Chapter 2
Air Quality and Health Effects

- **The South Coast Air Basin (Basin) experiences high levels of ozone due to the large amount of air emissions combined with ideal weather and topography for ozone formation.**
- **The Basin does not meet federal ozone standards or the annual PM2.5 standard. It met the 24-hour PM2.5 standard for the first time based on 2018-2020 data but continues to exceed the annual PM2.5 standard.**
- **The Coachella Valley also fails to meet federal ozone standards due to transport of pollution from the South Coast Air Basin.**
- **The highest levels of ozone are typically in the Inland Empire; the highest levels of PM2.5 are typically in South Central Los Angeles and metropolitan Riverside County.**
- **The region experienced unusually high levels of ozone in 2020 due to record-breaking heatwaves and wildfires.**

In This Chapter

Introduction

There are many factors that contribute to the high levels of air pollution experienced in the South Coast Air Basin (Basin). The substantial amount of emissions from the nation's second largest urban area combined with meteorological conditions and topography that create the ideal conditions for the formation of pollutants such as ozone and fine particulate matter (PM2.5, particles less than 2.5 microns in diameter). Weather conditions such as low wind speed[1] and low mixing heights[2] hampers the dispersion of those emissions, and frequent strong temperature inversions form a cap that traps the emissions close to the ground. The mountainous terrain surrounding the Basin further traps pollutants as they are pushed inland with the sea breeze. Southern California also has abundant sunshine, which drives the photochemical reactions that form ozone and a significant portion of fine particulate matter. Together all these factors create a "perfect storm" of conditions for forming air pollution.

In the Basin, high ozone is typically observed from April through October, when longer days and more intense sunlight drives the photochemical reactions that form ozone. Elevated PM10 (particles less than 10 microns in diameter) and PM2.5 concentrations can occur in the Basin throughout the year. High PM10 levels are typically caused by windblown dust and are associated with high wind events. PM2.5 is both directly emitted (primary PM2.5) and formed in the atmosphere from the reaction of gas-phase precursors (secondary PM2.5); most PM2.5 in the Basin is formed from secondary processes. High PM2.5 levels tend to occur most frequently in fall and winter when stagnant conditions trap pollutants and enhance formation of PM2.5 in the atmosphere. Weather conditions are therefore a primary driver of observed air pollutant levels in our region.

While the 2022 Air Quality Management Plan (AQMP) is focused on strategies to meet the 2015 8-hour ozone standard, it is important to capture the broader picture of air quality in our region. This chapter provides a summary of air quality trends in both the Basin and the Riverside County portion of the Salton Sea Air Basin (SSAB), which we refer to as the Coachella Valley. We first provide an overview of the federal National Ambient Air Quality Standards (NAAQS or federal standards) and the California Ambient Air Quality Standards (CAAQS or State standards). We also briefly discuss the health effects due to air pollution exposure. We then summarize air quality trends in both the Basin and the Coachella Valley. We provide a summary of nationwide air quality data, with air quality in the Basin compared to conditions in other major U.S. and California urban areas. Finally, we examine potential causes of high ozone levels observed in the Basin in 2020. Additional details on current air quality and trends and comparisons can be found in Appendix II: Current Air Quality.

Note that more detailed information of the topics discussed in this chapter can be found in the Appendices. Appendix I contains further information on the health effects of air pollution. Appendix II contains additional details on current air quality and trends with comparisons to the federal and State standards, including spatial and temporal variability and location-specific air monitoring data. Further,

[1] The average windspeed for Los Angeles is the lowest of the nation's 10 largest urban areas.

[2] The maximum mixing height is an index of how well pollutants can be dispersed vertically in the atmosphere.

current air quality and trend information specific to the Coachella Valley planning area is included in Chapter 7, along with the State Implementation Plan (SIP)'s elements for the 2015 8-hour ozone national ambient air quality standards specific to the Coachella Valley.

Ambient Air Quality Standards

Federal and State Standards

Both the federal government and the State of California have established ambient air quality standards for six air pollutants: Ozone, Carbon Monoxide (CO), Nitrogen Dioxide (NO_2), Sulfur Dioxide (SO_2), PM (includes both PM10 and PM2.5), and lead. California has also set a standard for sulfates (SO_4^{2-}), which are a component of particulate matter, and a nuisance odor standard for hydrogen sulfide (H_2S).

The NAAQS for each criteria air pollutant is determined after a lengthy review of available health and air pollution data, with the aim of safeguarding public health. The U.S. EPA is legally barred from considering economic costs when setting the NAAQS. Some pollutants that have both short- and long-term health consequences are regulated by establishing standards with different averaging times. PM2.5 for instance has daily and annual limits. Each standard has a different date by which it must be attained based on the date that an area is designated as nonattainment of the standard and the severity of the air pollutant concentrations.

California has its own standards for the same criteria pollutants in addition to sulfate, and hydrogen sulfide. Some California standards (CAAQS) such as the PM2.5 annual, ozone and CO 8-hour standards are similar to the NAAQS, but others are more stringent. Moreover, some CAAQS use averaging periods and calculation methods that are different from the NAAQS. The added stringency results from the State's own assessment of the nexus between pollutants and public health in California. See Chapter 6 for details.

In addition to criteria pollutants, more than 200 toxic air pollutants have been identified by the Office of Environmental Health Hazard Assessment (OEHHA). Examples include benzene, hexavalent chromium perchloroethylene and diesel exhaust. The most recent list of toxic air pollutants with their associated health risk is available in the OEHHA database.[3] Air toxics are regulated by controlling their emissions at the source, and do not have maximum permissible ambient concentrations like criteria pollutants do. The NAAQS and CAAQS for each of these pollutants and their effects on health and welfare are summarized in Table 2-1.

[3] https://ww2.arb.ca.gov/sites/default/files/classic/toxics/healthval/contable.pdf.

TABLE 2-1

AMBIENT AIR QUALITY STANDARDS AND KEY HEALTH AND WELFARE EFFECTS

AIR POLLUTANT	FEDERAL STANDARD (NAAQS)	STATE STANDARD (CAAQS)	KEY HEALTH & WELFARE EFFECTS[#]
	Concentration, Averaging Time, Year of NAAQS Review	Concentration, Averaging Time	
Ozone (O3)	**0.070 ppm, 8-Hour (2015)** 0.075 ppm, 8-Hour (2008) 0.08 ppm, 8-Hour (1997) 0.12 ppm, 1-Hour (1979)	**0.070 ppm, 8-Hour** **0.09 ppm, 1-Hour**	(a) Pulmonary function decrements and localized lung injury in humans and animals; (b) asthma exacerbation; (c) chronic obstructive pulmonary disease (COPD) exacerbation; (d) respiratory infection; (e) increased school absences, and hospital admissions and emergency department (ED) visits for combined respiratory diseases; (e) increased mortality; (f) possible metabolic effects Vegetation damage; property damage
Carbon Monoxide (CO)	**35 ppm, 1-Hour (1971)** **9 ppm, 8-Hour (1971)**	**20 ppm, 1-Hour** **9.0 ppm, 8-Hour**	Visibility reduction (a) Aggravation of angina pectoris and other aspects of coronary heart disease; (b) decreased exercise tolerance in persons with peripheral vascular disease and lung disease; (c) possible impairment of central nervous system functions; (d) possible increased risk to fetuses; (f) possible increased risk of pulmonary disease; (g) possible emergency department visits for respiratory diseases overall and visits for asthma.

TABLE 2-1 (CONTINUED)

AMBIENT AIR QUALITY STANDARDS AND KEY HEALTH AND WELFARE EFFECTS

AIR POLLUTANT	FEDERAL STANDARD (NAAQS)	STATE STANDARD (CAAQS)	KEY HEALTH & WELFARE EFFECTS[#]
	Concentration, Averaging Time, Year of NAAQS Review	Concentration, Averaging Time	
Fine Particulate Matter (PM2.5)	**35 µg/m³, 24-Hour (2006)** 65 µg/m³, 24-Hour (1997) 12.0 µg/m³, **Annual (2012)** 15.0 µg/m³, Annual (1997)	**12.0 µg/m³, Annual**	Short -term (a) increase in mortality rates; (b) increase in respiratory infections; (c) increase in number and severity of asthma attacks; (d) COPD exacerbation; (e) increase in combined respiratory-diseases and number of hospital admissions; (f) increased mortality due to cardiovascular or respiratory diseases; (g) increase in hospital admissions for acute respiratory conditions; (h) increase in school absences; (i) increase in lost work days; (j) decrease in respiratory function in children; (k) increase medication use in children and adults with asthma. Long-term (a) reduced lung function growth in children; (b) changes in lung development; (c) development of asthma in children; (d) increased risk of cardiovascular diseases; (e) increased total mortality from lung cancer; (f) increased risk of premature death. Possible link to metabolic, nervous system, and reproductive and developmental effects for short-term and long-term exposure to PM2.5.
Respirable Particulate Matter (PM10)	**150 µg/m³, 24-Hour (1997)**	**50 µg/m³, 24-Hour** **20 µg/m³, Annual**	

TABLE 2-1 (CONTINUED)

AMBIENT AIR QUALITY STANDARDS AND KEY HEALTH AND WELFARE EFFECTS

AIR POLLUTANT	FEDERAL STANDARD (NAAQS)	STATE STANDARD (CAAQS)	KEY HEALTH & WELFARE EFFECTS[#]
	Concentration, Averaging Time, Year of NAAQS Review	Concentration, Averaging Time	
Nitrogen Dioxide (NO_2)	**100 ppb, 1-Hour (2010) 0.053 ppm, Annual (1971)**	**0.18 ppm, 1-Hour 0.030 ppm, Annual**	Short-term (a) asthma exacerbations ("asthma attacks") Long-term (a) asthma development; (b) higher risk of all-cause, cardiovascular, and respiratory mortality. Both short and long term NO_2 exposure is also associated with chronic obstructive pulmonary disease (COPD) risk. Potential impacts on cardiovascular health, mortality and cancer, aggravate chronic respiratory disease. Contribution to atmospheric discoloration
Sulfur Dioxide (SO_2)	**75 ppb, 1-Hour (2010)**	**0.25 ppm, 1-Hour 0.04 ppm, 24-Hour**	Respiratory symptoms (bronchoconstriction, possible wheezing or shortness of breath) during exercise or physical activity in persons with asthma. Possible allergic sensitization, airway inflammation, asthma development
Lead (Pb)	**0.15 µg/m^3, rolling 3-month average (2008)**	**1.5 µg/m^3, 30-day average**	(a) Learning disabilities; (b) impairment of blood formation and nerve function; (c) cardiovascular effects, including coronary heart disease and hypertension Possible male reproductive system effects

TABLE 2-1 (CONCLUED)

AMBIENT AIR QUALITY STANDARDS AND KEY HEALTH AND WELFARE EFFECTS

AIR POLLUTANT	FEDERAL STANDARD (NAAQS)	STATE STANDARD (CAAQS)	KEY HEALTH & WELFARE EFFECTS[#]
	Concentration, Averaging Time, Year of NAAQS Review	Concentration, Averaging Time	
Sulfates-PM10 (SO_4^{2-})	**N/A**	**25 µg/m³, 24-Hour**	(a) Decrease in lung function; (b) aggravation of asthmatic symptoms; (c) vegetation damage; (d) Degradation of visibility; (e) property damage
Hydrogen Sulfide (H_2S)	**N/A**	**0.03 ppm, 1-hour**	Exposure to lower ambient concentrations above the standard may result in objectionable odor and may be accompanied by symptoms such as headaches, nausea, dizziness, nasal irritation, cough, and shortness of breath

ppm - parts per million by volume; ppb - parts per billion by volume (0.01 ppm = 10 ppb).
Standards in bold are the current, most stringent standards; there may be continuing obligations for former standards.
State standards are "not-to-exceed" values based on State designation value calculations.
Federal standards follow the 3-year design value form of the NAAQS.
[#] List of health and welfare effects is not comprehensive; detailed health effects information can be found in Appendix I: Health Effects or in the U.S. EPA NAAQS documentation at https://www.epa.gov/naaqs.

On October 1, 2015, the U.S. EPA finalized the new 2015 ozone standard at 0.070 ppm or 70 ppb for an 8-hour average, retaining the same form as the previous 8-hour standards. The 2015 ozone NAAQS became effective as of December 28, 2015. The PM2.5 standards currently in effect are the 2006 24-hour standard of 35 µg/m³, and the 2013 annual standard of 12 µg/m³. The U.S. EPA last reviewed the PM2.5 and ozone standards in 2020 and decided to retain them at their current levels. However, the present administration is re-evaluating the 2020 review and expects to finalize that re-evaluation within the next few years. See Chapter 9 for more details.

The Basin and the Coachella Valley, as well as much of California, have been designated nonattainment for the 2015 8-hour ozone standard. The Basin and San Joaquin Valley are the only areas with an "extreme" nonattainment designation for the 2015 8-hour ozone standard. The Basin is designated nonattainment for current and former federal and State ozone standards, as well as the current PM2.5 standards. However, 2018-2020 was the first 3-year period where the Basin met the 24-hour PM2.5 standard of 35 µg/m³ after removing elevated measurements driven by the Bobcat and El Dorado wildfires in the fall of 2020. The Los Angeles County portion of the Basin is also designated as a nonattainment area for the federal lead standard based on source-specific monitoring at two locations as determined by the

U.S. EPA using 2007-2009 data. However, all stations in the Basin, including the near-source monitoring in Los Angeles County, have remained below the lead NAAQS for the 2012 through 2020 period.

In June 2013, the U.S. EPA approved re-designation of the Basin as an attainment area for the 24-hour PM10 federal standard. The Basin also continues to be in attainment of the CO, NO_2, and SO_2 NAAQS. The Coachella Valley remains a nonattainment area for both the ozone and the PM10 NAAQS. However, PM10 concentrations in the Coachella Valley are continually evaluated and the influence of high-wind exceptional events are routinely assessed; a re-designation to attainment of the PM10 NAAQS could be possible in the near future. Further details on the federal and State standards are presented in this chapter by pollutant, along with the South Coast AQMD's current attainment status.

In this chapter and in Appendix II: Current Air Quality, the number of days exceeding air quality standards and the statistics that are compared to the NAAQS (design values[4]) using data measured at stations in the Basin and the Coachella Valley are presented. These metrics are instructive regarding trends and control strategy effectiveness. However, it should be noted that an exceedance of the concentration level of a federal standard does not necessarily mean that the NAAQS was violated or that it would cause nonattainment. The form of the standard must also be considered. For example, for 24-hour PM2.5, the form of the standard is the annual 98th percentile measurement of all of the 24-hour PM2.5 daily samples at each station, averaged over three years at each station. For 8-hour ozone, the form of the standard is the annual fourth highest measured 8-hour average daily maximum concentration at each station, averaged over three years at each station.

For NAAQS attainment/nonattainment decisions, the most recent three years of data are considered (two years for CO and one year for 24-hour SO2), along with the form of the standard, to calculate a *design value* for each station.[5] The overall design value for an air basin is the highest design value of all the stations in that basin. Table 2-2 shows the NAAQS, along with the design value and form of each federal standard. The California State air quality standards are values not to be exceeded, typically evaluated over a 3-year period, and the data is evaluated in terms of a *State designation value*, which eliminates some statistical data outliers and exceptional events, which are above the Expected Peak Day Concentration.[6] Attainment deadlines for the State standards are 'as soon as practicable'.

[4] Design values are statistical metrics that can be compared directly to the NAAQS.

[5] Note that for modeling attainment demonstrations, the U.S. EPA modeling guidance recommends a 5-year weighted average for the design value instead of the 3-year.

[6] See https://ww2.arb.ca.gov/sites/default/files/classic/research/apr/past/93-49.pdf.

