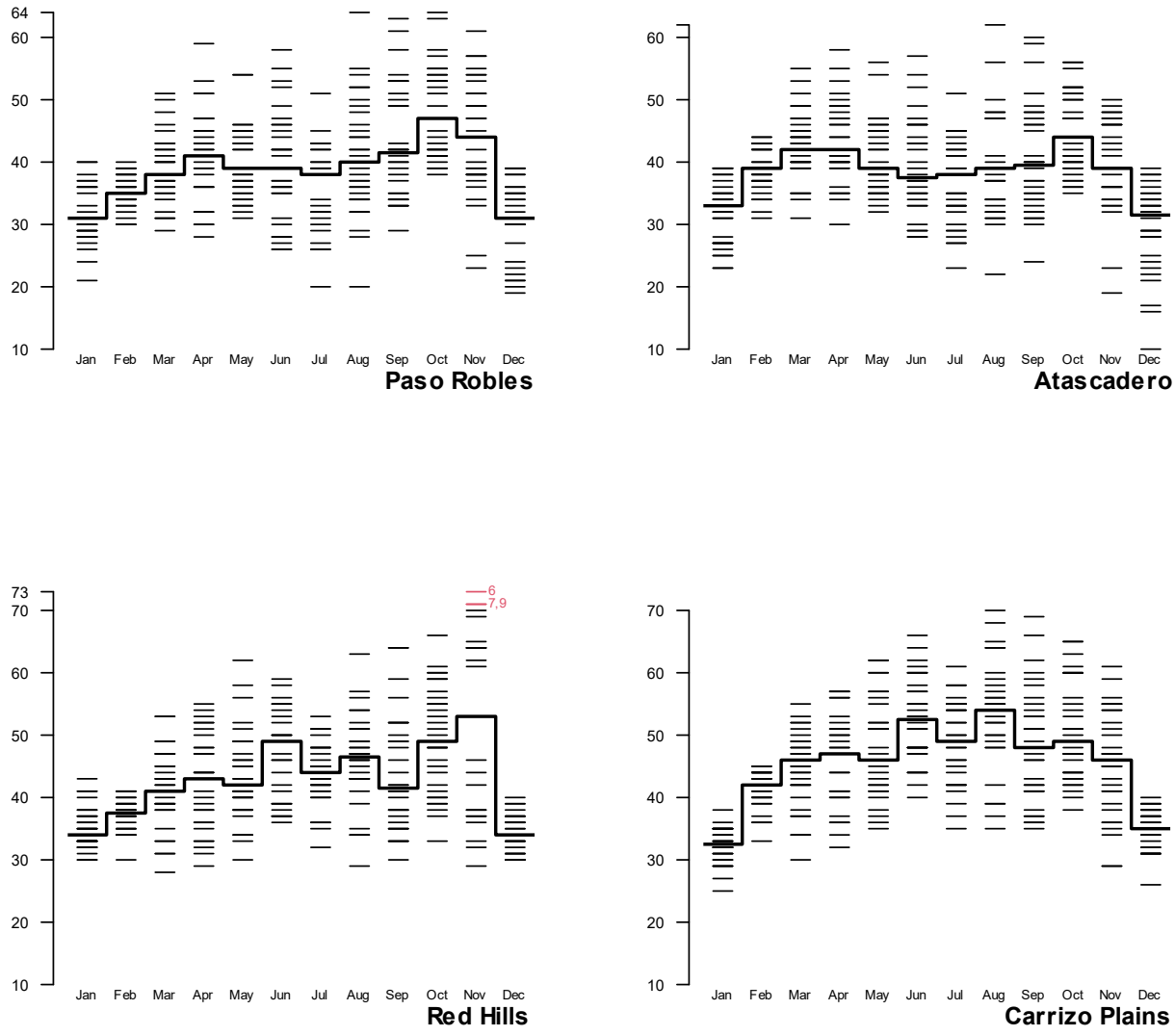


Figure 3: Daily Maximum 8-Hour Average for 2019 (ppb)