TABLE 2-2

NATIONAL AMBIENT AIR QUALITY STANDARDS (NAAQS) AND DESIGN VALUE REQUIREMENTS

Pollutant	Averaging Time**	NAAQS Level	Design Value Form of NAAQS*
Ozone (O3)	1-Hour (1979) [revoked 2005]	0.12 ppm	Not to be exceeded more than once per year averaged over 3 years
	8-Hour (2015)	**0.070 ppm**	**Annual fourth highest 8-hour average concentration, averaged over 3 years**
	8-Hour(2008) [revised 2015]	0.075 ppm	
	8-Hour(1997) [revoked 2015]	0.08 ppm	
Fine Particulate Matter (PM2.5)	**24-Hour (2006)**	**35 µg/m^3**	**3-year average of the annual 98th percentile of daily 24-hour concentration**
	24-Hour (1997)	**65 µg/m^3**	
	Annual (2012)	**12.0 µg/m^3**	**Annual average concentration, averaged over 3 years** *(annual averages based on average of 4 quarters)*
	Annual (1997) [revised 2012]	15.0 µg/m^3	
Respirable Particulate Matter (PM10)	**24-Hour (1987)**	**150 µg/m^3**	**Not to be exceeded more than once per year averaged over 3 years**
	Annual (1987) [revoked 2006]	50 µg/m^3	Annual average concentration, averaged over 3 years
Carbon Monoxide (CO)	**1-Hour (1971)**	**35 ppm**	**Not to be exceeded more than once a year. Design value is the higher of each year's annual second maximum in a two-year period.**
	8-Hour (1971)	**9 ppm**	
Nitrogen Dioxide (NO_2)	**1-Hour (2010)**	**100 ppb**	**3-year avg. of the annual 98th percentile of the daily maximum 1-hour average concentrations (rounded)**
	Annual (1971)	**0.053 ppm**	**Annual avg. concentration, averaged over 3 years**

TABLE 2-2 (CONTINUED)

NATIONAL AMBIENT AIR QUALITY STANDARDS (NAAQS) AND DESIGN VALUE REQUIREMENTS

Pollutant	Averaging Time**	NAAQS Level	Design Value Form of NAAQS*
Sulfur Dioxide (SO_2)	**1-Hour (2010)**	**75 ppb**	**99th percentile of 1-hour daily maximum concentrations, averaged over 3 years**
	24-Hour (1971) [revoked 2010]	0.14 ppm	Not to be exceeded more than once per year
	Annual (1971) [revoked 2010]	0.03 ppm	Annual arithmetic average
Lead (Pb)	**3-Month Rolling Average (2008)##**	**0.15 µg/m³**	**Highest rolling 3-month average of the 3 years**

Bold text denotes the current and most stringent NAAQS.

* The NAAQS is attained when the design value (form of concentration listed) is equal to or less than the level of the NAAQS; for pollutants with the design values based on "exceedances" (1-hour ozone, 24-hour PM10, CO, and 24-hour SO_2), the NAAQS is attained when the concentration associated with the design value is less than or equal to the standard level:

- For 1-hour ozone and 24-hour PM10, the NAAQS is attained when the fourth highest daily concentrations of the 3-year period is less than or equal to the standard level and
- For CO, the standard is attained when the maximum of the second highest daily concentration each year in the most recent two years is equal to or less than the standard level.

** Year of the U.S. EPA NAAQS update review shown in parenthesis and revoked or revised status in brackets; for revoked or revised NAAQS, areas may have continuing obligations until that standard is attained: for 1-hour ozone, the Basin has continuing obligations under the former 1979 standard; for 8-hour ozone, the NAAQS was lowered from 0.08 ppm to 0.075 ppm to 0.070 ppm, but the previous 8-hour ozone NAAQS and most related implementation rules remain in place until that standard is attained.

3-month rolling averages of the first year (of the 3-year period) include November and December monthly averages of the prior year; the 3-month average is based on the average of "monthly" averages.

Attainment Status

Figure 2-1 shows the South Coast and Coachella Valley 3-year design values (2018-2020) for ozone, PM2.5, and PM10, as a percentage of the corresponding current and former federal standards. The current status of NAAQS attainment for all the criteria pollutants is presented in Table 2-3 for the Basin and in Table 2-4 for the Coachella Valley.

The U.S. EPA allows certain air quality data to be excluded when evaluating whether a region meets the NAAQS. Under the Exceptional Events Rule,[7] air quality data can be excluded when determining attainment status for data that is influenced by exceptional events. Exceptional events are natural events or human-caused events that are unlikely to recur at a particular location that are also not reasonably controllable or preventable. These events must meet strict evidence requirements, such as high winds,

[7] The U.S. EPA Exceptional Events Rule, *Treatment of Data Influenced by Exceptional Events*, became effective May 21, 2007 and was revised on September 16, 2016 [40 CFR 50.14(c)(3)]. The previous U.S. EPA *Natural Events Policy* for Particulate Matter was issued May 30, 1996.

wildfires, volcanoes, or some cultural events (such as Independence Day or New Year's fireworks). For several PM measurements in the Basin and the Coachella Valley in 2018 through 2020, the South Coast AQMD applied the U.S. EPA Exceptional Events Rule to flag some PM10 and PM2.5 data due to high-wind natural events, wildfires, and fireworks on Independence Day and New Year's Eve. All of the exceptional event flags through 2020 have been submitted with the affected data to the U.S. EPA's Air Quality System (AQS) database. Staff are currently preparing the documentation required to support high PM2.5 levels recorded during the Bobcat and El Dorado fires in 2020 and the U.S. EPA must approve the submittals before those events can be officially classified as exceptional events. The process to achieve PM2.5 re-designation for the Basin to attainment status for the 24-hour standard will therefore depend upon the U.S. EPA's concurrence this exceptional event demonstration.

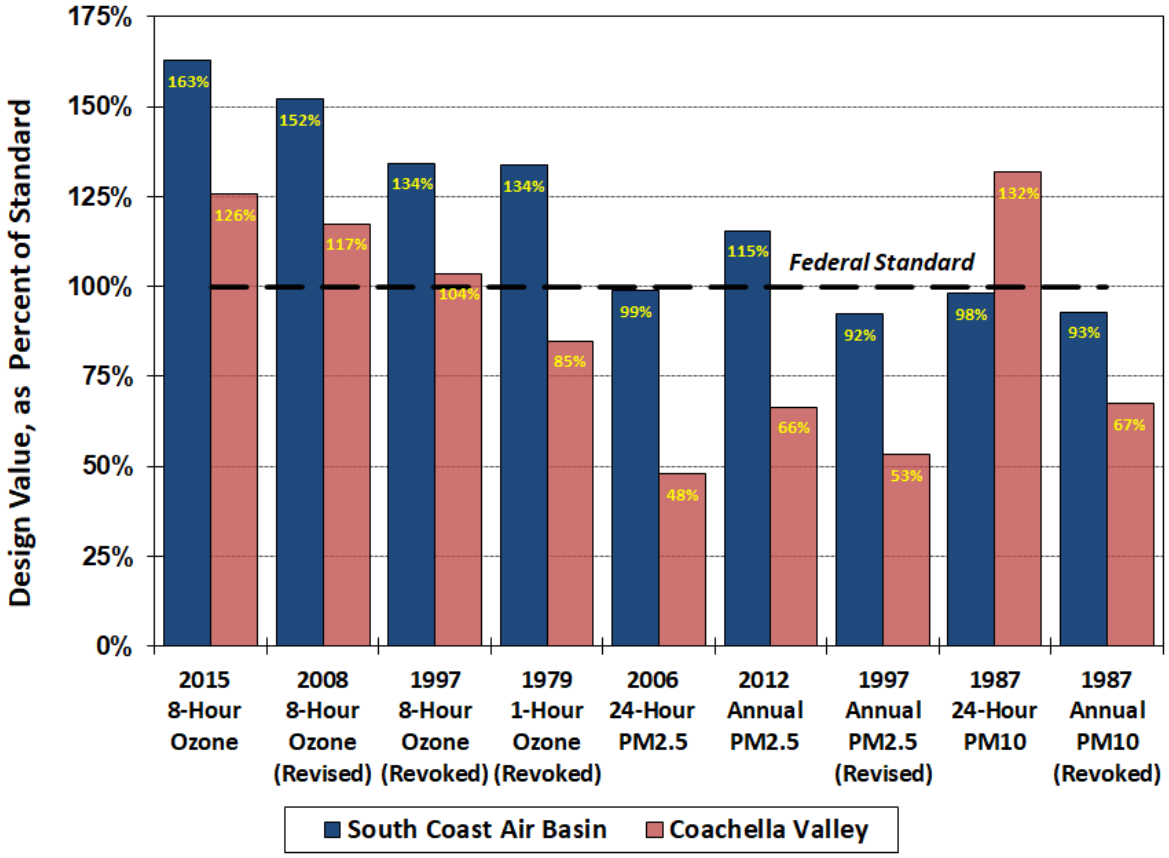

FIGURE 2-1

SOUTH COAST AIR BASIN AND COACHELLA VALLEY 2018-2020 3-YEAR DESIGN VALUES

(PERCENTAGE OF CURRENT AND FORMER FEDERAL STANDARDS, BY CRITERIA POLLUTANT; PM10[8] AND PM2.5 DATA FLAGGED AS EXCEPTIONAL EVENTS EXCLUDED BUT SUPPORTING DOCUMENTATION AND THE U.S. EPA CONCURRENCE STILL NEEDED; PM10 VALUES ARE CONCENTRATION-BASED DESIGN VALUES[9])

[8] A PM10 measurement conducted at the Long Beach Hudson monitor on July 19, 2018 resulted in an exceedance of the 24-hour PM10 standard. While South Coast AQMD staff believes that this exceedance does not meet the U.S. EPA criteria for removal as an exceptional event, it was recorded on a day with heavy construction immediately adjacent and underneath the monitoring station, and thus is not representative of local conditions. Following the South Coast AQMD data validation procedures, this measurement has been invalidated using the U.S. EPA Air Quality System (AQS) null data code for Construction/Repairs in Area (AC).

[9] The concentration-based design value is the fourth highest concentration at a monitor in a three-year period after repeating each measurement $round(dyear/d)$ times in each year, where $dyear$ is the number of days in the year, d is the number of measurements at the monitor, and $round()$ rounds to the nearest integer.

TABLE 2-3

NATIONAL AMBIENT AIR QUALITY STANDARDS (NAAQS) ATTAINMENT STATUS - SOUTH COAST AIR BASIN

Criteria Pollutant	Averaging Time	Designation[a]	Attainment Date[b]
Ozone (O3)	(1979) **1-Hour** (0.12 ppm)[c]	Nonattainment ("extreme")	2/26/2023 (revised deadline)
	(2015) **8-Hour** (0.070 ppm)[d]	Nonattainment ("extreme")	8/3/2038
	(2008) **8-Hour** (0.075 ppm)[d]	Nonattainment ("extreme")	7/20/2032
	(1997) **8-Hour** (0.08 ppm)[d]	Nonattainment ("extreme")	6/15/2024
PM2.5[e]	(2006) **24-Hour** (35	Nonattainment ("serious")	12/31/2023
	(2012) **Annual** (12.0 $\mu g/m^3$)	Nonattainment ("serious")	12/31/2025
	(1997) **Annual** (15.0 $\mu g/m^3$)	Attainment (final determination pending)	4/5/2015 (attained 2013)
PM10[f]	(1987) **24-hour** (150 $\mu g/m^3$)	Attainment (Maintenance)	7/26/2013 (attained)
Lead (Pb)[g]	(2008) **3-Months Rolling** (0.15 $\mu g/m^3$)	Nonattainment (Partial) (Attainment determination to be requested)	12/31/2015
CO	(1971) **1-Hour** (35 ppm)	Attainment (Maintenance)	6/11/2007
	(1971) **8-Hour** (9 ppm)	Attainment (Maintenance)	6/11/2007
NO_2[h]	(2010) **1-Hour** (100 ppb)	Unclassifiable/Attainment	N/A (attained)
	(1971) **Annual** (0.053 ppm)	Attainment (Maintenance)	9/22/1998 (attained)
SO_2[i]	(2010) **1-Hour** (75 ppb)	Unclassifiable/Attainment	1/9/2018
	(1971) **24-Hour** (0.14 ppm)	Unclassifiable/Attainment	3/19/1979 (attained)

a) The U.S. EPA often only declares Nonattainment areas; everywhere else is listed as Unclassifiable/Attainment or Unclassifiable.

b) A design value below the NAAQS for data through the full year or smog season prior to the attainment date is typically required for an attainment demonstration.

c) The 1979 1-hour ozone NAAQS (0.12 ppm) was revoked, effective 6/15/2005; however, the Basin has not attained this standard and therefore has some continuing obligations with respect to the revoked standard; original attainment date was 11/15/2010; the revised attainment date is 2/6/2023.

d) The 2008 8-hour ozone NAAQS (0.075 ppm) was revised to 0.070 ppm, effective 12/28/2015 with classifications and implementation goals to be finalized by 10/1/2017; the 1997 8-hour ozone NAAQS (0.08 ppm) was revoked in the 2008 ozone NAAQS implementation rule, effective 4/6/2015; there are continuing obligations under the revoked 1997 and revised 2008 ozone NAAQS until they are attained.
e) The attainment deadline for the 2006 24-hour PM2.5 NAAQS was 12/31/2015 for the former "moderate" classification; the U.S. EPA approved reclassification to "serious," effective 2/12/2016 with an attainment deadline of 12/31/2019; the 2012 (proposal year) annual PM2.5 NAAQS was revised on 1/15/2013, effective 3/18/2013, from 15 to 12 $\mu g/m^3$; new annual designations were final 1/15/2015, effective 4/15/2015; on 7/25/2016 the U.S. EPA finalized a determination that the Basin attained the 1997 annual (15.0 $\mu g/m^3$) and 24-hour PM2.5 (65 $\mu g/m^3$) NAAQS, effective 8/24/2016.
f) The annual PM10 NAAQS was revoked, effective 12/18/2006; the 24-hour PM10 NAAQS deadline was 12/31/2006; the Basin's Attainment Re-designation Request and PM10 Maintenance Plan was approved by the U.S. EPA on 6/26/2013, effective 7/26/2013.
g) Partial Nonattainment designation - Los Angeles County portion of the Basin only for near-source monitors; expect to remain in attainment based on current monitoring data; attainment re-designation request pending.
h) New 1-hour NO_2 NAAQS became effective 8/2/2010, with attainment designations 1/20/2012; annual NO_2 NAAQS retained.
i) The 1971 annual and 24-hour SO2 NAAQS were revoked, effective 8/23/2010.

TABLE 2-4

NATIONAL AMBIENT AIR QUALITY STANDARDS (NAAQS) ATTAINMENT STATUS
COACHELLA VALLEY PORTION OF THE SALTON SEA AIR BASIN

Criteria Pollutant	Averaging Time	Designation[a]	Attainment Date[b]
Ozone (O3)	(1979) **1-Hour** (0.12 ppm)[c]	Attainment	11/15/2007 (attained 12/31/2013)
	(2015) **8-Hour** (0.070 ppm)[d]	Nonattainment ("Severe-15")	8/3/2033
	(2008) **8-Hour** (0.075 ppm)[d]	Nonattainment ("Severe-15")[i)]	7/20/2027
	(1997) **8-Hour** (0.08 ppm)[d]	Nonattainment ("Extreme")	6/15/2024
PM2.5[e]	(2006) **24-Hour** (35 $\mu g/m^3$)	Unclassifiable/Attainment	N/A (attained)
	(2012) **Annual** (12.0 $\mu g/m^3$)	Unclassifiable/Attainment	N/A (attained)
	(1997) **Annual** (15.0 $\mu g/m^3$)	Unclassifiable/Attainment	N/A (attained)
PM10[f]	(1987) **24-hour** (150 $\mu g/m^3$)	Nonattainment ("Serious")	12/31/2006
Lead (Pb)	(2008) **3-Months Rolling** (0.15 $\mu g/m^3$)	Unclassifiable/Attainment	Unclassifiable/ Attainment

TABLE 2-4 (CONTINUED)

NATIONAL AMBIENT AIR QUALITY STANDARDS (NAAQS) ATTAINMENT STATUS
COACHELLA VALLEY PORTION OF THE SALTON SEA AIR BASIN

Criteria Pollutant	Averaging Time	Designation[a]	Attainment Date[b]
CO	(1971) **1-Hour** (35 ppm)	Unclassifiable/Attainment	N/A (attained)
	(1971) **8-Hour** (9 ppm)	Unclassifiable/Attainment	N/A (attained)
NO_2[g]	(2010) **1-Hour** (100 ppb)	Unclassifiable/Attainment	N/A (attained)
	(1971) **Annual** (0.053 ppm)	Unclassifiable/Attainment	N/A (attained)
SO_2[h]	(2010) **1-Hour** (75 ppb)	Unclassifiable/Attainment	N/A (attained)
	(1971) **24-Hour** (0.14 ppm) (1971) **Annual** (0.03 ppm)	Unclassifiable/Attainment	Unclassifiable/ Attainment

a) The U.S. EPA often only declares Nonattainment areas; everywhere else is listed as Unclassifiable/Attainment or Unclassifiable.
b) A design value below the NAAQS for data through the full year or smog season prior to the attainment date is typically required for an attainment demonstration.
c) The 1979 1-hour ozone NAAQS (0.12 ppm) was revoked, effective 6/15/2005; the Southeast Desert Modified Air Quality Management Area, including the Coachella Valley, had not timely attained this standard by the 11/15/2007 "severe-17" deadline, based on 2005-2007 data; on 8/25/2014, the U.S. EPA proposed a clean data finding based on 2011-2013 data and a determination of attainment for the former 1-hour ozone NAAQS for the Southeast Desert nonattainment area; this rule was finalized by the U.S. EPA on 4/15/2015, effective 5/15/2015, that included preliminary 2014 data.
d) The 2008 8-hour ozone NAAQS (0.075 ppm) was revised to 0.070 ppm, effective 12/28/2015; the 1997 8-hour ozone NAAQS (0.08 ppm) was revoked in the 2008 ozone NAAQS implementation rule, effective 4/6/2015; there are continuing obligations under the 1997 and 2008 ozone NAAQS until they are attained. The Coachella Valley was reclassified to "extreme" nonattainment effective 7/10/2019.
e) The annual PM2.5 standard was revised on 1/15/2013, effective 3/18/2013, from 15 to 12 $\mu g/m^3$.
f) The annual PM10 standard was revoked, effective 12/18/2006; the 24-hour PM10 NAAQS attainment deadline was 12/31/2006; the Coachella Valley Attainment Re-designation Request and PM10 Maintenance Plan was postponed by the U.S. EPA pending additional monitoring and analysis in the southeastern Coachella Valley.
g) New 1-hour NO_2 NAAQS became effective 8/2/2010; attainment designations 1/20/2012; annual NO_2 NAAQS retained.
h) The 1971 Annual and 24-hour SO_2 NAAQS were revoked, effective 8/23/2010.
i) Requested voluntary reclassification to "extreme" in November 2022.

After approving a standard, the U.S. EPA designates areas across the nation as attainment or as nonattainment of the standard. The U.S. EPA classifies areas of ozone nonattainment (e.g., "extreme," "severe," "serious," "moderate" or "marginal") based on how much an area exceeds the standard, which in turn affects requirements for a SIP and determines the attainment date. The more severe the ozone problem, the more time is allowed to demonstrate attainment in recognition of the greater challenges involved to reach attainment. However, the higher classifications are also subject to more stringent requirements. See Chapter 6 for details. The current status of CAAQS attainment for the pollutants with State standards is presented in Table 2-5 for the Basin and the Riverside County portion of the SSAB (Coachella Valley).

TABLE 2-5

CALIFORNIA AMBIENT AIR QUALITY STANDARDS (CAAQS) ATTAINMENT STATUS SOUTH COAST AIR BASIN AND COACHELLA VALLEY PORTION OF SALTON SEA AIR BASIN

Pollutant	Averaging Time and Level[b]	Designation[a]	
		South Coast Air Basin	Coachella Valley
Ozone (O3)	**1-Hour** (0.09 ppm)	Nonattainment	Nonattainment
	8-Hour (0.070 ppm)	Nonattainment	Nonattainment
PM2.5	**Annual** (12.0 µg/m^3)	Nonattainment	Attainment
PM10	**24-Hour** (50 µg/m^3)	Nonattainment	Nonattainment
	Annual (20 µg/m^3)	Nonattainment	Nonattainment
Lead (Pb)	**30-Day Average** (1.5 µg/m^3)	Attainment	Attainment
CO	**1-Hour** (20 ppm)	Attainment	Attainment
	8-Hour (9.0 ppm)	Attainment	Attainment
NO_2	**1-Hour** (0.18 ppm)	Attainment	Attainment
	Annual (0.030 ppm)	Attainment[d]	Attainment
SO_2	**1-Hour** (0.25 ppm)	Attainment	Attainment
	24-Hour (0.04 ppm)	Attainment	Attainment
Sulfates	**24-Hour** (25 µg/m^3)	Attainment	Attainment
H_2S[c]	**1-Hour** (0.03 ppm)	Unclassified	Unclassified [c)]

a) CA State designations shown were updated by CARB in 2019, based on the 2016-2018 3-year period; stated designations are based on a 3-year data period after consideration of outliers and exceptional events; Source: http://www.arb.ca.gov/desig/statedesig.htm#current.

b) CA State standards, or CAAQS, for ozone, CO, SO_2, NO_2, PM10 and PM2.5 are values not to be exceeded; lead, sulfates, and H_2S standards are values not to be equaled or exceeded; CAAQS are listed in the Table of Standards in Section 70200 of Title 17 of the California Code of Regulations.

c) The South Coast AQMD began monitoring H_2S in the southeastern Coachella Valley in November 2013 due to odor events related to the Salton Sea; this area has not yet been classified, but nonattainment is anticipated for the H_2S CAAQS in at least part of the Coachella Valley.

d) The CA-60 near-road portion of San Bernardino, Riverside and Los Angeles Counties has recently been redesignated as an attainment area based on data collected between 2018 and 2020.

Ozone

Despite substantial improvements in air quality over the past few decades, some air monitoring stations in the Basin still exceed the NAAQS and frequently record the highest ozone levels in the United States. In 2020, one or more stations in the Basin exceeded the most current federal standards on a total of 181 days (49 percent of the year), including: 8-hour ozone (157 days over the 2015 ozone NAAQS), 24-hour PM2.5 (39 days),[10] PM10 (3 days), and NO_2 (1 day). Nine of the top 10 stations in the nation most frequently exceeding the 2015 8-hour ozone NAAQS in 2020 were located within the Basin,[11] including stations in San Bernardino, Riverside, and Los Angeles Counties. Regarding the former ozone NAAQS,[12] 142 days exceeded the revised 2008 8-hour ozone NAAQS, 97 days exceeded the revoked 1997 8-hour ozone NAAQS, and 27 days exceeded the revoked 1-hour ozone NAAQS at one or more stations in the Basin in 2020. Table 2-6 summarizes the number of days exceeding current and former federal and State 1-hour and 8-hour ozone standard levels by county in the Basin and the Coachella Valley in 2020.

[10] Data includes both FRM filter-based and continuous measurements.

[11] The only station outside the Basin in the top 10 most 8-hour ozone exceedances is located on Ash Mountain in Sequoia and Kings Canyon National Park.

[12] While the former federal 8-hour and 1-hour ozone NAAQS have been revised or revoked by the U.S. EPA, nonattainment areas, including the Basin, still have continuing obligations under each standard until it is attained.

TABLE 2-6

2020 NUMBER OF DAYS EXCEEDING CURRENT AND FORMER OZONE STANDARDS AT THE PEAK STATION BY BASIN AND COUNTY

Basin/ County	2020 # Days > Current (2015) 8-Hour Ozone NAAQS (0.070 ppm)	Area of Max Current Federal Standard Exceedances	2020 # Days > Former (2008) 8-Hour Ozone NAAQS (0.075 ppm)	2020 # Days > Former (1997) 8-Hour Ozone NAAQS (0.08 ppm)	2020 # Days > Former (1979) 1-Hour Ozone NAAQS (0.12 ppm)	2020 # Days > Current 8-Hour State Ozone Standard (0.07 ppm)	2020 # Days > Current 1-Hour State Ozone Standard (0.09 ppm)
South Coast Air Basin							
Los Angeles	97	East San Gabriel Valley	71	32	17	100	76
Orange	32	Saddleback Valley	25	10	3	34	20
Riverside	89	Metropolitan Riverside County	62	32	7	96	51
San Bernardino	**141**	**East San Bernardino Valley**	**127**	**78**	**16**	**145**	**104**
Salton Sea Air Basin							
Riverside	49	Coachella Valley (Palm Springs)	28	5	0	53	9

Bold text denotes the peak value.

PM2.5

PM2.5 levels in the Basin have improved significantly in recent years. Since 2015, none of the monitoring stations[13] in the Basin have recorded violations of the former 1997 annual PM2.5 NAAQS (15.0 µg/m^3). On July 25, 2016, the U.S. EPA finalized a determination that the Basin attained the 1997 annual (15.0 µg/m^3) and 24-hour PM2.5 (65 µg/m^3) NAAQS, effective August 24, 2016. However, the Basin does not meet the 2012 annual PM2.5 NAAQS (12.0 µg/m^3), with six monitoring stations having design values above the standard for the 2018-2020 period.[14] These stations include: Ontario-Route 60 Near Road (Basin

[13] South Coast AQMD employs continuous monitors at several stations in the Basin to provide real-time data for the public and to support daily air quality forecasting. Continuous PM2.5 monitors at seven stations, including Anaheim, Central Los Angeles, Long Beach-Route 710 Near Road, Long Beach (South), Ontario-Route 60 Near Road, Mira Loma, and Rubidoux are FEM monitors. On scheduled sampling days, when FRM measurements are not available at a FEM station, FEM measurements are used to replace missing FRM measurements for regulatory/attainment determination purpose. In the 2018-2020 period, the U.S. EPA has granted South Coast AQMD a waiver from using the FEM monitor at Central LA for regulatory/attainment determination purposes since it does not meet the accuracy requirements to be considered comparable to the NAAQS.

[14] Six stations exceed the 2012 annual PM2.5 standard after removing likely exceptional events.

maximum at 13.8 µg/m^3), Mira Loma, Rubidoux, Long Beach-Route 710 Near Road station, Pico Rivera, and Compton. The Coachella Valley is in attainment of both the annual and 24-hour PM2.5 NAAQS.

In 2020, 16 stations in the Basin had one or more PM2.5 daily average concentrations exceeding the level of the federal 24-hour PM2.5 NAAQS (35.4 µg/m^3), with a total of 28 days[15] over that standard in the Basin. However, in the 2018-2020 period, after removing likely exceptional events, the Basin met the 24-hour PM2.5 NAAQS.[16]

PM10

The Basin attains the current 1987 PM10 24-hour NAAQS after removing three 2019 exceedances caused by high winds that can be reasonably considered exceptional events based on criteria established by the U.S. EPA.[17] However, the Coachella Valley does not attain the 1987 PM10 24-hour NAAQS due to exceedances at the Mecca monitoring station. The vast majority of exceedances at this station are associated with high-wind events and would likely be approved as exceptional events. PM10 measurements at this station are routinely evaluated to better understand the causes of exceedances in this region. Additional monitoring as part of the AB617 program in the Eastern Coachella Valley community may provide additional information to assist in bringing the region into attainment of the PM10 NAAQS.

Lead

The U.S. EPA designated the Los Angeles County portion of the Basin (excluding the San Clemente and Santa Catalina Islands and the Antelope Valley) as nonattainment for the revised (2008) federal lead standard (0.15 µg/m^3, rolling 3-month average). This designation was based on two source-specific monitors in Vernon and in the City of Industry exceeding the 2008 standard over the 2007-2009 period. For the most recent seven design value periods, 2012-2014 through 2018-2020, no stations in Los Angeles County showed violations of the federal lead standard, with a maximum 3-month rolling average design value in the most recent period (2018-2020) of 0.01 µg/m^3. The remainder of the Basin outside the Los Angeles County nonattainment area, as well as the Coachella Valley, remain in attainment of the 2008 lead standard, including both ambient monitors and source-oriented monitors.

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[15] Data includes exceptional events. FRM filter-based measurements and NAAQS-comparable FEM continuous measurements were used to do the calculation.

[16] The 24-hour PM2.5 design value is based on the annual 98th percentile concentration for each station averaged over the 3-year period; for stations that monitor every day, this is typically the eighth highest concentration.

[17] A PM10 measurement conducted at the Long Beach Hudson monitor on July 19, 2018 resulted in an exceedance of the 24-hour PM10 standard. While South Coast AQMD staff believes that this exceedance does not meet the U.S. EPA criteria for removal as an exceptional event, it was recorded on a day with heavy construction immediately adjacent and underneath the monitoring station, and thus is not representative of local conditions. Following the South Coast AQMD data validation procedures, this measurement has been invalidated using the U.S. EPA Air Quality System (AQS) null data code for Construction/Repairs in Area (AC).

Other Criteria Pollutants

The South Coast AQMD continues to attain the NAAQS for SO_2, CO, and NO_2. While the concentration level of the current 1-hour NO_2 federal standard (100 ppb) was exceeded in the Basin at one station on one day in 2020 (in San Bernardino at the CA-60 near-road station), the NAAQS NO_2 design value[18] has not been exceeded. Therefore, the Basin remains in attainment of the NO_2 NAAQS. The peak 1- and 8-hour CO values of 4.5 and 3.1 ppm, respectively are well below the value of the federal standards of 35 and 20 ppm, respectively. The design value for 1-hour SO_2 is 4 ppb, which is well below the federal standard of 75 ppb.

Current Air Quality

While the 2022 Air Quality Management Plan is specifically designed to address attainment of the 2015 8-hour ozone standard, levels of all other criteria pollutants are also summarized in this document.

In 2020, ozone, PM2.5, PM10, and NO_2 peak values exceeded federal standard concentration levels at one or more of the routine monitoring stations in the Basin, while ozone and PM10 exceeded those standard levels in the Coachella Valley. However, an exceedance of the concentration level does not necessarily mean a violation of the NAAQS. This is because the design value form of the standard must also be considered for attainment determination. For example, the 2020 1-hour maximum NO_2 concentration in the Basin was 101.6 ppb at the CA-60 near-road station in Ontario station, but the Basin did not violate the federal NO_2 NAAQS, because the station's design value – in this case the 98th percentile daily maximum hourly concentration – was under the federal standard of 100 ppb for the 2018-2020 period.

At this time, the only pollutants in the Basin with design values in violation of the respective NAAQS are ozone, (all current and former federal standards) and PM2.5 (current annual federal standard, after removing exceptional events). In the Coachella Valley, design values for ozone violate the NAAQS for the current and former 8-hour federal ozone standards and design values for PM10 violate the federal 24-hr PM10 standard.

Figure 2-2 shows the trend of the Basin maximum 3-year design value concentrations for ozone (1-hour and 8-hour) and PM2.5 (24-hour and annual) since 1995, as percentages of the corresponding current federal standards (note that PM2.5 monitoring began in 1999 so the first 3-year design value was only available in 2001). In this plot, PM2.5 concentrations above the 24-hour standard attributed to the Bobcat and El Dorado fire in 2020 are excluded because these events meet the exclusion criteria specified in the U.S. EPA Exceptional Event Rule. Although there is some year-to-year variability, PM2.5 concentrations show significant improvement over the years while ozone design values have been relatively flat over the past decade.

[18] The 1-hour NO_2 design value is the 3-year average of the annual 98th percentile of the daily 1-hour maximums.

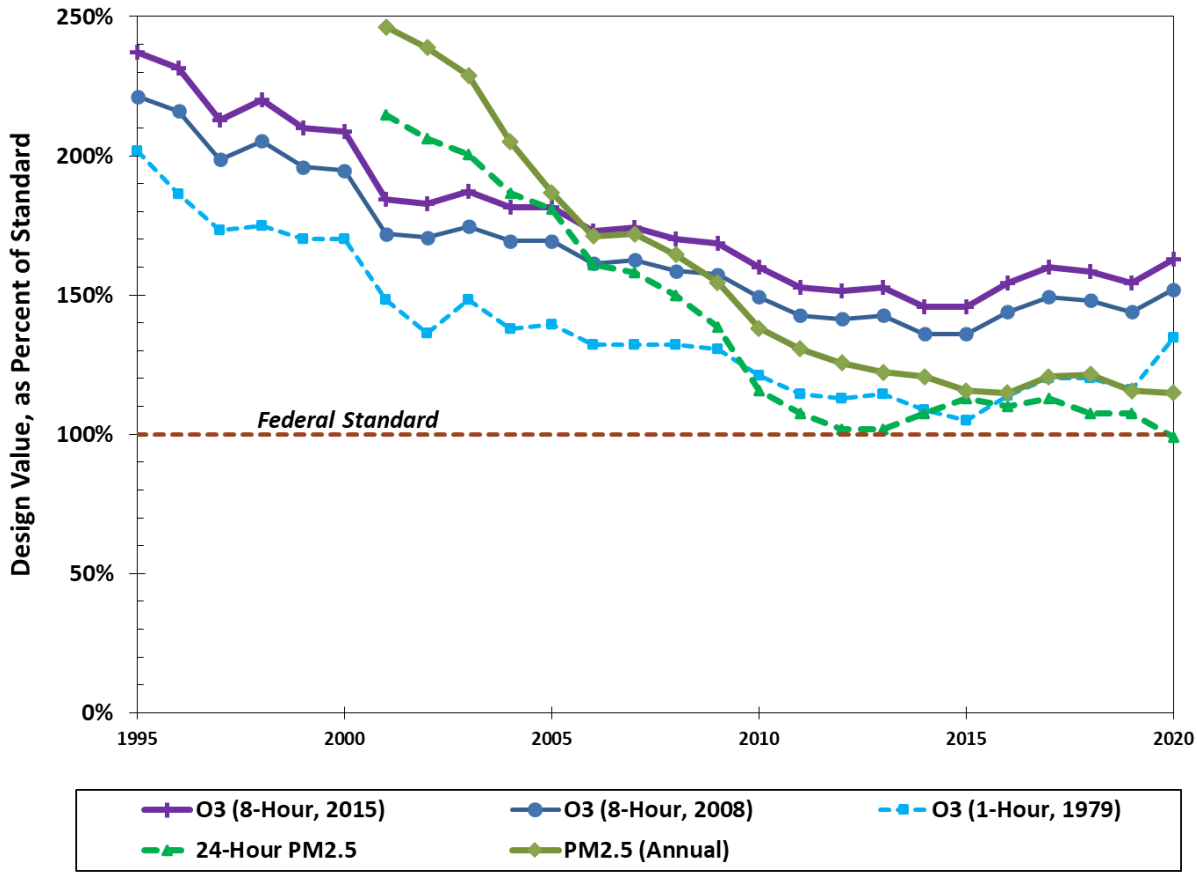

FIGURE 2-2
TRENDS OF SOUTH COAST AIR BASIN MAXIMUM 3-YEAR DESIGN VALUES FOR OZONE (2015 8-HOUR, 2008 8-HOUR, AND 1979 1-HOUR NAAQS) AND PM2.5 (24-HOUR AND ANNUAL), 1995-2020

(AS PERCENTAGES OF CURRENT FEDERAL STANDARDS. 24-HOUR PM2.5 DESIGN VALUES EXCLUDE EXCEPTIONAL EVENTS CAUSED BY THE BOBCAT AND EL DORADO FIRES IN 2020)

Monitoring Network Status

The U.S. EPA has set monitoring requirements for the criteria pollutants, including ozone, PM (including both PM10 and PM2.5), carbon monoxide (CO), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), and lead (Pb). In 2020, the South Coast AQMD measured concentrations of air pollutants at 38 routine ambient air monitoring stations in its jurisdiction, with primary focus on these criteria pollutants. In addition to the ambient air monitoring, lead concentrations are monitored at four source-oriented monitoring sites, immediately downwind of stationary lead sources.