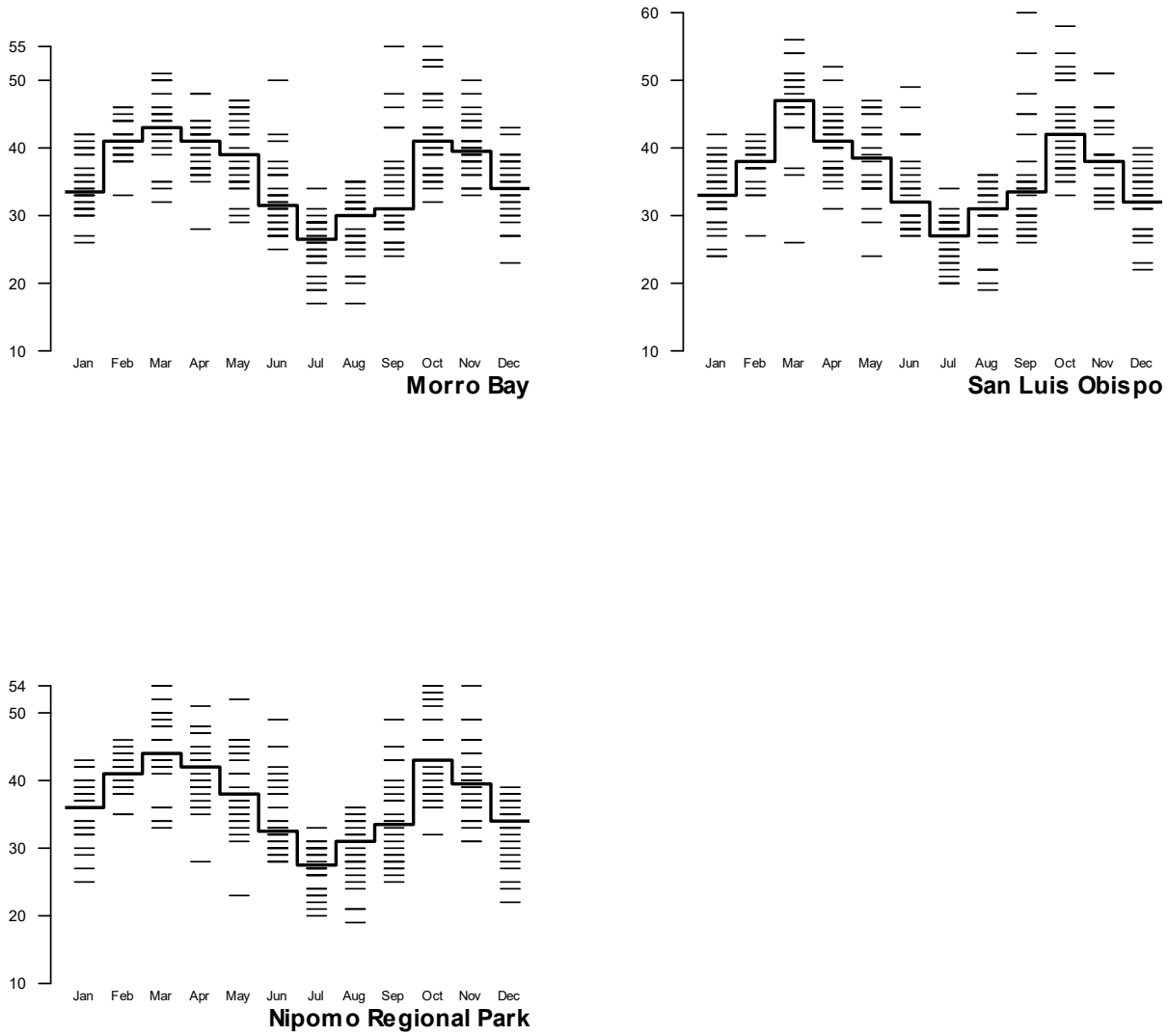


Figure 4: Daily Maximum 8-Hour Average for 2019 (ppb)

Particulate Matter Summary

In 2019, there were no exceedances of the federal 24-hour PM_{10} standard (150 μg/m^3) anywhere in the county. Exceedances of the California 24-hour PM_{10} standard (50 μg/m^3) were observed on 54 days: 51 days at CDF, 36 at Mesa2, 14 at NRP, 7 at Paso Robles, 6 at Oso Flaco, 4 at Atascadero, and 1 at San Luis Obispo.[3] This year, CDF, Mesa2, and NRP exceeded the state annual average PM_{10} standard of 20 μg/m^3.

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 μg/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. This year there were 35 days that violated the Rule 1001 standard, as well as 4 possible violation days when the CDF 24-hour average exceeded 55 μg/m^3 but could not be compared to Oso Flaco because the Oso Flaco station was offline.

In 2019 no monitoring station in the county recorded exceedances of the federal 24-hour $PM_{2.5}$ standard (35 μg/m^3) or the federal and state annual average standards (both 12 μg/m^3).

Table 4 lists the highest 24-hour concentrations recorded in 2019 and the dates on which they occurred, as well as the annual averages for PM_{10} and $PM_{2.5}$. Concentrations are in μg/m^3. Values exceeding federal standards are shown in **bold**; those exceeding state standards are underlined.

Wind-blown dust from the San Joaquin Valley and the ODSVRA caused elevated PM_{10} and $PM_{2.5}$ this year. 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 2nd and 3rd highest 24-hour PM_{10} averages at Mesa 2 and CDF and the 3rd highest at Nipomo Regional.

October 28th saw the highest 24-hour PM_{10} averages at all monitors in the county. These elevated levels were associated with wind-blown dust originating in the San Joaquin Valley. This multiday transport event began in earnest on the evening of October 27th, with peak 24-hour average concentrations occurring on October 28th and slowly dispersed over the next week before returning to normal levels by November 2nd. (In the San Joaquin Valley, 24-hour PM_{10} averages exceeded 500 μg/m^3 during this period). A press release regarding this event was issued on October 30th. This event was responsible for the top 3 highest 24-hour PM_{10} averages at the Paso Robles, Atascadero, and San Luis Obispo monitors, the top 2 highest at NRP, and the single highest at CDF, Mesa2, and Oso Flaco.

[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 55 exceedances of the state PM_{10} standard at CDF, 40 at Mesa2, 15 at Nipomo Regional Park, 9 at Paso Robles, 7 at Oso Flaco, 4 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.

[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 2019 ($\mu g/m^3$)

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	134 10/28	129 10/30	109 10/27	17.4				
Atascadero	98 10/28	81 10/27	79 10/30	13.8	17.3 01/01	15.0 01/25	15.0 12/31	4.2
San Luis Obispo	100 10/28	45 10/29	44 11/01	12.1	14.8 10/28	14.5 07/25	11.7 06/10	5.2
CDF, Arroyo Grande	132 10/28	115 08/21	105 09/09	25.5	26.2 08/21	25.7 09/09	24.8 09/08	6.1
Nipomo Regional Park	139 10/28	75 10/27	71 07/01	20.4				
Oso Flaco	133 10/28	79 04/09	64 03/12	16.2				
Mesa2, Nipomo	136 10/28	104 04/09	103 07/15	24.5	23.6 07/15	23.0 08/21	21.0 04/09	7.0

‡ 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 $\mu g/m^3$.

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

Figures 5 and 6, below, show the 24-hour $PM_{2.5}$ and PM_{10} values from the stations where these pollutants were measured in 2019. 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 $\mu g/m^3$.