There have been three changes to the South Coast AQMD ambient air monitoring network since the 2016 AQMP. The long-term monitoring station at Costa Mesa was closed in 2017 because the lease was terminated by the owner due to the sale of the property. Two new monitoring stations were added in

January 2020. The North Hollywood station was added to represent the East San Fernando Valley and the Signal Hill station was added to represent the South Coastal LA County region.

Ozone (O3)

Health Effects, Ozone

The adverse effects of ozone air pollution exposure on health have been studied for many years, as documented by a significant body of peer-reviewed scientific research, including studies conducted in Southern California. The 2020 U.S. EPA document, *Integrated Science Assessment of Ozone and Related Photochemical Oxidants*,[19] describes these health effects and discusses the state of the scientific knowledge and research. A summary of health effects information and additional references can also be found in Appendix I: Health Effects. The U.S. EPA is currently reconsidering the decision to retain the 2015 ozone standard in 2020 based on the existing scientific record. This decision is expected by the end of 2023.[20]

Individuals working outdoors, children (including teenagers), older adults, people with preexisting lung disease, such as asthma, and individuals with certain nutritional deficiencies are considered to be the sub-groups most susceptible to ozone effects. Short-term exposures (lasting for a few hours) to ozone at levels typically observed in Southern California can result in breathing pattern changes, reduction of breathing capacity, increased susceptibility to infections, inflammation of the lung tissue, and some immunological changes. Elevated ozone levels are associated with asthma exacerbation, chronic obstructive pulmonary disease (COPD) exacerbation, respiratory infection, increased school absences and hospital admissions and emergency department (ED) visits for combined respiratory diseases, as well as increased mortality. An increased risk for asthma has been found in children who participate in multiple sports and live in high-ozone communities.

Ozone exposure under exercising conditions is known to increase the severity of respiratory symptoms. Although lung volume and airway resistance changes observed after a single exposure diminish with repeated exposures, biochemical and cellular changes appear to persist, which can lead to subsequent lung structural changes.

In addition, recent evidence indicates that short-term exposure to ozone is likely to induce metabolic effects. There is also some evidence that ozone exposure can affect the cardiovascular and nervous systems, reproduction and development, and mortality, although there are more uncertainties associated with interpretation of the evidence for these effects.

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[19] U.S. EPA. (2020). Integrated Science Assessment of Ozone and Related Photochemical Oxidants (Final Report). U.S. Environmental Protection Agency, Washington, DC, EPA/600/R-20/012. https://www.epa.gov/isa/integrated-science-assessment-isa-ozone-and-related-photochemical-oxidants.

[20] https://www.epa.gov/ground-level-ozone-pollution/epa-reconsider-previous-administrations-decision-retain-2015-ozone.

Air Quality, Ozone

Ozone is formed in the atmosphere from the reaction of NOx and volatile organic compounds (VOCs) in the presence of sunlight. NOx and VOC emissions are produced from a wide variety of sources such as vehicles, consumer products, industrial processes, and vegetation. See Chapter 3. Ozone levels are also highly dependent on temperature with the highest ozone concentrations typically measured on the hottest days each summer. The reactions that form ozone are faster at higher temperatures and many VOC emission sources are temperature dependent, with higher emissions on hotter days. Since sunlight is a key ingredient in the formation of ozone, season also plays an important role. In general, ozone concentrations are higher on long days with plentiful sunshine. Mixing and ventilation of the Basin also influence ozone concentrations. Inversion layers that trap emissions and ozone near the ground are common in Southern California. Stagnant summer days under high pressure limit ventilation of the Basin and allow for the accumulation of pollution. See Figure 2-3.

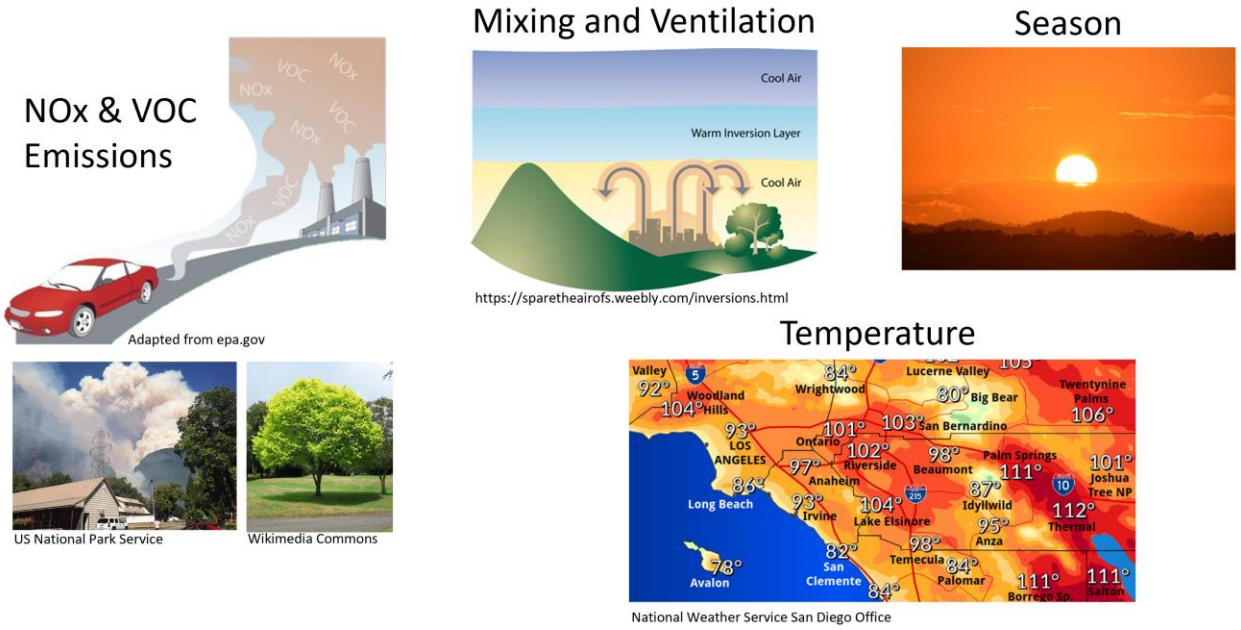

FIGURE 2-3
FACTORS INFLUENCING OZONE CONCENTRATIONS

In 2020, the South Coast AQMD routinely monitored ambient ozone at 29 locations in the Basin and the Coachella Valley portion of the SSAB. The 2020 Basin maximum ozone concentrations continued to exceed federal standards by wide margins, although significant improvement has been achieved over the past several decades. Figure 2-4 shows the trend from 1980 through 2020 of the annual number of Basin days

exceeding various metrics for ozone. These metrics include the 1-hour Stage 1[21] level (0.20 ppm), the 1-hour Health Advisory level (0.15 ppm), the former (1979) 1-hour NAAQS (0.12 ppm), the former (1997 and 2008) 8-hour NAAQS (0.08 and 0.075 ppm), and the new 2015 8-hour NAAQS (0.070 ppm). All the ozone trends show significant improvements achieved through the period. However, they also show the need for continued efforts in order to meet all the 8-hour ozone standards and the 1979 1-hour standard.

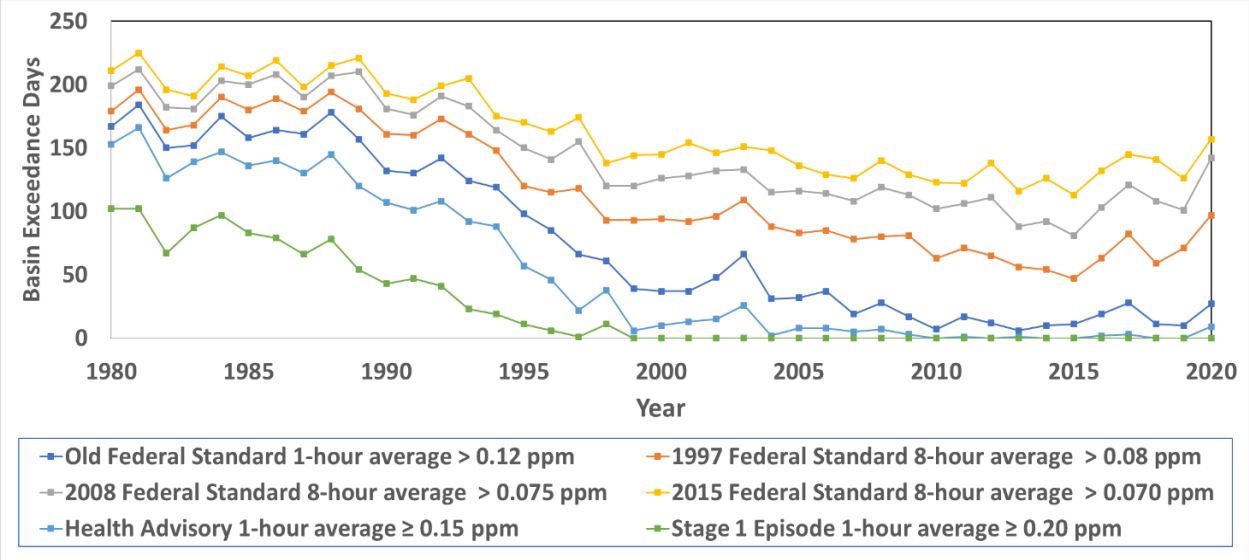

FIGURE 2-4
TREND OF NUMBER OF BASIN DAYS EXCEEDING CURRENT AND FORMER OZONE NAAQS AND 1-HOUR OZONE EPISODE LEVELS (HEALTH ADVISORY AND STAGE-1), 1980 THROUGH 2020

All counties in the Basin, as well as the Coachella Valley, exceeded the level of the 2015 (0.070 ppm) and the former 2008 (0.075 ppm) and 1997 (0.08 ppm) 8-hour ozone NAAQS in 2020. While not all stations had days exceeding the previous 8-hour standards, all monitoring stations had at least one day over the 2015 federal standard.

The 2015 ozone federal standard was exceeded at a minimum of one station on a total of 157 days in 2020 (142 days over the 2008 standard and 97 days over the 1997 standard). The 8-hour State ozone standard (0.070 ppm, although the rounding convention differs from federal standard) was exceeded in the Basin on 160 days in 2020. The Coachella Valley exceeded the 2015 8-hour ozone NAAQS on 64 days (38 days for the 2008 ozone NAAQS, six days for the 1997 ozone NAAQS, and 63 days for the State 8-hour ozone NAAQS). The station with the highest number of days in 2015 over the 2015, 2008, and 1997 8-hour federal ozone standards (141, 127, and 78 days, respectively) was in the Eastern San Bernardino

[21] While the 1-hour ozone episode levels and the related 1-hour ozone health warnings still exist, they are essentially replaced by the more protective health warnings associated with the current 8-hour ozone NAAQS. The 1-hour ozone episode warning levels include the State Health Advisory (0.15 ppm), Stage 1 (0.20 ppm), Stage 2 (0.35 ppm), and Stage 3 (0.50 ppm). The Basin's last 1-hour ozone Stage 1 episode occurred in 2003. The last 1-hour ozone Stage 2 episode occurred in 1988 and the last Stage 3 episode occurred in 1974.

Valley (Redlands). The 2015 maximum 8-hour average ozone concentration of 0.139 ppm was measured at the Central San Bernardino Mountains station (Crestline-Lake Gregory).

When compared to the design value form of the federal standard, all four of the Basin's counties were above the 2015, 2008 and 1997 8-hour ozone NAAQS for the 2018-2020 design values. The Basin's highest 2018-2020 8-hour ozone design value (0.114 ppm, measured in the Central San Bernardino Mountains at Crestline-Lake Gregory) was 163 percent of the 2015 8-hour ozone NAAQS (152 percent of the 2008 NAAQS and 143 percent of the 1997 NAAQS). Table 2-7 shows the 2020 maximum 8-hour ozone concentrations and design values by air basin and county, compared to current and former federal, and current State standards.

TABLE 2-7

2020 MAXIMUM 8-HOUR AVERAGE OZONE CONCENTRATIONS AND DESIGN VALUES BY BASIN AND COUNTY

Basin/ County	2020 Maximum 8-Hour Ozone Average (ppm)	2018-2020 8-Hour Ozone Design Value (ppm)	Percent of Current (2015) 8-Hour Ozone NAAQS (0.070 ppm)	Percent of Former (2008) 8-Hour Ozone NAAQS (0.075 ppm)	Percent of Former (1997) 8-Hour Ozone NAAQS (0.08 ppm)	Area of Design Value Maximum	2018-2020 8-Hour Ozone State Designation Value# (ppm)	Percent of State 8-hour Ozone Standard (0.070 ppm)
South Coast Air Basin								
Los Angeles	0.138	0.107	153	143	127	East San Gabriel Valley	0.121	173
Orange	0.122	0.082	117	109	98	Saddleback Valley	0.092	131
Riverside	0.117	0.098	140	131	117	Metropolitan Riverside County	0.109	156
San Bernardino	**0.139**	**0.114**	**163**	**152**	**136**	**East San Bernardino Valley**	**0.126**	**180**
Salton Sea Air Basin								
Riverside	0.094	0.088	126	117	105	Coachella Valley (Palm Springs)	0.095	136

Bold text denotes the peak value

The *State 8-Hour Designation Value* is the highest State 8-hour ozone average, rounded to three decimal places, during the last 3 years (State designation value source: https://www.arb.ca.gov/adam/select8/sc8start.php).

All monitored locations measured maximum 1-hour average ozone concentrations well below the Stage 1 episode level (0.20 ppm, 1-hour) in 2020. Except for one day in 2003 (at a special-purpose monitor in the San Bernardino Mountains), the Stage 1 ozone episode level has not been exceeded in the Basin since 1998.

The Basin exceeded the level of the revoked (1979) 1-hour federal ozone standard (0.12 ppm) on 27 days in 2020, with exceedances in all four Counties. The most exceedances of the former 1-hour standard in 2020 (17 days) occurred in the Eastern San Gabriel Valley at the Glendora air monitoring station. The 2020 peak 1-hour ozone concentration in the Basin was 0.185 ppm, measured in metropolitan Los Angeles (downtown Los Angeles air monitoring station). In the Coachella Valley, 1-hour ozone concentrations did not exceed the revoked 1-hour federal standard in 2020. The State 1-hour ozone standard (0.09 ppm) was exceeded in the Basin on 133 days and in the Coachella Valley on 9 days.

The calculated peak 2018-2020 1-hour ozone design value[22] (0.167 ppm in metropolitan Los Angeles at the downtown Los Angeles air monitoring station) was 134 percent of the former 1-hour NAAQS. The Coachella Valley design value did not exceed the former 1-hour federal ozone standard in 2020 and has remained in attainment of the former NAAQS since 2008. Table 2-8 shows the 2020 maximum 1-hour ozone concentrations and calculated design values by air basin and county, compared to the former federal and current State standards.

[22] The former 1979 1-hour ozone NAAQS allows for one exceedance per year on average when averaged over three years. The calculated design value is the fourth highest value over a 3-year period, allowing the design value to be expressed in terms of a concentration. When shown in parts-per-million to 3 decimal places, the design value is compared to 0.125 ppm, which would exceed the NAAQS.

TABLE 2-8

2020 MAXIMUM 1-HOUR AVERAGE OZONE CONCENTRATIONS AND DESIGN VALUES BY BASIN AND COUNTY

Basin/ County	2020 Maximum 1-Hour Ozone Average (ppm)	2018-2020 1-Hour Ozone Design Value (ppm)	Percent of Former (1979) 1-Hour Ozone NAAQS (0.12 ppm)	Area of Design Value Max	2018-2020 1-Hour Ozone State Designation Value[#] (ppm)	Percent of State 1-Hour Ozone Standard (0.09 ppm)
South Coast Air Basin						
Los Angeles	**0.185**	**0.167**	**135**	**East San Gabriel Valley**	**0.19**	**211**
Orange	0.171	0.113	91	North Orange County	0.17	189
Riverside	0.150	0.131	106	Metropolitan Riverside County	0.15	167
San Bernardino	0.173	0.155	125	Eastern San Bernardino Valley	0.17	189
Salton Sea Air Basin						
Riverside	0.102	0.106	85	Coachella Valley (Palm Springs)	0.11	122

Bold text denotes the peak value.

[#] The *State 1-Hour Designation Value* is the highest hourly ozone measurement during the last 3 years, rounded to two decimal places. In practice, the designation value is the highest measured concentration in the 3-year period that remains, after excluding measurements identified as affected by highly irregular or infrequent events (State designation value source: https://www.arb.ca.gov/adam/select8/sc8start.php).

The number of days exceeding the current and former ozone standards in the Basin varies widely by area. Figures 2-5 through 2-7 map the number of days in 2020 exceeding the 2015 8-hour ozone NAAQS and the former 2008 and 1997 8-hour ozone NAAQS in different areas of the Basin. The number of exceedances of the federal 8-hour ozone standards was lowest in the coastal areas, due in large part to the prevailing sea breeze which transports emissions inland before photochemistry produces high ozone concentrations. The concentrations increase downwind towards the Riverside County valleys and the San Bernardino County valleys and adjacent mountain areas, as well as the area around Santa Clarita in Los Angeles County. The Eastern San Bernardino Valley area recorded the greatest number of exceedances of the current and former 8-hour federal standards (141 days for the 2015 ozone NAAQS, 127 days for the 2008 NAAQS, and 78 days for the 1997 NAAQS).

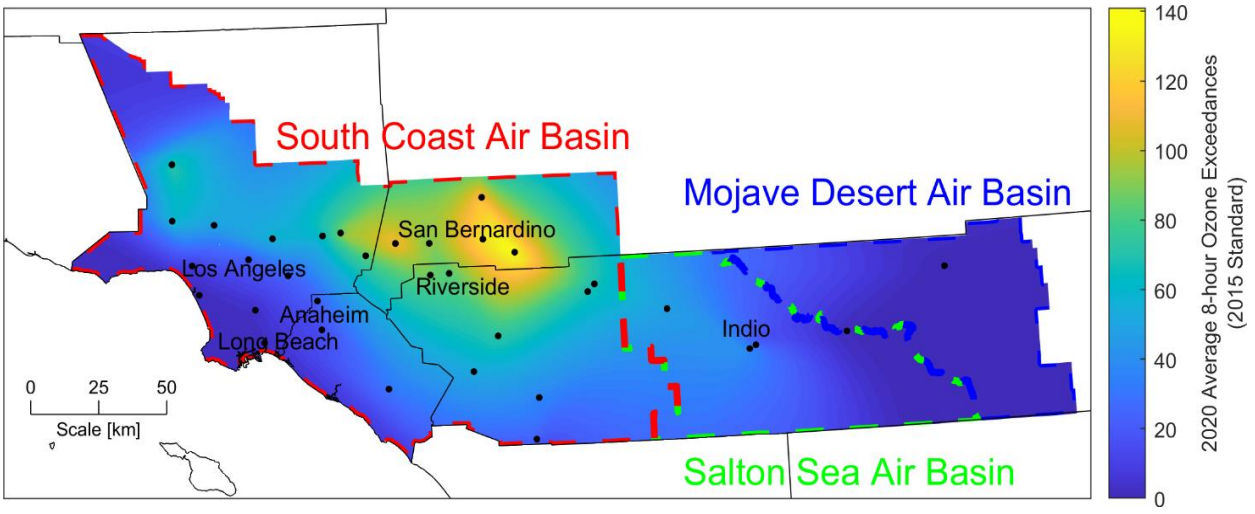

FIGURE 2-5

NUMBER OF DAYS IN 2020 EXCEEDING THE 2015 8-HOUR OZONE FEDERAL STANDARD

(8-HOUR AVERAGE OZONE > 0.070 PPM)

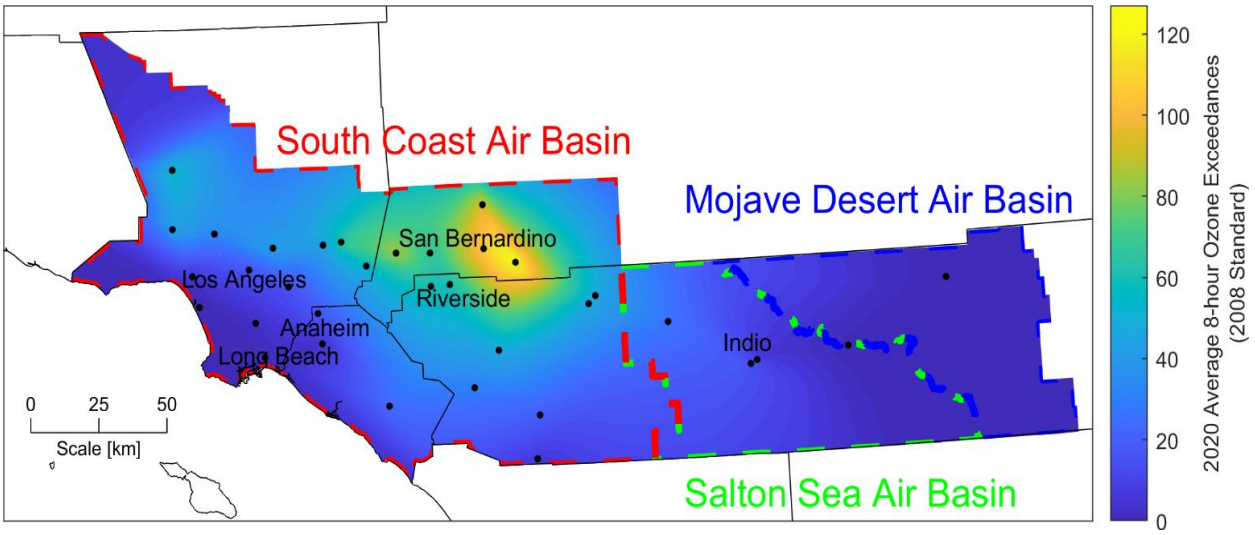

FIGURE 2-6

NUMBER OF DAYS IN 2020 EXCEEDING THE REVISED 2008 8-HOUR OZONE FEDERAL STANDARD

(8-HOUR AVERAGE OZONE > 0.075 PPM)

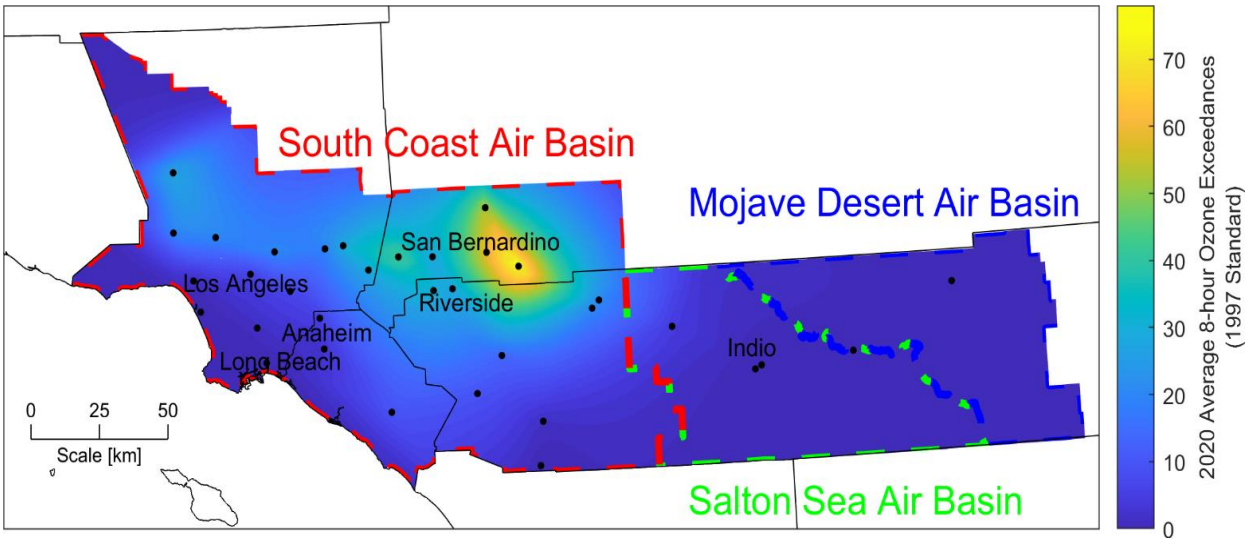

FIGURE 2-7
NUMBER OF DAYS IN 2020 EXCEEDING THE REVOKED 1997 8-HOUR OZONE FEDERAL STANDARD
(8-HOUR AVERAGE OZONE > 0.08 PPM)

Figure 2-8 maps the number of days in 2020 exceeding the revoked 1979 1-hour ozone NAAQS in different areas of the Basin. The former 1-hour federal standard was exceeded in a large portion of the Basin. It was exceeded the most (17 days) in the Eastern San Gabriel Valley at the Glendora air monitoring station. Exceedances of the 1-hour ozone standard extended to all areas monitored in San Bernardino County and in Metropolitan Riverside County, as well as in Santa Clarita and the eastern San Gabriel Valley in Los Angeles County. The Coachella Valley did not exceed the former 1-hour ozone standard in 2020.

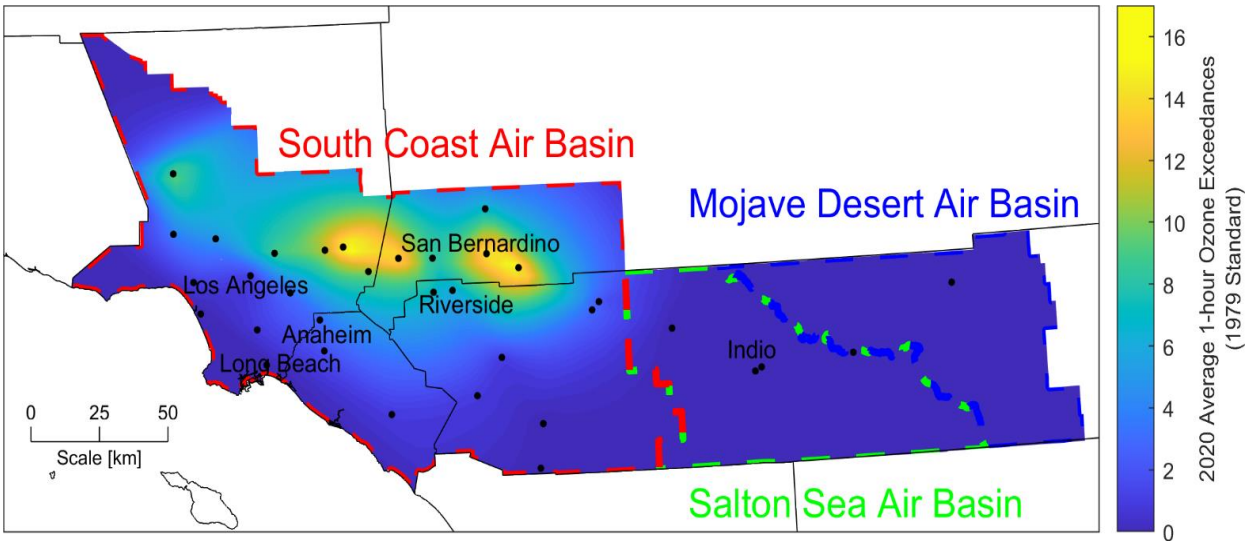

FIGURE 2-8
NUMBER OF DAYS IN 2020 EXCEEDING THE REVOKED 1979 1-HOUR FEDERAL OZONE STANDARD
(1-HOUR AVERAGE OZONE > 0.12 PPM)

Particulate Matter (PM2.5 and PM10)

Health Effects, Particulate Matter

A significant body of peer-reviewed scientific research, including studies conducted in Southern California, points to adverse impacts of particulate matter air pollution on both increased illness (morbidity) and increased death rates (mortality). The 2019 U.S. EPA *Integrated Science Assessment for Particulate Matter*[23] as well as the Supplement to the 2019 Integrated Science Assessment for Particulate Matter[24] describe these health effects and discusses the state of the scientific knowledge. As of early 2022, the U.S. EPA is evaluating the need to strengthen the standards for fine particulate matter based on the best available science and recommendations from the Clean Air Scientific Advisory Committee (CASAC).[25] A summary of health effects information and additional references can also be found in Appendix I: Health Effects.

Several studies have found correlations between elevated ambient particulate matter levels and an increase in mortality rates, respiratory infections, number and severity of asthma attacks, chronic

[23] U.S. EPA. (2019). Integrated Science Assessment for Particulate Matter (Final Report). U.S. Environmental Protection Agency, Washington, DC, EPA/600/R-19/188. https://www.epa.gov/isa/integrated-science-assessment-isa-particulate-matter.

[24] U.S. EPA. (2021). Supplement to Integrated Science Assessment for Particulate Matter (Final Report). U.S. Environmental Protection Agency, Washington, DC, EPA/600/R-21/198. https://cfpub.epa.gov/ncea/isa/recordisplay.cfm?deid=352823.

[25] U.S. EPA. (2021) Policy Assessment Updates for the PM NAAQS Reconsideration. https://casac.epa.gov/ords/sab/f?p=105:18:7422383326691:::RP,18:P18_ID:2607#report.

obstructive pulmonary disease exacerbation, combined respiratory-diseases and the number of hospital admissions in different parts of the United States and in various areas around the world.

Higher levels of PM2.5 have also been related to increased mortality due to cardiovascular or respiratory diseases, hospital admissions for acute respiratory conditions, school absences, lost workdays, a decrease in respiratory function in children, and increased medication use in children and adults with asthma.

Long-term exposure to PM has been found to be associated with reduced lung function growth in children, changes in lung development, development of asthma in children, and increased risk of cardiovascular diseases in adults. In recent years, studies have reported an association between long-term exposure to PM2.5 and increased total mortality (reduction in life-span and increased mortality) from lung cancer.

The U.S. EPA, in its most recent review, has concluded that both short-term and long-term exposure to PM2.5 are causally related to cardiovascular effects and increased mortality risk. In addition, new evidence is suggestive of metabolic, nervous system, and reproductive and developmental effects for short-term and long-term exposure to PM2.5.

Young children and non-white populations appear to be most susceptible to the effects of PM10 and PM2.5. With lesser evidence, people with pre-existing conditions of cardiovascular disease; respiratory illness; and obesity; individuals with certain genetic polymorphisms that control antioxidant response, regulate enzyme activity, or regulate procoagulants; older adults (for cardiovascular effects); individuals with lower socioeconomic status and smokers also appear to be more susceptible to the effects of PM10 and PM2.5.

An expanded discussion of studies relating to PM exposures and mortality, including a brief description of how studies accounted for potential confounding factors, is contained in Appendix I of this document.

Air Quality, PM2.5

The South Coast AQMD began regular monitoring of PM2.5 in 1999 following the U.S. EPA's adoption of the national PM2.5 standards in 1997. In 2020, ambient PM2.5 concentrations were monitored at 27 locations throughout the South Coast AQMD, including two stations in the SSAB in the Coachella Valley and two near-road sites. Filter-based Federal Reference Method (FRM) PM2.5 sampling was employed at 19 of these stations and nine of the FRM measurement stations sampled daily to improve temporal coverage with the FRM measurements beyond the required 1-in-3-day sampling schedule, including the two near-road sites. Seventeen stations,[26] including two near-road sites, employed continuous PM2.5 monitors and nine of these were collocated with FRM measurements. PM2.5 continuous monitors at seven stations are federal equivalent method (FEM) PM2.5 monitors. Data collected at six out of these seven FEM continuous PM2.5 monitors are comparable to the NAAQS. On scheduled sampling days, when FRM measurements are not available at a FEM station, FEM measurements are used to replace missing FRM measurements for regulatory/attainment determination purposes. In the 2018-2020 period, one

[26] The special purpose monitoring of continuous PM2.5 at the North Hollywood station and the Compton station began operation January 1, 2020 and July 1, 2020, respectively.