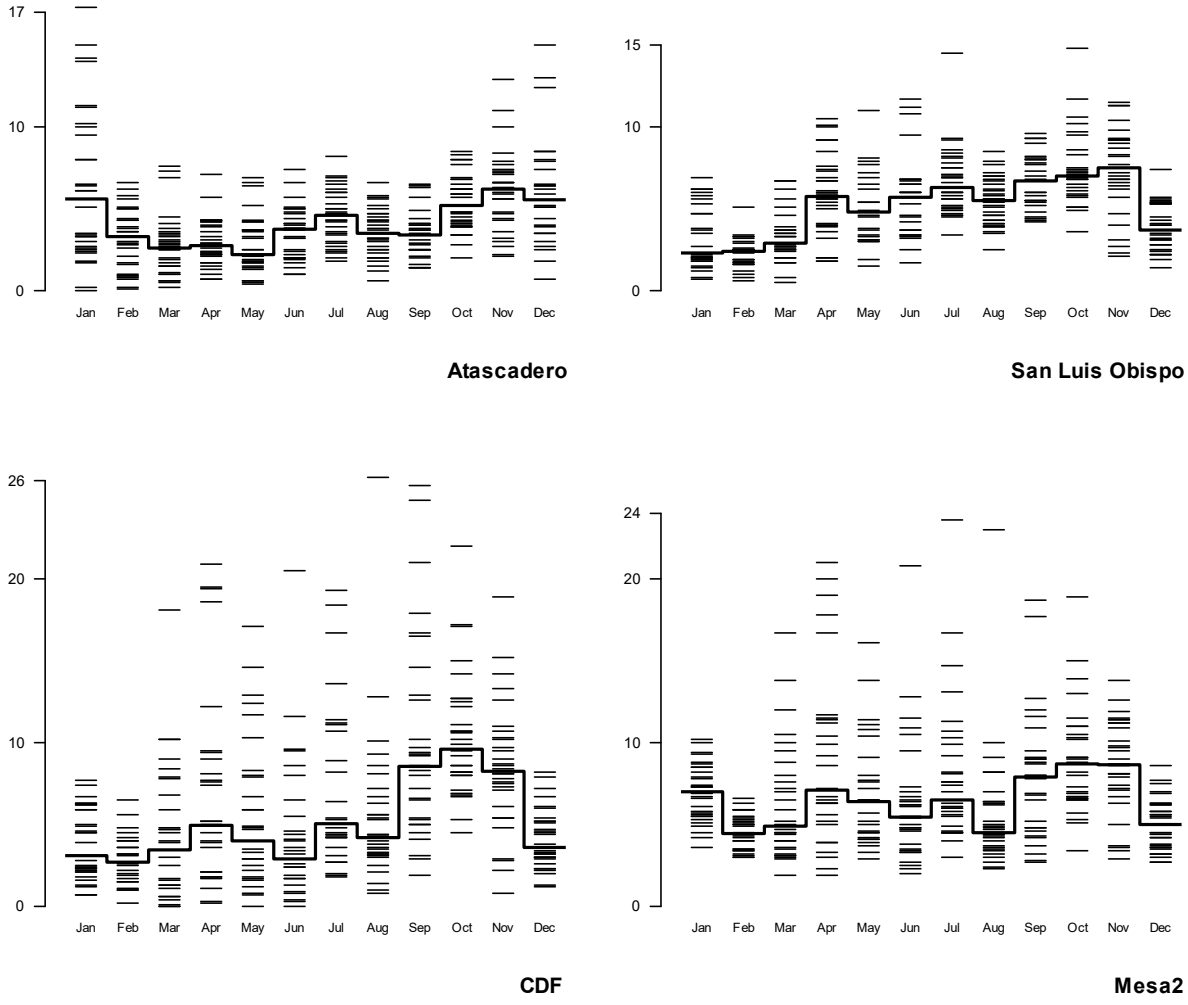


Figure 5: Daily $PM_{2.5}$ Values for 2019 ($\mu g/m^3$)

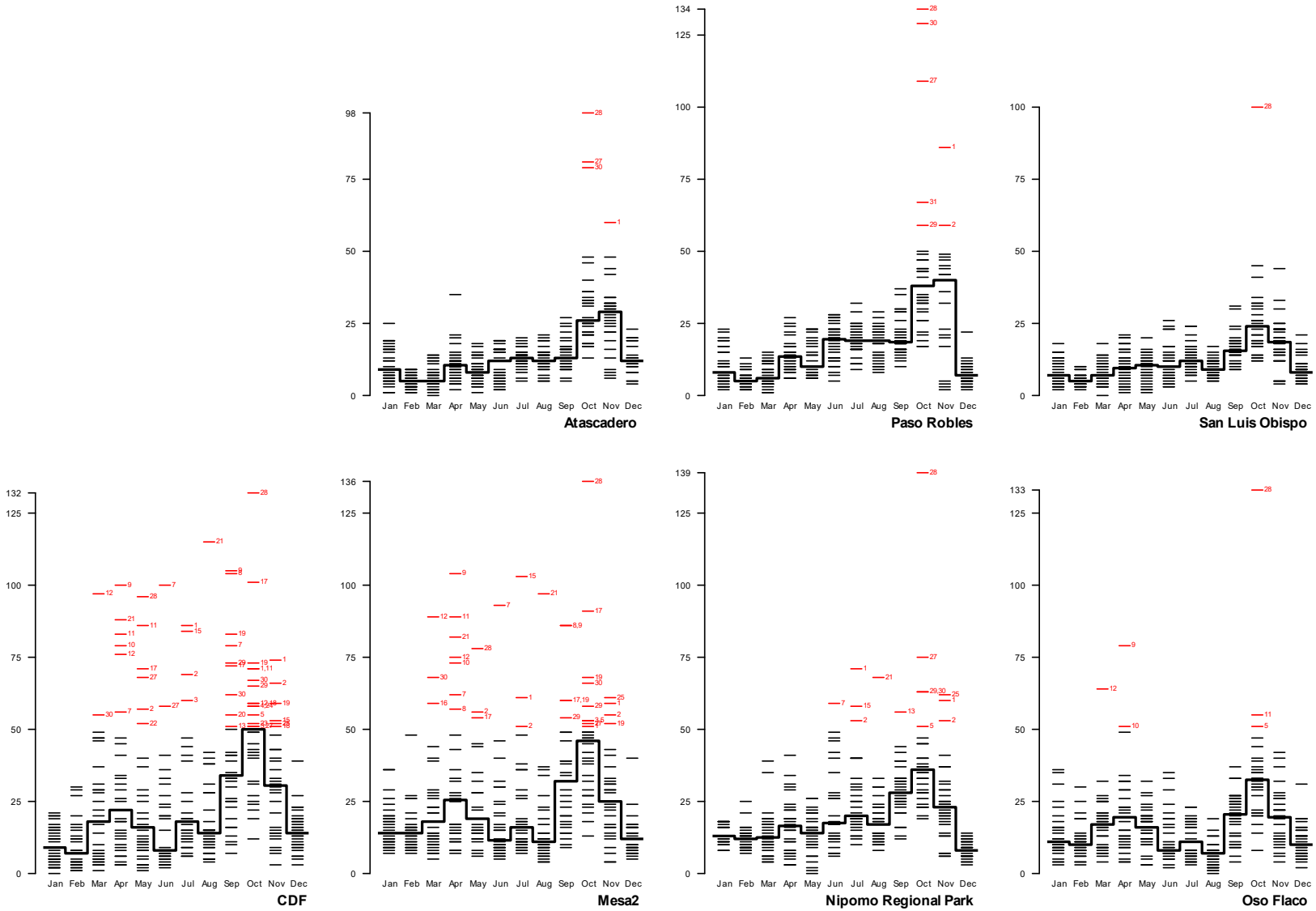


Figure 6: Daily PM_{10} Values for 2019 ($\mu g/m^3$)

10-Year Trends

Ozone

Figure 7, 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 8 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.

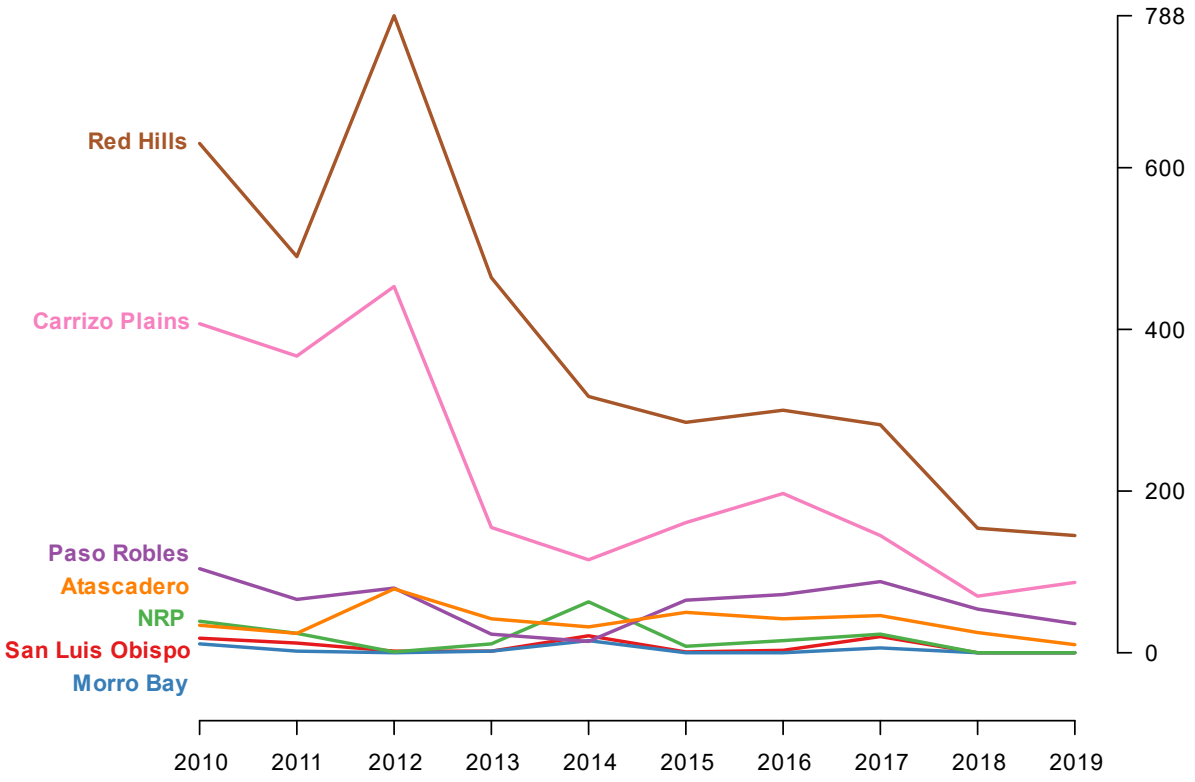


Figure 7: Hours At or Above 65 ppb Ozone, 2010-2019

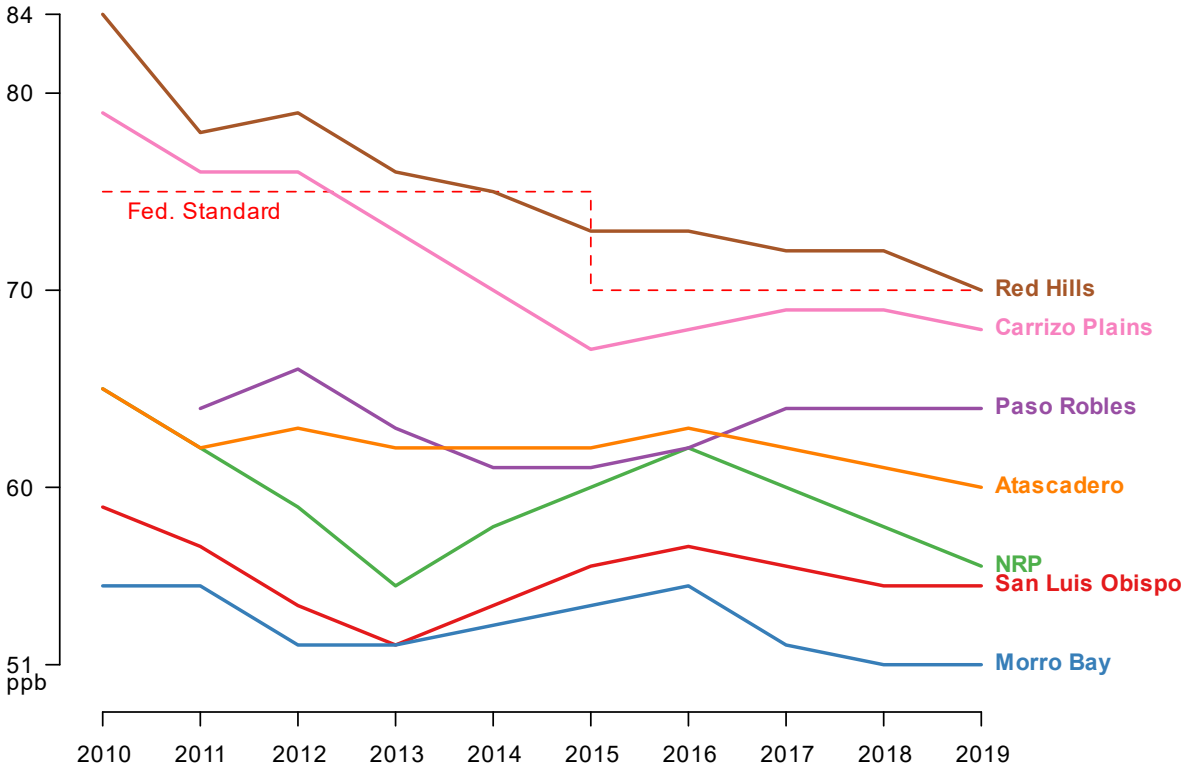


Figure 8: Ozone Design Value Trends, 2010-2019

Particulate Matter

Figure 9 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 10 plots the total number of hours each year when PM_{10} was at or above 50 μg/m^3 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 11 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).

Figure 12 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/m^3 state and federal $PM_{2.5}$ standard for the annual average.