FEM continuous PM2.5 monitor in the Basin does not meet the U.S. EPA criteria to be used for NAAQS comparison[27] and the South Coast AQMD has been granted annual waivers by the U.S. EPA precluding the use of FEM monitors that do not pass comparability criteria for NAAQS attainment consideration. The continuous data is used for forecasting, real-time air quality alerts, real-time AQI dissemination, and for evaluating hour-by-hour variations.

The 2018-2020 24-hour PM2.5 design values are summarized in Table 2-9. PM2.5 concentrations were higher in the inland valley areas of metropolitan Riverside County and in south central Los Angeles County. The Basin met the 24-hour PM2.5 NAAQS for the 2018-2020 period after removing exceedances collected during the Bobcat and El Dorado fires as these events meet the criteria for exclusion under the U.S. EPA Exceptional Events Rule. The highest 24-hour design value was measured in Metropolitan Riverside County (Mira Loma), with a design value of 35 µg/m^3. If exceptional events are included, the highest 2018-2020 PM2.5 24-hour design value was measured at the Central Los Angeles and South San Gabriel Valley stations (37 µg/m^3). The 2018-2020 24-hour design values measured at the Metropolitan Riverside County (Mira Loma) and CA-60 Near Road stations (36 µg/m^3) also violate the 24-hour PM2.5 NAAQS (35 µg/m^3). There is no State 24-hour PM2.5 standard.

PM2.5 is both directly emitted and also forms in the atmosphere. The higher PM2.5 concentrations in the Basin are mainly due to the secondary formation of smaller particulates resulting from precursor gas emissions (i.e., NOx, SOx, NH3, and VOC) that are converted to PM in the atmosphere. The precursors are from mobile, stationary and area sources, with the largest portion resulting from fuel combustion. Most of the 24-hour PM2.5 exceedances in the Basin occur in the late fall and winter months. Cold and humid weather conditions favor the conversion of inorganic vapors into particles in the atmosphere, resulting in high PM2.5 levels. Other unfavorable weather conditions such as a low and stable boundary layer and the lack of storms and rainfall can also contribute to high PM2.5 concentrations, as the precursors and particles are not dispersed or washed out as frequently. During the winter months, especially the holiday season, residential wood burning is also a major contributor to particulate mass and precursors, leading to high PM2.5 concentrations in the coastal and inland valley areas.

In contrast to PM10, PM2.5 concentrations were relatively low in the Coachella Valley area of the SSAB. PM10 concentrations are normally higher in the desert areas due to windblown and fugitive dust emissions; PM2.5 is relatively low in the desert area due to fewer combustion-related emissions sources and less secondary aerosol formation in the atmosphere. The PM2.5 federal standards were not exceeded in the Coachella Valley in 2020 and the highest 24-hour and annual average 2018-2020 design values (17 and 8.0 µg/m^3, respectively, both at the Indio air monitoring station) are well below the PM2.5 NAAQS.

[27] The U.S. EPA waiver from NAAQS compliance for the continuous FEM PM2.5 samplers is re-evaluated annually as part of the South Coast AQMD Annual Air Quality Monitoring Network Plan [http://www.aqmd.gov/home/library/clean-air-plans/monitoring-network-plan].

TABLE 2-9

2018-2020 PM2.5 24-HR DESIGN VALUES BY BASIN AND COUNTY*

Basin/ County	Regulatory Significant Exceptional Events Removed**			All Data Included#		
	2018-2020 PM2.5 24-Hour Design Value (µg/m³)	Percent of Current (2006) PM2.5 NAAQS (35 µg/m³)	Area of Design Value Max	2018-2020 PM2.5 24-Hour Design Value (µg/m³)	Percent of Current (2006) PM2.5 NAAQS (35 µg/m³)	Area of Design Value Max
South Coast Air Basin						
Los Angeles	**35**	**100##**	**East San Gabriel Valley (Azusa), South Central Los Angeles County, and I-710 Near Road**	**37**	**106**	**Central Los Angeles and South San Gabriel Valley**
Orange	33	94	Central Orange County	33	94	Central Orange County
Riverside	**35**	**100##**	**Metropolitan Riverside County (Mira Loma)**	36	103	Metropolitan Riverside County (Mira Loma)
San Bernardino	**35**	**100##**	**Central San Bernardino Valley (Fontana)**	36	103	CA-60 Near Road
Salton Sea Air Basin						
Riverside	17	49	Coachella Valley (Indio)	17	49	Coachella Valley (Indio)

Bold text denotes the peak value.

* Based on FRM filter data and NAAQS-comparable FEM continuous data.

** Regulatory significant exceptional events are exceptional events whose removal from the design value calculation influences a regulatory decision such as attainment vs. nonattainment. 24-Hour PM2.5 samples exceeding the 24-hour PM2.5 NAAQS during September 11, 2020 - September 16, 2020 at the Central Los Angeles, Pico Rivera, Route 60 Near Road, and Mira Loma stations were removed to calculate design values; these exceedances were caused by smoke from the Bobcat and El Dorado Fires. The South Coast AQMD is preparing an exceptional event demonstration consistent with U.S. EPA exceptional event guidance for this event.

Data includes exceptional events.

100 percent of the NAAQS is not in violation of that standard.

The 2018-2020 annual PM2.5 design values are summarized in Table 2-10, based on the FRM and continuous PM2.5 measurements. The Basin maximum 2018-2020 annual average design value was 14.2

µg/m^3 at the CA-60 Near Road station (118 percent of the current 2012 annual average PM2.5 NAAQS, 12.0 µg/m^3). This design value is below the former 1997 annual average PM2.5 NAAQS (15.0 µg/m^3), for which the Basin remains in attainment. The annual PM2.5 State standard is based on the highest annual average over the 3-year period. It is still violated in all counties of the Basin, but not in the Coachella Valley. Figure 2-9 shows the distribution of 2018-2020 annual PM2.5 design values in different areas of the Basin.

TABLE 2-10

2018-2020 PM2.5 ANNUAL DESIGN VALUES BY BASIN AND COUNTY

Basin/ County	2018-2020 PM2.5 Annual Design Value (µg/m^3)*#	Percent of Current (2012) PM2.5 Annual NAAQS (12.0 µg/m^3)	Percent of Former (1997) Annual NAAQS (15.0 µg/m^3)	Area of Design Value Max	2018-2020 3-Year High State Annual Average PM2.5 Designation Value (µg/m^3)##	Percent of State PM2.5 Annual Standard (12 µg/m^3)
South Coast Air Basin						
Los Angeles	13.0	108	87	South Central Los Angeles County	16.2	135
Orange	11.0	92	73	Central Orange County	12.3	103
Riverside	13.8	115	92	Metropolitan Riverside County (Mira Loma)	**16.4**	**137**
San Bernardino	**14.2**	**118**	**95**	**CA-60 Near Road**	15.4	128
Salton Sea Air Basin						
Riverside	8.0	67	53	Coachella Valley (Indio)	8.4	70

Bold text denotes the peak value.

* Based on FRM filter data and NAAQS-comparable FEM continuous data; the federal design value is based on the average of the 3 annual averages in the period.

\# Value includes all exceptional events, however, removal of suspected exceptional events result in a lower design value.

\## Based on combined FRM filter and continuous FEM data (federal FEM waiver is not applied to State designation value); data includes exceptional events; the State annual designation value is the highest year in the 3-year period.

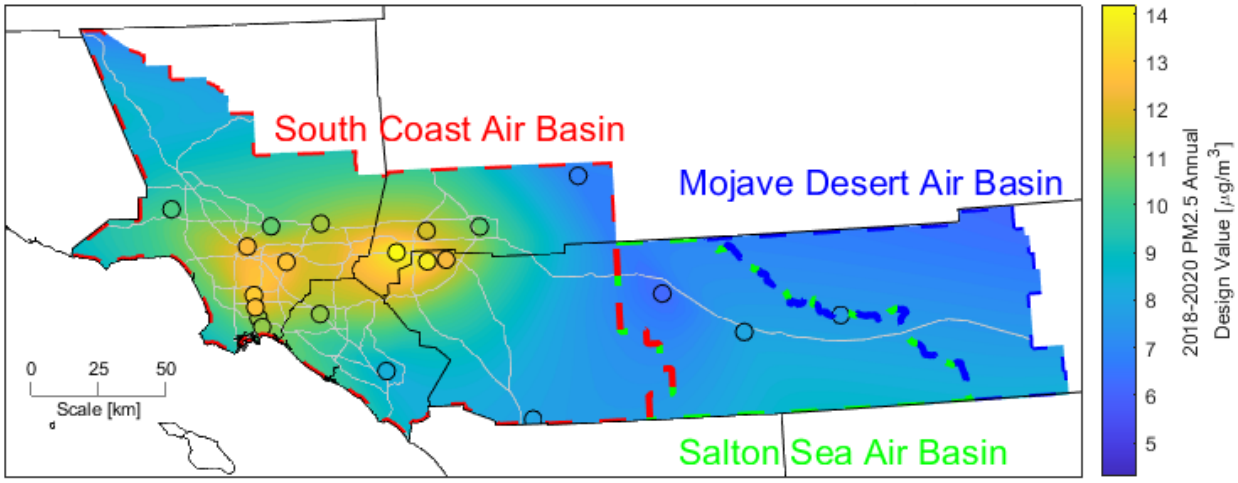

FIGURE 2-9
2018-2020 PM2.5 ANNUAL AVERAGE FEDERAL DESIGN VALUE

Near-Road PM2.5

On December 14, 2012, the U.S. EPA strengthened the NAAQS for PM2.5 and, as part of the revisions, added a requirement to monitor near the most heavily trafficked roadways in large urban areas. Particle pollution is expected to be higher along these roadways as a result of direct emissions from cars and heavy-duty diesel trucks and buses. The South Coast AQMD installed the two required PM2.5 monitors before January 1, 2015, at locations selected based upon the existing near-roadway NO_2 sites that were ranked higher for heavy-duty diesel traffic. The locations are: (1) I-710, located at Long Beach Blvd. in Los Angeles County near Compton and Long Beach; and (2) CA-Route 60, located west of Vineyard Avenue near the San Bernardino/Riverside County border near Ontario, Mira Loma and Upland. These near-road sites measure PM2.5 daily with both FRM filter-based measurements and FEM continuous measurements.

Table 2-11 summarizes the 2018-2020 annual and 24-hour PM2.5 design values from the near-road sites and nearby ambient monitoring stations. The 2018-2020 PM2.5 annual design values from the Route 710 and Route 60 Near-Road sites were 12.7 and 14.2 µg/m^3, respectively. The nearby ambient stations in South Coastal Los Angeles County (North Long Beach Station) and in Metropolitan Riverside County (Mira Loma station) measured 11.1 and 13.8 µg/m^3, respectively, for the 2018-2020 annual design values. Thus, the PM2.5 annual design values of these sites for 2018-2020 indicate that the near-road sites do indeed measure higher than the nearby ambient stations, on average. The CA-60 near-road station became the 3-year design value site for the Basin for the PM2.5 annual average NAAQS beginning in 2017 when the first 3-year design value was available.

After removing the regulatory significant exceptional events,[28] the 2018-2020 24-hour PM2.5 design value is higher at the I-710 Near-Road than at the nearby N. Long Beach station. However, the 2018-2020 24-hour PM2.5 design value remains higher at Mira Loma (35 µg/m^3) than at the CA-60 Near-Road site (34 µg/m^3). PM2.5 24-hour concentrations at the Mira Loma station are likely higher than the near-road site on the highest days, due to the influence of nearby residential wood burning and the influence of enhanced secondary particle formation at Mira Loma.

TABLE 2-11

2018-2020 ANNUAL PM2.5 DESIGN VALUES AND 24-HOUR PM2.5 DESIGN VALUES AT THE SOUTH COAST AIR BASIN NEAR-ROAD SITES AND NEARBY AMBIENT STATIONS

Near-Road PM2.5*			Nearby Ambient PM2.5*		
Near-Road Station	2018-2020 Annual PM2.5 Design Value (µg/m^3)#	2018-2020 24-Hour PM2.5 Design Value (µg/m^3)##	Ambient Station	2018-2020 Annual PM2.5 Design Value (µg/m^3)#	2018-2020 24-Hour PM2.5 Design Value (µg/m^3)##
Route 710 N. R.	12.7	**35**	**North Long Beach**	11.1	33
Route 60 N. R.	**14.2**	34	**Mira Loma**	13.8	**35**

Bold text denotes the peak value.

* Filter-based FRM measurements and NAAQS-comparable FEM measurements were used to calculate the design values

\# Data includes exceptional events.

\## 24-Hour PM2.5 samples exceeding the 24-hour PM2.5 NAAQS during September 11, 2020 - September 16, 2020 at the Route 60 Near Road and Mira Loma stations were removed to calculate design values; these exceedances were caused by smoke from the Bobcat and El Dorado Fires. The South Coast AQMD is preparing an exceptional event demonstration consistent with U.S. EPA exceptional event guidance for this event. Events with an exceptional event demonstration that the U.S. EPA has concurred upon may be removed from the design value determination.

The annual PM2.5 NAAQS is 12.0 µg/m^3; the 24-hour PM2.5 NAAQS is 35 µg/m^3.

I-710 N. R. is located on Interstate 710 at Long Beach Bl. in Long Beach in Los Angeles County.

CA-60 N.R. is located on California Route 60 west of Vineyard Av. in Ontario in San Bernardino County.

Impacts of Meteorology on PM2.5 Air Quality

PM2.5 concentrations are influenced by atmospheric pollutant transport and dispersion. Winds and turbulence mix air pollution with the cleaner air in the atmosphere and transport pollutants out of the South Coast AQMD jurisdiction. Rainfall and associated storms also help to reduce PM2.5 concentrations. To analyze the impact of meteorology on PM2.5, we constructed two indexes that quantify the influence of atmospheric transport and dispersion on concentrations. The indexes are calculated using equations 1

[28] Regulatory significant exceptional events are exceptional events whose removal from the design value calculation influences a regulatory decision.

and 2 in Appendix II. The meteorological indexes were calculated using hourly historical measurements of wind speed, temperature, and total sky cover at several of the South Coast AQMD and Automated Surface Observing Systems (ASOS) monitoring stations. See Appendix II for details of the meteorological index calculation. Appendix II also provides an analysis of the relationship between hourly PM2.5 concentrations measured at Mira Loma (Van Buren) and the meteorological indexes, demonstrating that they are useful for quantifying the influence of meteorology on concentrations.

The trend of normalized quarterly meteorological indexes is shown in Figure 2-34 (Appendix II). Both indexes increased over time at both Compton and Mira Loma (Van Buren), the stations with the highest PM2.5 98th percentile values in recent years, relative to the baseline period of 2010 - 2020. Meteorological conditions were slightly favorable to higher concentrations in recent years, although there is significant variation. This shows that the transport and dispersion related meteorological conditions in the design value period of 2018 - 2020 were somewhat favorable to higher PM2.5 concentrations.

The net impact of the drought on air quality in the Basin from 2013 through 2015 has been to disrupt the steady progress seen in prior years toward attainment of the 24-hour PM2.5 NAAQS. Lower rainfall results in less washing of road surfaces and brings drier ground surfaces, which reduces the natural crusting of soils that is improved by moisture. This can lead to enhanced resuspension of fugitive dust by moving vehicles and winds. Fugitive dust can raise concentrations of both PM10 and PM2.5. More importantly, less rain reduces the natural air pollution cleansing effect of precipitation due to washout - particulate matter and its precursors captured and removed by raindrops. The reduced frequency of storms also translates to fewer days of enhanced pollutant dispersion. Without the storm systems and related winds, there is less mixing of air pollutants with cleaner air in the atmosphere and less of the transport that moves pollutants out of the region. The lack of windy, unstable weather conditions during storms results in longer episodes of stagnant air when particulate pollution builds to unhealthful levels. Dry conditions also contributed to increased frequency and intensity of wildfire events throughout the State, with resulting impacts to both particulate and ozone air quality.