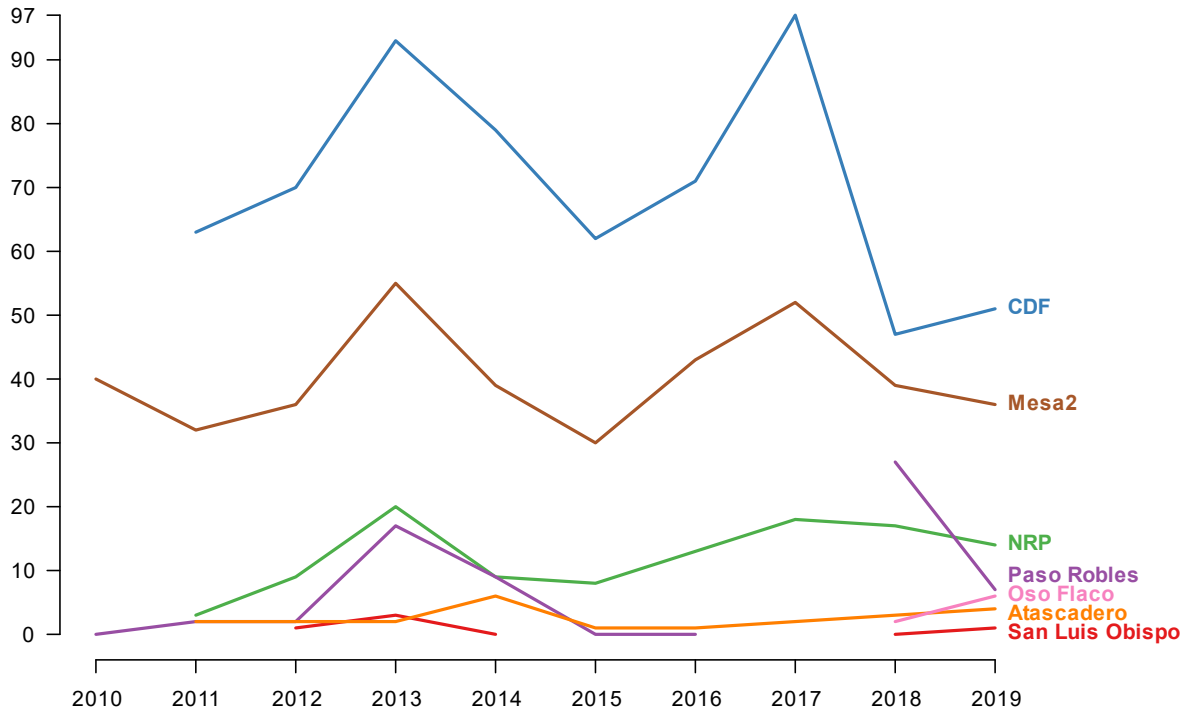


Figure 9: Exceedances of the California 24-hour PM_{10} Standard, 2010–2019

[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.

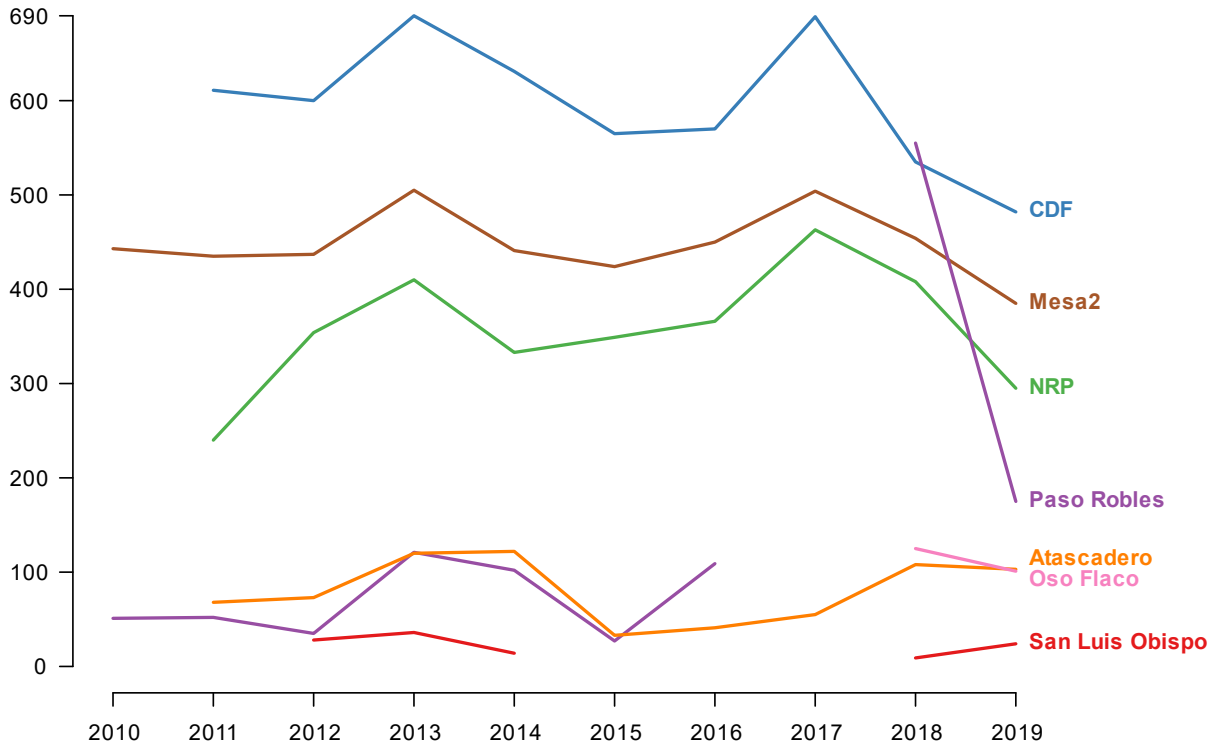


Figure 10: Hours At or Above 50 μg/m^3 PM_{10} between 10 a.m. and 4 p.m., 2010–2019

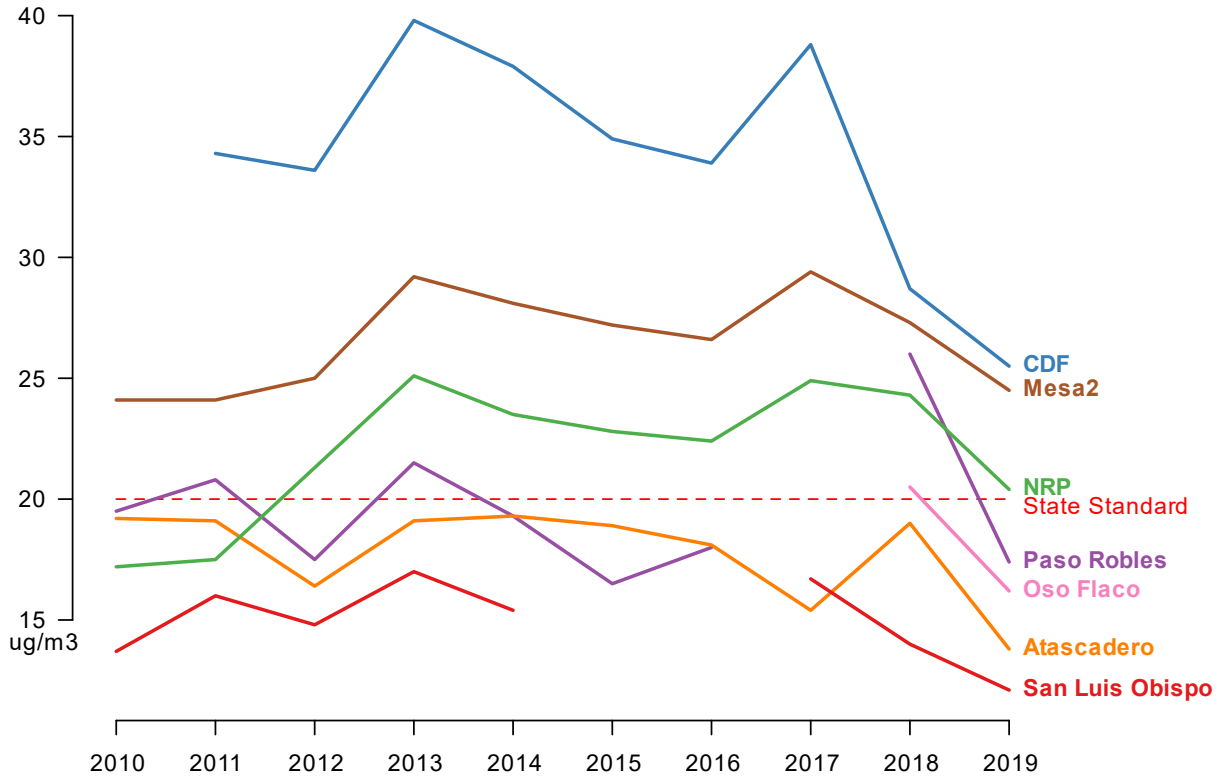


Figure 11: PM_{10} Annual Averages, 2009–2019

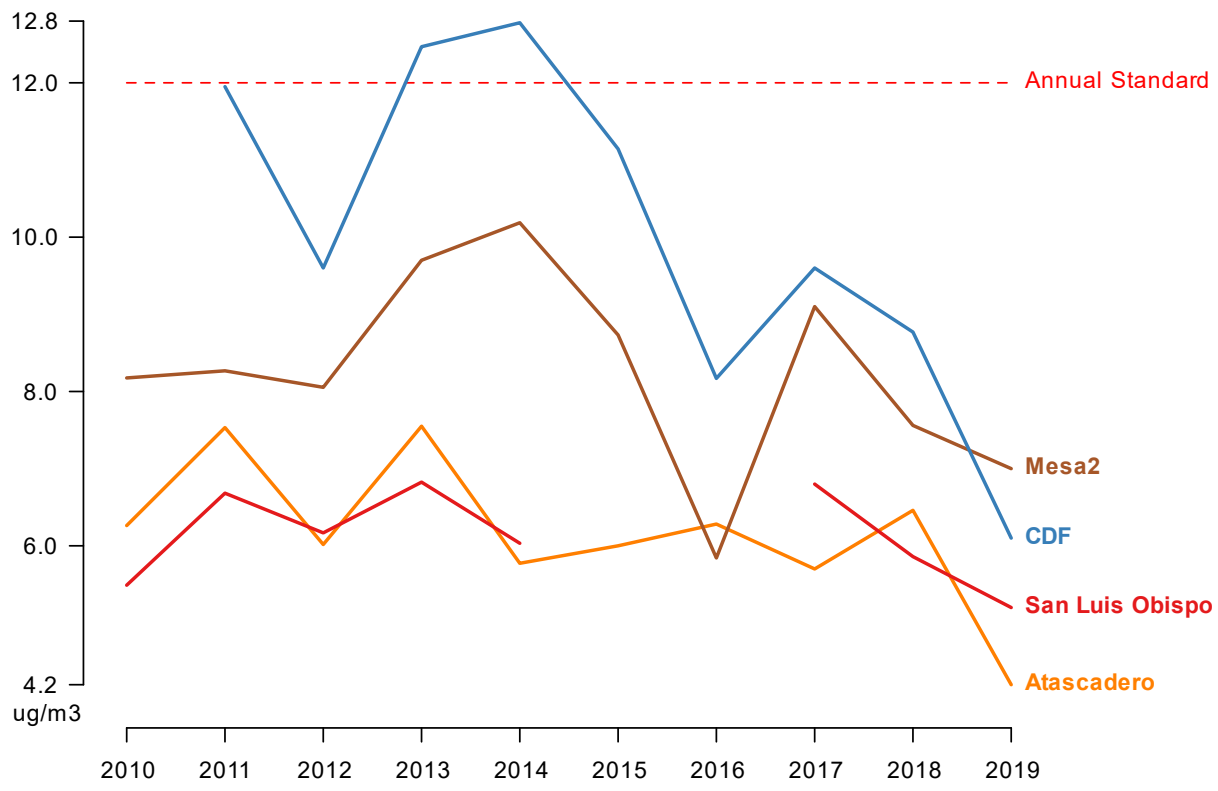


Figure 12: $PM_{2.5}$ Annual Averages, 2010-2019

Appendix A: Assessing the Effectiveness of ODSVRA Mitigations

Introduction

Windblown dust from the ODSVRA remains the predominant air quality challenge affecting South San Luis Obispo County, causing dozens of exceedances of the state PM_{10} standard each year in the region. For more than a decade, the District 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 District's website.[6] To date, State Parks has completed several dust control projects, both permanent and temporary.

To gauge the effectiveness of these controls, recent Annual Air Quality Reports[7] have included appendices that analyzed trends in particulate matter on the Nipomo Mesa. The 2018 Report was the first to conclude that mitigations deployed that year had resulted in a statistically significant improvement in the air quality at CDF. Specifically, it found that event-day PM_{10} at CDF was statistically significant lower by 22.4% (95% CI: 7.4 - 34.9%; p-value: 0.0061) in 2018 as compared to 2017. In other words, in 2018, wind event PM_{10} levels at CDF were 22.4% lower than what they would have been if the 2018 mitigation projects had not been undertaken and instead the smaller projects of 2017 remained. In earlier years, dust mitigation projects did not detectibly reduce PM_{10} levels at CDF. This Appendix updates the analysis for 2019, using the same methodology employed in the 2017 and 2018 Reports.

Background and Methodology

From 2011 to 2019, the annual number of exceedances of the state PM_{10} standard at CDF varied from as few as 47 to as many as 97. It would be naïve to attribute these year-to-year changes solely to changes in the extent of State Parks' mitigation efforts. As discussed in previous Annual Air Quality Reports, downwind PM_{10} concentrations are potentially influenced not only by the mitigations, but also by other factors including regional particulate matter events, wildfires, non-ODSRVA sources, and—most importantly—meteorology, in particular, the strength and direction of on-shore 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.