The total rainfall during quarters 1 and 4, averaged over 3-years at the Los Angeles International Airport (KLAX) and Ontario International Airport (KONT) National Weather Service meteorological stations from 2001-2020 are shown in Figure 2-10 along with the trend of 24-hour PM2.5 design values. KLAX is located on the western side of the Basin and KONT is located towards the center of the Basin. The first and fourth quarters are the most important to consider, since the vast majority of the days that exceed the federal 24-hour standard in the Basin occur during this period. This is also the time period that the Basin typically experiences the most rainfall and more frequent storm events.

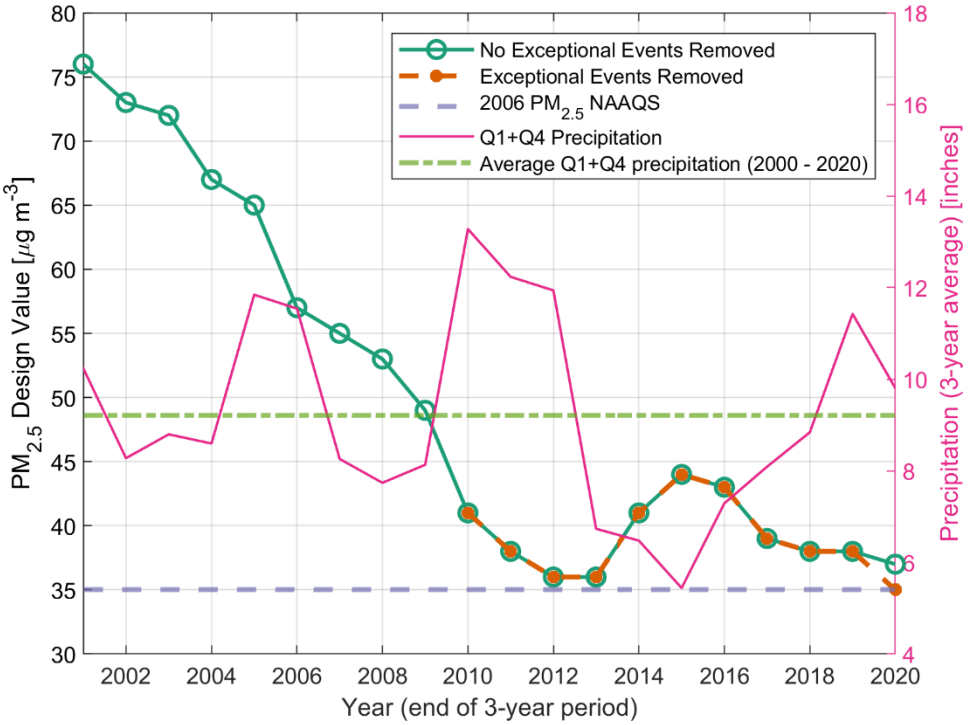

FIGURE 2-10
TREND OF SOUTH COAST AIR BASIN MAXIMUM 24-HOUR PM2.5 DESIGN VALUES AND 3-YEAR AVERAGE OF RAINFALL IN QUARTERS 1 (JAN.-MAR.) AND 4 (OCT.-DEC.) AT KLAX AND KONT.

After the drought from 2013 - 2015, annual precipitation totals in recent years (9.80 inches from 2018 - 2020) have been slightly above average (9.21 inches from 2000 - 2020). After 2015, due to rainfall returning to near-average levels, PM2.5 concentrations have resumed the long-term decreasing trend. The design value in 2020 was 35 µg/m^3 after removing exceedances caused by the Bobcat and El Dorado fires, which caused high PM2.5 measurements in the fall of 2020. After removing these exceptional events, the Basin has met the 2006 24-hour PM2.5 NAAQS based on the 2018-2020 design value period.

As a result of the disrupted progress toward attainment of the federal 24-hour PM2.5 standard, the South Coast AQMD submitted a request and the U.S. EPA approved, a “bump up” to the nonattainment classification from “moderate” to “serious.” This reclassification required that the Basin attain the standard as soon as practicable, but not beyond December 31, 2019. Because of the failure to attain the 2006 24-hour PM2.5 NAAQS by 2019, the South Coast AQMD developed a Section 189(d) Plan) to address the attainment planning requirements for the Basin. In 2021, after meeting the 2006 24-hour PM2.5 NAAQS with 2018 - 2020 data, the South Coast AQMD developed a redesignation request and maintenance plan for 24-hour average PM2.5, requesting the U.S. EPA to redesignate the Basin to attainment of the 1997 and 2006 24-hour PM2.5 NAAQS.

Air Quality, PM10

In 2020, the South Coast AQMD routinely monitored PM10 concentrations at 23 locations in the Basin and the Coachella Valley. Of these, 18 employed FRM filter samplers. The FRM PM10 minimum sampling

schedule set by the U.S. EPA requires one 24-hour filter sample every sixth day. At the Riverside-Rubidoux, Mira Loma, and Indio stations, the 24-hour filter sample is collected once every three days. In addition, ten stations have FEM[29] continuous monitors. Both FEM and FRM instruments are used for determining attainment. Attainment is considered at each instrument separately[30], even if they are collocated at the same station.

In the second quarter of 2020, the FRM monitors were not operated from March 28, 2020 to June 26, 2020 due to the COVID-19 Pandemic. As a result, only the continuous monitors had complete data for the second quarter of 2020.

Attainment of the 24-hour PM10 NAAQS is based on the design value, which represents the average number of exceedances of the standard in a three-year period. This form is not useful for analyzing trends of concentrations over time because a single exceedance with a concentration just over the standard is treated the same as an exceedance with a concentration well over the standard. We therefore also use a different but related form, referred to as the concentration-based design value in this section.

For this analysis, the concentration-based design value is defined as the fourth highest concentration at a monitor in a three-year period, after simulating days without measurements. To simulate days without measurements, each measurement is repeated n times in each year, where $n = round\left(\frac{dyear}{d}\right)$, where $dyear$ is the number of days in the year (365 or 366), d is the number of measurements at the monitor, and $round()$ rounds to the nearest integer. The concentration-based design value can be complete or incomplete. The value is complete if all quarters in the three-year period are at least 75 percent complete or the concentration-based design value is 155 µg m^{-3} or larger. Completeness is calculated by dividing the number of valid samples by the number of scheduled samples. This methodology produces similar conclusions as the official exceedance-based design values, but also provides additional context when tracking trends in measured concentrations over time. In general, concentration-based design values of 155 µg m^3 correspond to an exceedance of the standard.

The 24-hour PM10 design values in 2020 are summarized by county and basin in Table 2-12, along with the State designation values. The federal 24-hour standard level (155 µg/m^3 is the exceedance level) was exceeded at seven stations in the Basin on nine different days during the 2018 through 2020 period. These high 24-hour averages were due to high-wind exceptional events and also do not jeopardize the attainment status because exceptional events are removed from design value calculations if they are concurred upon by U.S. EPA. The Basin has remained in attainment of the PM10 NAAQS since 2006. The Basin maximum concentration-based design value for 24-hour PM10, without exceptional events removed, is 170 µg/m^3, 110 percent of the NAAQS in Metropolitan Riverside County at the Mira Loma

[29] The continuous FEM PM10 monitors deployed by South Coast AQMD are primarily Beta Attenuation Monitor (BAM) instruments, although some PM10 Tapered Element Oscillating Microbalance (TEOM) instruments are also used, most notably in the Coachella Valley.

[30] At the Indio and Mira Loma stations, two monitors that sample every sixth day are operated with a three day offset to simulate a once every third day sample schedule and are treated as a single monitor.

(Van Buren) monitoring station. After removing exceptional events due to high-winds the maximum concentration-based design value is 152 µg/m^3, 98 percent of the NAAQS, in East San Gabriel Valley at the Azusa monitoring station. The much more stringent State 24-hour PM10 standard (50 µg/m^3) was exceeded at many stations in the Basin and in the Coachella Valley.

The Coachella Valley had eighteen days in 2018-2020 exceeding the 24-hour PM10 NAAQS, with concentrations as high as 680 µg/m^3 at the Mecca (Saul Martinez) monitoring station, almost all of which were due to windblown dust and sand associated with high-wind exceptional events. The Palm Springs monitoring station only exceeded on two of those days. The FEM monitor at Saul Martinez Elementary School, in the town of Mecca in the southeastern portion of the Coachella Valley, exceeded the standard on seventeen days from 2018-2020, almost all related to high-wind events. The Coachella Valley 2018-2020 concentration-based design value for 24-hour PM10 is 204 µg/m^3 at Mecca (Saul Martinez) after the exclusion of exceptional events with wind speeds exceeding 25 mph in the Coachella Valley. The official design value that is used to determine attainment is 2.0, which exceeds the PM10 NAAQS even after the exclusion of suspected exceptional events. The other exceedances at Mecca (Saul Martinez) were also likely caused by windblown dust and sand, but wind speeds in upwind regions were likely not high enough to entrain undisturbed natural soils, and thus these exceedances may not be exceptional events.

TABLE 2-12

2018-2020 24-HOUR PM10 DESIGN VALUES BY BASIN AND COUNTY

Basin/ County	2018-2020 PM10 24-Hour Concentration-Based Design Value ($\mu g/m^3$)	2018-2020 Percent of PM10 NAAQS (150 $\mu g/m^3$)#	2018-2020 PM10 24-Hour Design Value	Area of Design Value Max	2018-2020 High State PM10 24-Hour Designation Value ($\mu g/m^3$)##	2018-2020 Percent of State PM10 24-Hour Standard (50 $\mu g/m^3$)
South Coast Air Basin						
Los Angeles	155 (152)	100 (98)	2.0 (0.7)	East San Gabriel Valley	95	190
Orange	127	82	0.3	Central Orange County	94	188
Riverside	**170 (148)**	**110 (95)**	**1.7 (1.0)**	**Metropolitan Riverside County**	**134**	**268**
San Bernardino	117	75	0.8	Northwest San Bernardino Valley	95	190
Salton Sea Air Basin						
Riverside	**274 (204)**	**177 (132)**	**5.8 (2.0)**	**Coachella Valley - Mecca (Saul Martinez)**	**Insufficient data**	**Insufficient data**

Bold text denotes the peak design value.

Values in parenthesis are calculated after removing suspected exceptional events. PM10 concentrations that were related to high-wind events have been flagged for exclusion from NAAQS comparison in accordance with the U.S. EPA Exceptional Events Rule; U.S. EPA concurrence is required for exclusion of exceptional events after submittal of supporting documentation.

155 $\mu g/m^3$ is needed to exceed the level of the PM10 NAAQS.

The State 24-hour Expected Peak Day Concentration (EPDC) is a calculated 3-year value after accounting for statistical outliers; the State 24-hour Designation Value is the highest concentration at or below the EPDC over the 3-year period; State data may include exceptional events; State PM10 24-hour average designation value includes FRM and BAM FEM data, but not TEOM FEM instruments since the TEOM is not a California Approved Sampler (CAS) for standard compliance (SCAQMD uses TEOM instruments to supplement FEM measurements in the Coachella Valley).

While the annual PM10 NAAQS standard was revoked in 2006, the annual PM10 design values and State designation values in 2020 are summarized by county and air basin in Table 2-13. Suspected exceptional events were removed before calculating the design values. The annual PM10 design value for 2018-2020 exceeded the former NAAQS at Mira Loma (Van Buren), at 51 $\mu g/m^3$. No other stations in the Basin or the Coachella Valley exceeded the former NAAQS for the 2018-2020 design value. The much more stringent

State annual PM10 standard (20 µg/m^3) was exceeded at most stations in each county in the Basin and in the Coachella Valley.

TABLE 2-13

2018-2020 ANNUAL PM10 DESIGN VALUES BY BASIN AND COUNTY

Basin/County	2018-2020 PM10 Annual Design Value (µg/m^3)	2018-2020 Percent of Former PM10 Annual NAAQS** (50 µg/m^3)	Area of Design Value Max	2018-2020 3-Yr. High State PM10 Annual Designation Value (µg/m^3)#	2018-2020 Percent of Current PM10 State Standard (20 µg/m^3)
South Coast Air Basin					
Los Angeles	33*	66	East San Gabriel Valley	34	170
Orange	27*	54	Central Orange County	28	140
Riverside	**51**	**102**	**Metropolitan Riverside County**	**45**	**225**
San Bernardino	35*	70	Central San Bernardino Valley	34	170
Salton Sea Air Basin					
Riverside	**38***	**76**	**Coachella Valley - Mecca (Saul Martinez)**	**39**	**195**

Bold text denotes the peak value.

* All quarters do not have at least 75 percent data completeness.

** The federal annual PM10 standard was revoked in 2006.

State data may include exceptional events; State PM10 annual average designation value includes FRM and BAM FEM data, but not TEOM FEM instruments since the TEOM is not a California Approved Sampler (CAS) for standard compliance (the South Coast AQMD uses TEOM instruments to supplement FEM measurements in the Coachella Valley); State annual designation value is the highest year in the 3-year period.

Other Criteria Air Pollutants

Carbon Monoxide (CO)

Health Effects, CO

The adverse effects of ambient carbon monoxide air pollution exposure on health have been reviewed in the 2010 U.S. EPA *Integrated Science Assessment for Carbon Monoxide.*[31] This document presents a review of the available scientific studies and conclusions on the causal determination of the health effects

[31] U.S. EPA. (2010). Integrated Science Assessment for Carbon Monoxide (Final Report). U.S. Environmental Protection Agency, Washington, DC, EPA/600/R-09/019F. http://cfpub.epa.gov/ncea/cfm/recordisplay.cfm?deid=218686.

of CO. A summary of health effects information and additional references can also be found in Appendix I: Health Effects.

Individuals with a deficient blood supply to the heart are the most susceptible to the adverse effects of CO exposure. The effects observed include earlier onset of chest pain with exercise, and electrocardiograph changes indicative of worsening oxygen supply delivery to the heart.

Inhaled CO has no known direct toxic effect on the lungs, but instead exerts its effect on tissues by interfering with oxygen transport, by competing with oxygen to combine with hemoglobin present in the blood to form carboxyhemoglobin (COHb). Hence, people with conditions requiring an increased oxygen supply can be adversely affected by exposure to CO. Individuals most at risk include patients with diseases involving heart and blood vessels, fetuses, and patients with chronic hypoxemia (oxygen deficiency), such as is seen at high altitudes.

Recent studies suggest that ambient CO may increase the risk of pulmonary disease. CO is also associated with emergency department visits for respiratory diseases overall and visits for asthma. Reductions in birth weight and impaired neurobehavioral development have been observed in animals chronically exposed to CO resulting in COHb levels similar to those observed in smokers. Recent studies have found increased risks for adverse birth outcomes with exposure to elevated CO levels, including pre-term births and heart abnormalities.

Air Quality, CO

Ambient carbon monoxide concentrations were measured at 23 locations in the South Coast AQMD jurisdiction, including one station in the Coachella Valley and two near-road monitors. Tables 2-14 and 2-15 summarize the 2020 maximum 1-hour and 8-hour average concentrations of CO by air basin and county. In 2020, no areas in the Basin or the Coachella Valley exceeded the CO air quality standards, including the near-road stations. The highest concentrations of CO continued to be recorded in the areas of Los Angeles County, where vehicular traffic is most dense, with the maximum 8-hour and 1-hour concentration (3.1 ppm and 4.5 ppm, respectively) recorded in the South Central Los Angeles County area. The near-road monitors in Orange and San Bernardino counties did not increase the Basin's maximum CO values or design values in 2020 over that from Los Angeles County, although the near-road concentrations were often higher than the nearest ambient stations.

All areas of the Basin have continued to remain below the federal standards (35 ppm 1-hour and 9 ppm 8-hour) since 2003. The U.S. EPA re-designated the Basin to attainment of the federal CO standards, effective June 11, 2017. The Basin and the Coachella Valley are also well below the State CO standards (20 ppm 1-hour and 9.0 ppm 8-hour).

TABLE 2-14

2020 MAXIMUM 1-HOUR CO CONCENTRATIONS AND 2020 DESIGN VALUES BY BASIN AND COUNTY

Basin/County	2020 Maximum CO 1-Hour Average (ppm)	2019-2020 CO 1-Hour Design Value* (ppm)	Percent of CO 1-Hour NAAQS (35 ppm)	Area of Design Value Max	Percent of CO 1-Hour State Standard (20 ppm)
South Coast Air Basin					
Los Angeles	**4.5**	**3.8**	**11**	**South Central L.A. County**	**19**
Orange	2.4 *(2.4 at I-5 N.R.)*	2.5 *(2.5 at I-5 N.R.)*	7 *(7)*	North Orange County	13 *(13)*
Riverside	1.9	1.8	5	Metropolitan Riverside County	9
San Bernardino	1.9 *(1.5 at I-10 N.R.)*	2.2 *(1.5 at I-10 N.R.)*	6 *(4)*	Central San Bernardino Valley	11 *(8)*
Salton Sea Air Basin					
Riverside	0.8	0.8	2	Coachella Valley	4

Bold text denotes Basin maximum; I-5 and I-10 near-road monitors are shown in parenthesis.