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. The crux of the idea is that 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 approximately the same trends in meteorology, and they should be similarly influenced by wildfires and regional particulate matter events. 2017 is used as the baseline to compare other years to, since this year had the least amount of mitigation and is thus the closest possible scenario to a fully un-mitigated baseline.

See the previous Annual Air Quality Reports for a more complete description of the methodology, which requires PM_{10} data from Oso Flaco and CDF as well as wind data from CDF and a State Parks managed meteorology station (S1 Tower) located within the ODSVRA. The CDF and Oso Flaco data used in this

[6] https://www.slocleanair.org/air-quality/oceano-dunes-efforts.php;

[7] San Luis Obispo County Air Pollution Control District, "2015 Annual Air Quality Report," "2016 Annual Air Quality Report," "2017 Annual Air Quality Report," and "2018 Annual Air Quality Report" at https://www.slocleanair.org/library/air-quality-reports.php.

analysis are fully validated, but the S1 Tower data used in this analysis was obtained from State Parks, and its validation status is unknown. It was used as-is.

Results

Applying the methodology to the 2019 data yields a 7.6% improvement in event-day PM_{10} at CDF compared to the baseline year of 2017; however, the improvement is not statistically significant (95% CI: -23.2 to +30.7%; p-value: 0.593). This decrease in the ratio for 2019 versus 2017 is less than the decrease reported last year for 2018 versus 2017, meaning that event-day PM_{10} at CDF actually *increased* in 2019 compared to 2018. This is depicted in Figure A1, below, which shows boxplots of the ratio of CDF to Oso Flaco PM_{10} on wind event days. Table A1 summarizes these results along with the results from previous years.

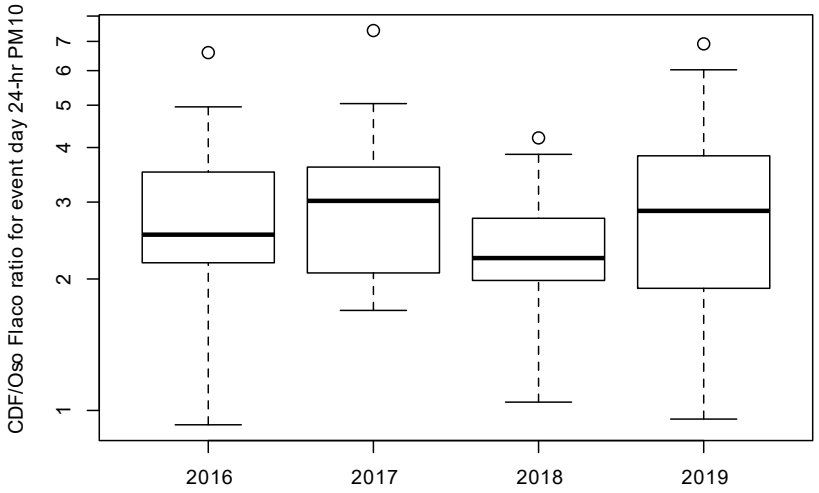


Figure A1: Ratio of 24-hr PM_{10} at CDF to Oso Flaco on wind event days, by year

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

Year	Total Dust Mitigation Extent (approx. acres)[8]	Change, vs 2017 baseline, in Ratio of Event-Day PM_{10} (CDF vs Oso Flaco)		
		Percent Change	95% Confidence Interval	P-value
2019	133	- 7.6%	+ 23.2% to – 30.7%	0.593
2018	141	- 22.4%	- 7.4% to - 34.9%	0.006
2017	51	0 %	n.a.	n.a.
2016	69	- 12.7%	+16.8% to -38.4%	0.363

[8] Mitigation acreage is derived from State Parks' Draft Particulate Matter Reduction Plan (June 2017), Revised 2019 Annual Report and Work Plan (December 31, 2019), and 2020 Annual Report Work Plan, Forth Draft (September 30, 2020). These documents are available online; see Footnote 6. The figures cited in this table differ from those noted in previous Annual Air Quality Reports, due to the inclusion of about 47 acres of dust controls installed in or prior to 2018, including about 29 acres of revegetation in the non-riding area of the ODSVRA.

Discussion

The analysis for 2019 suggests that PM_{10} levels at CDF may have improved in this year as compared to 2017, and this improvement is attributable to the dust control projects on the ODSVRA. This improvement, however, is not statistically significant; moreover, compared to 2018, PM_{10} levels in 2019 appear to have increased. The apparent increase in event-day PM_{10} at CDF from 2018 to 2019 is not surprising considering that 1) the total areal extent of dust control project decreased from 2018 to 2019 (see Table A1), 2) some wind fencing erected in 2018 may have become significantly inundated with sand or otherwise degraded, making it less effective in 2019, and 3) approximately 50 acres of wind fencing was removed in September 2019 and eventually replaced with vegetation, but in the meantime—including the month of October, which was very windy—these 50 acres were uncontrolled.

While the improvement seen in 2018 seems to have been partially reversed in 2019, preliminary analysis of 2020 PM_{10} data is encouraging. As discussed in a Frequently Asked Questions document dated June 30, 2020,[9] and in a presentation to the District Hearing Board on October 23, 2020,[10] approximately 90 additional acres of dust controls were deployed in early 2020, and various analyses suggest these new controls are reducing PM_{10} at CDF. For example, Figure A2, below, which was presented at the October 23rd meeting, shows the number of hours each year (through October 18th) at CDF with PM_{10} greater than 300 $\mu g/m^3$. While there were slightly more in 2019 than 2018, 2020 has the fewest by far.

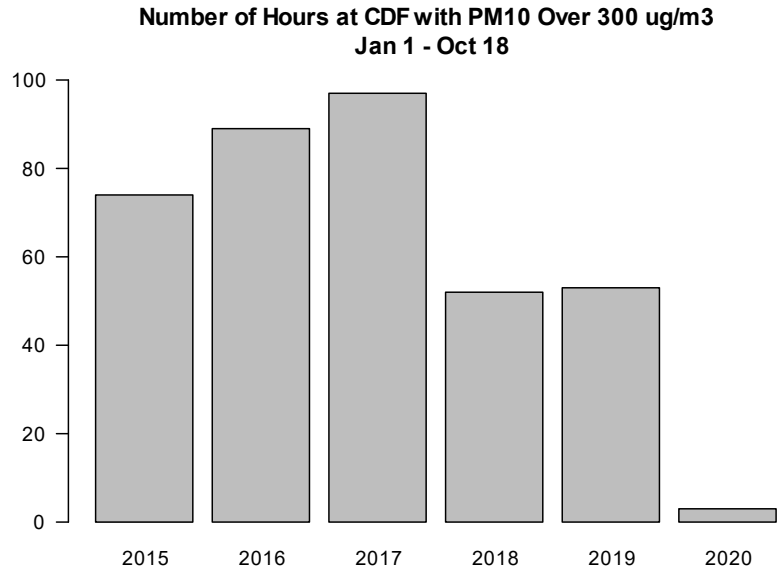
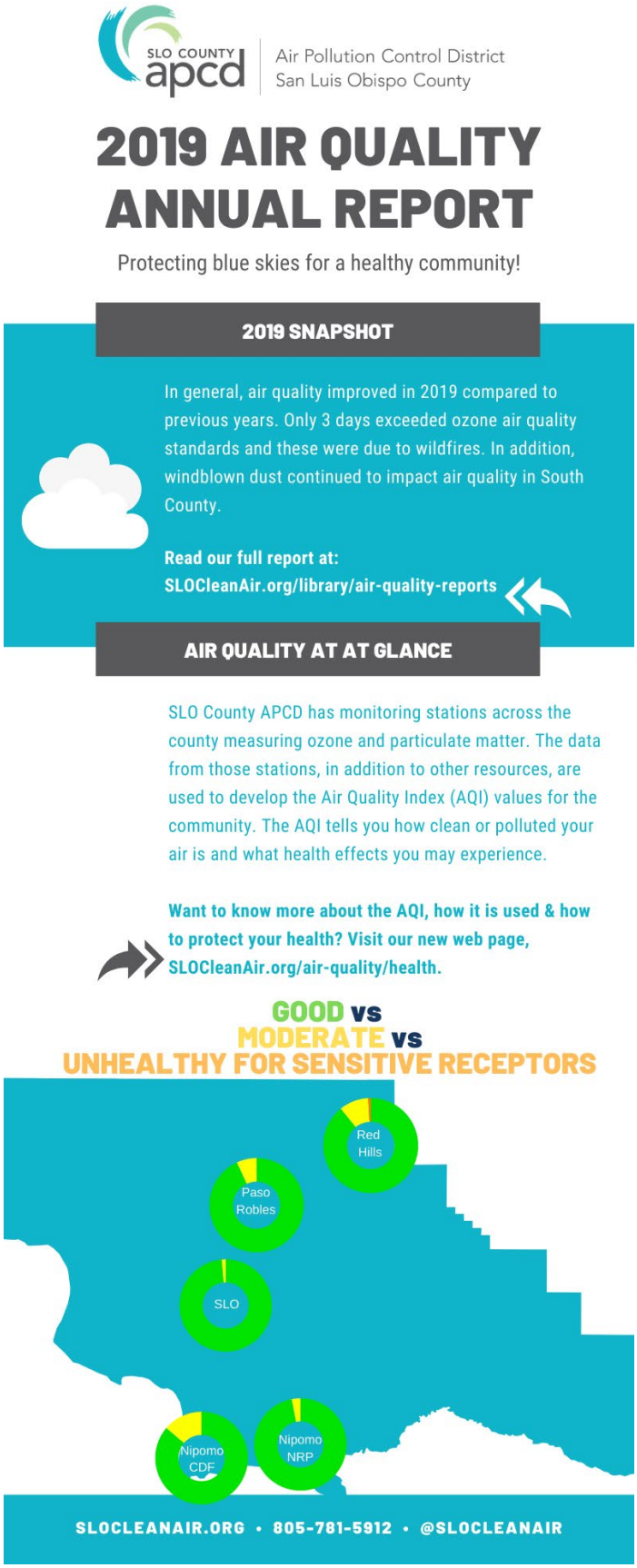


Figure A2: Hours at CDF Greater than 300 $\mu g/m^3$

[9] San Luis Obispo County Air Pollution Control District, "Frequently Asked Questions: Air Quality and the Temporary Closure of Oceano Dunes," June 30, 2020. Available online at https://storage.googleapis.com/slocleanair-org/images/cms/upload/files/June2020FAQ-42.pdf.

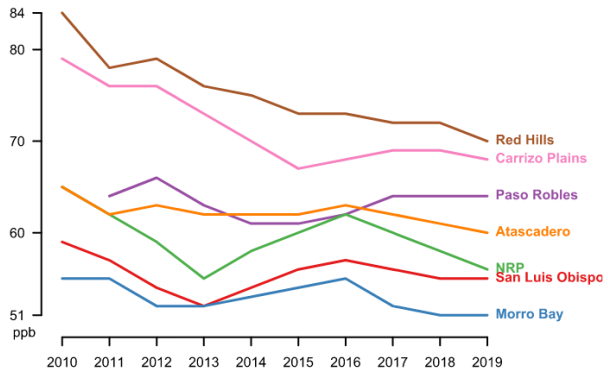
[10] Karl A Tupper, "Effects of Dust Control Projects & Basis of Provisional Approval of ARWP," [Presentation]. Meeting of the San Luis Obispo County Air Pollution Control Hearing Board, October 23, 2020. Video available online at https://www.youtube.com/watch?v=YKBCOp8c8Tk.

Appendix B: Infographic Summarizing 2019 Air Quality



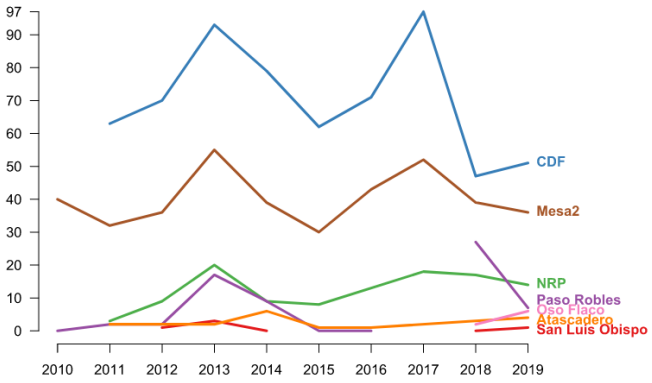
OZONE TRENDS

Despite wildfire impacts, ozone levels continued to improve in 2019, including in the eastern portion of the county which tends to see the highest levels.



PARTICULATE MATTER TRENDS

Overall, PM levels improved across the county, though there was a slight increase in the number of PM10 exceedances at a few sites. Particulate pollution remains high on the Nipomo Mesa, and the SLO County APCD staff, governing board, and hearing board continue to work with all stakeholders to resolve the issue.



Find out more about your local air quality by signing up to receive text notifications with our AirAware program!

SLOCleanAir.org/air-quality-alerts

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