* The 1-hour CO design value is the maximum in a two-year period 2nd highest daily maximum 1-hour average concentration at the most polluted station.

I-5 N. R. is located on Interstate 5 at Vernon St. in Anaheim in Orange County.

I-10 N.R. is located on Interstate 10 at Etiwanda Av. in Ontario in San Bernardino County.

TABLE 2-15

2020 MAXIMUM 8-HOUR CO CONCENTRATIONS AND 2020 DESIGN VALUES BY BASIN AND COUNTY

Basin/ County	2020 Maximum CO 8-Hour Average (ppm)	2020 CO 8-Hour Design Value* (ppm)	Percent of CO 8-Hour NAAQS (9 ppm)	Area of Design Value Max	Percent of CO 8-Hour State Standard (9.0 ppm)
South Coast Air Basin					
Los Angeles	**3.1**	**2.9**	**32**	**South Central L.A. County**	**32**
Orange	2.0 *(2.0 at I-5 N.R.)*	1.8 *(1.8 at I-5 N.R.)*	20 *(20)*	I-5 Near Road	20 *(20)*
Riverside	1.5	1.5	17	Metropolitan Riverside County	17
San Bernardino	1.4 *(1.2 at I-10 N.R.)*	1.4 *(1.1 at I-10 N.R.)*	16 *(12)*	Central San Bernardino Valley	16 *(12)*
Salton Sea Air Basin					
Riverside	0.5	0.5	6	Coachella Valley	6

Bold text denotes Basin maximum; I-5 and I-10 near-road monitors are shown in parentheses

* The 8-hour CO design value is the 2nd highest daily maximum 8-hour average concentration at the most polluted station in a two year-period.

I-5 N. R. is located on Interstate 5 at Vernon St. in Anaheim in Orange County

I-10 N.R. is located on Interstate 10 at Etiwanda Av. in Ontario in San Bernardino County

Near-Road CO

On August 12, 2011, the U.S. EPA issued a decision to retain the existing NAAQS for CO, determining that those standards provided the required level of public health protection. However, the U.S. EPA added a monitoring requirement for near-road CO monitors in urban areas with population of 1 million or more, utilizing stations that would be implemented to meet the 2010 NO_2 near-road monitoring requirements. The two CO monitors are at the I-5 Near-Road site, located in Orange County near Anaheim, and the I-10 Near-Road site, located near Etiwanda Avenue in San Bernardino County near Ontario, Rancho Cucamonga and Fontana.

The near-road CO measurements began at these two locations in late December 2014. From that time to the end of 2020, the data show that while the near-road measurements were often higher than the nearest ambient monitors, as would be expected in the near-road environment, they did not exceed the levels of the 1-hour or 8-hour CO NAAQS. Tables 2-16 and 2-17 compare the available near-road measurements for annual peak 1-hour and 8-hour CO, respectively, to the comparable measurements from the nearby ambient stations at Anaheim and Fontana. The form of the CO standard is such that the peak concentration is not to be exceeded more than once per year. The tables include the second highest concentration for comparison to this design value form of the standard.

The 2020 near-road peak 1-hour CO concentration measured was 2.4 ppm, measured at the I-5 Near-Road site, while the peak 8-hour CO concentration was 2.0 ppm at the I-10 Near-Road site, both well below the respective NAAQS levels (35 ppm and 9 ppm, respectively). The 2020 I-5 near-road CO design values were higher than that of the nearest ambient stations for both federal standards while the I-10 near-road design values were comparable to the nearest ambient stations. South Central Los Angeles (Compton) continues to be the station with the highest design values in the South Coast Air Basin.

TABLE 2-16

2018 THROUGH 2020 MAXIMUM AND SECOND HIGHEST 1-HOUR CO CONCENTRATIONS AT SOUTH COAST AIR BASIN NEAR-ROAD SITES AND NEARBY AMBIENT STATIONS

Near-Road Station	Near-Road Sites CO						Ambient Station	Nearby Ambient CO					
	Peak 1-Hour CO (ppm)			2nd Maximum 1-Hour CO (ppm)				Peak 1-Hour CO (ppm)			2nd Maximum 1-Hour CO (ppm)		
	2018	2019	2020	2018	2019	2020		2018	2019	2020	2018	2019	2020
I-5 N. R.	**2.7**	**2.6**	**2.4**	**2.7**	**2.3**	**2.1**	**Anaheim**	2.3	2.4	2.3	2.2	2.4	2.1
I-10 N. R.	1.6	1.5	1.5	1.5	1.4	1.5	**Fontana**	**1.9**	**2.7**	**1.7**	**1.6**	**2.2**	**1.5**

Bold text denotes maximum concentration between near-road and nearby ambient stations.
I-5 N. R. is located on Interstate 5 at Vernon St. in Anaheim in Orange County.
I-10 N.R. is located on Interstate 10 at Etiwanda Av. in Ontario in San Bernardino County.

TABLE 2-17

2018 THROUGH 2020 MAXIMUM AND SECOND HIGHEST 8-HOUR CO CONCENTRATIONS AT SOUTH COAST AIR BASIN NEAR-ROAD SITES AND NEARBY AMBIENT STATIONS

Near-Road Station	Near-Road Sites CO						Ambient Station	Nearby Ambient CO					
	Peak 8-Hour CO (ppm)			2nd Maximum 8-Hour CO (ppm)				Peak 8-Hour CO (ppm)			2nd Maximum 8-Hour CO (ppm)		
	2018	2019	2020	2018	2019	2020		2018	2019	2020	2018	2019	2020
I-5 N. R.	**2.2**	**1.6**	**2.0**	**2.0**	**1.5**	**1.8**	**Anaheim**	1.9	1.3	1.7	1.8	1.3	1.6
I-10 N. R.	**1.3**	**1.1**	**1.2**	**1.3**	**1.1**	**1.1**	**Fontana**	1.1	1.0	1.1	1.1	1.0	1.1

Bold text denotes maximum concentration between near-road and nearby ambient stations.
I-5 N. R. is located on Interstate 5 at Vernon St. in Anaheim in Orange County.
I-10 N.R. is located on Interstate 10 at Etiwanda Av. in Ontario in San Bernardino County.

Nitrogen Dioxide (NO_2)

Health Effects, NO_2

The adverse effects of ambient nitrogen dioxide air pollution exposure on health were reviewed in the 2008 U.S. EPA *Integrated Science Assessment for Oxides of Nitrogen - Health Criteria*,[32] and more recently in the 2016 U.S. EPA *Integrated Science Assessment for Oxides of Nitrogen - Health Criteria*.[33] These documents present detailed reviews of the available scientific studies and conclusions on the causal determination of the health effects of NO2. A summary of health effects information and additional references can also be found in Appendix I: Health Effects.

The 2016 U.S. EPA review noted the respiratory effects of NO_2, and evidence suggestive of impacts on cardiovascular health, mortality and cancer. Epidemiological studies indicate that long-term exposure to NO_2, is associated with a higher risk of all-cause, cardiovascular, and respiratory mortality. Recent studies also show that both short and long term NO_2 exposure is also associated with chronic obstructive pulmonary disease (COPD) risk. The 2016 ISA also indicated a causal relationship between short-term NO_2 exposures and asthma exacerbations ("asthma attacks") and a long-term link with asthma development. Experimental studies have found that NO_2 exposures increase responsiveness of airways, pulmonary inflammation, and oxidative stress, and can lead to the development of allergic responses. These biological responses provide evidence of a plausible mechanism for NO_2 to cause asthma. Additionally,

[32] U.S. EPA. (2008). Integrated Science Assessment for Oxides of Nitrogen - Health Criteria (Final Report). U.S. Environmental Protection Agency, Washington, DC, EPA/600/R-08/071. http://cfpub.epa.gov/ncea/isa/recordisplay.cfm?deid=194645.

[33] U.S. EPA. (2016). Integrated Science Assessment for Oxides of Nitrogen - Health Criteria (Final Report). U.S. Environmental Protection Agency, Washington, DC, EPA/600/R-15/068. https://cfpub.epa.gov/ncea/isa/recordisplay.cfm?deid=310879.

results from controlled exposure studies of asthmatics demonstrate an increase in the tendency of airways to contract in response to a chemical stimulus (airway responsiveness) or after inhaled allergens.

Animal studies also provide evidence that NO_2 exposures have negative effects on the immune system, and therefore increase the host's susceptibility to respiratory infections. Epidemiological studies showing associations between NO_2 levels and hospital admissions for respiratory infections support such a link, although the studies examining respiratory infections in children are less consistent.

Air Quality, NO_2

In 2020, ambient NO_2 concentrations were monitored at 27 locations, including one in the Coachella Valley and four near-road monitoring stations. The Basin has not exceeded the federal annual standard for NO_2 (0.053 ppm) since 1991, when the Los Angeles County portion of the Basin recorded the last violation of that standard in the U.S. The current 1-hour average NO2 NAAQS (100 ppb) was exceeded on one day in 2020 at the CA-60 near road site in San Bernardino County. However, the 98th percentile form of the standard was not exceeded and the 2018-2020 design value is not in violation of the NAAQS.

The higher relative concentrations in the Los Angeles area are indicative of the concentrated emission sources, especially heavy-duty vehicles. Although the Basin is in attainment of the State and federal standards, NO_2 is still of concern, since oxides of nitrogen (NOx) are precursors to both ozone and particulate matter. Further control of NOx will be required to attain the ozone and particulate standards.

Tables 2-18 and 2-19 summarize the 2020 maximum 1-hour and annual average concentrations of NO_2 by air basin and county. The near-road NO_2 data is summarized further below.

TABLE 2-18

2020 MAXIMUM 1-HOUR NO_2 CONCENTRATIONS AND 2018-2020 DESIGN VALUES BY BASIN AND COUNTY

Basin/ County	2020 Maximum NO2 1-Hour Average (ppb)	2018-2020 NO2 1-Hour Design Value (ppb)	Percent of NO2 1-Hour NAAQS (100 ppb)	Area of Design Value Max	2018-2020 NO2 1-Hour State Designation Value (ppm)	Percent of NO2 1-Hour State Standard (0.18 ppm)
South Coast Air Basin						
Los Angeles	90.3	81	81	I-710 Near Road	**0.100**	**56**
Orange	70.9	53	53	I-5 Near Road	0.060	33
Riverside	66.4	52	52	Metropolitan Riverside County	0.060	33
San Bernardino	**101.6**	**74**	**74**	**CA-60 Near Road**	0.090	50
Salton Sea Air Basin						
Riverside	47.4	34	34	Coachella Valley	0.040	22

Bold text denotes the peak value.

The 1-hour NO_2 design value is the annual 98th percentile daily maximum 1-hour concentration, averaged over 3 years at a station.

* Although the maximum 1-hour concentrations exceeded the standard on one day, the 98th percentile form of the design value did not exceed the NAAQS.

TABLE 2-19

2020 MAXIMUM ANNUAL AVERAGE NO_2 CONCENTRATIONS AND 2018-2020 DESIGN VALUES BY BASIN AND COUNTY

Basin/County	2020 Maximum NO2 Annual Average (ppm)	2018-2020 NO2 Annual Design Value (ppm)	Percent of NO2 Annual NAAQS (0.053 ppm)	Area of Design Value Max	2018-2020 NO2 Annual State Designation Value# (ppm	Percent of NO2 Annual State Standard (0.030 ppm)
South Coast Air Basin						
Los Angeles	0.0223	0.023	43	710 Near Road	0.023	77
Orange	0.0188	0.019	36	I-5 Near Road	0.020	67
Riverside	0.0136	0.015	28	Metropolitan Riverside County	0.014	47
San Bernardino	**0.0291**	**0.029**	**55**	**CA-60 Near Road**	**0.030**	**100**
Salton Sea Air Basin						
Riverside	0.0066	0.007	13	Coachella Valley	0.007	23

Bold text denotes the peak value.
The annual NO_2 design value is the annual average of the quarterly averages, averaged over 3 years at a station.
This table does not include near-road stations since the data period is insufficient for the design value calculation.

Near-Road NO_2

With the revised NO_2 federal standard in 2010, near-road NO_2 measurements were required to be phased in for larger cities. The four near-road monitoring stations are: (1) I-5 Near-Road, located in Orange County near Anaheim; (2) I-710 Near-Road, located at Long Beach Blvd. in Los Angeles County near Compton and Long Beach; (3) CA-60 Near-Road, located west of Vineyard Avenue near the San Bernardino/Riverside County border near Ontario, Mira Loma and Upland; and (4) I-10 Near-Road, located near Etiwanda Avenue in San Bernardino County near Ontario, Rancho Cucamonga and Fontana.

Even with the addition of the near-road sites, all of the standards remain in attainment. There have been exceedances of the peak 1-hour standard, at the I-710 near-road station in 2017, and the CA-60 near-road in 2020. However, the 98th percentile value has not exceeded the standard. Tables 2-20 and 2-21 show that while the near-road stations have higher values than nearby stations, they do not cause a violation of the federal standards.

TABLE 2-20

2018 THROUGH 2020 MAXIMUM AND 98TH PERCENTILE 1-HOUR NO_2 CONCENTRATIONS AT SOUTH COAST AIR BASIN NEAR-ROAD SITES AND NEARBY AMBIENT STATIONS

Near-Road Station	Near-Road Sites NO_2						Ambient Station	Nearby Ambient NO_2					
	Annual Peak 1-Hour NO_2 (ppb)			98th Percentile 1-Hour NO_2 (ppb)				Annual Peak 1-Hour NO_2 (ppb)			98th Percentile 1-Hour NO_2 (ppb)		
	2018	2019	2020	2018	2019	2020		2018	2019	2020	2018	2019	2020
I-5 N. R.	61.7	59.4	69.9	55.8	50.4	52.6	**Anaheim**	66.0	59.4	70.9	54.5	49.2	52.1
I-710 N. R.	**90.3**	**97.7**	90.3	**79.1**	**78.3**	**79.1**	**Compton**	**68.3**	70.0	**72.3**	55.6	52.8	**60.5**
CA-60 N. R.	79.4	87.7	**101.6**	71.3	73.9	78.0	**Upland**	58.7	57.9	55.4	48.9	46.4	44.8
I-10 N. R.	88.3	86.3	94.2	67.7	70.5	75.1	**Fontana**	63.0	**76.1**	66.4	**55.9**	**57.7**	57.9

Bold text denotes maximum concentration between near-road and nearby ambient stations.
N/A = data not available (monitoring not started).
The 1-hour NO_2 NAAQS is 100 ppb.
I-5 N. R. is located on Interstate 5 at Vernon St. in Anaheim in Orange County.
I-710 N. R. is located on Interstate 710 at Long Beach Bl. in Long Beach in Los Angeles County.
CA-60 N.R. is located on California Route 60 west of Vineyard Av. in Ontario in San Bernardino County.
I-10 N.R. is located on Interstate 10 at Etiwanda Av. in Ontario in San Bernardino County.

TABLE 2-21

2018 THROUGH 2020 ANNUAL NO_2 CONCENTRATIONS AT SOUTH COAST AIR BASIN NEAR-ROAD SITES AND NEARBY AMBIENT STATIONS

Near-Road Station	Near-Road NO_2			Ambient Station	Nearby Ambient NO_2		
	Annual Average NO_2 (ppb)				Annual Average NO_2 (ppb)		
	2018	2019	2020		2018	2019	2020
I-5 N. R.	20.8	19.2	18.8	**Anaheim**	13.7	12.7	13.3
I-710 N. R.	22.3	22.8	22.3	**Compton**	15.0	14.1	14.5
CA-60 N. R.	**30.4**	**29.0**	**29.1**	**Upland**	14.7	14.0	13.9
I-10 N. R.	27.2	27.6	28.7	**Fontana**	**18.3**	**14.3**	**14.9**

Bold text denotes maximum concentration between near-road and nearby ambient stations.
N/A = data not available (monitoring not started).
The annual average NO_2 NAAQS is 0.053 ppm, or 53 ppb.
I-5 N. R. is located on Interstate 5 at Vernon St. in Anaheim in Orange County.
I-710 N. R. is located on Interstate 710 at Long Beach Bl. in Long Beach in Los Angeles County.
CA-60 N.R. is located on California Route 60 west of Vineyard Av. in Ontario in San Bernardino County.
I-10 N.R. is located on Interstate 10 at Etiwanda Av. in Ontario in San Bernardino County.

Sulfur Dioxide (SO_2)

Health Effects, SO_2

The adverse effects of SO_2 air pollution exposure on health were reviewed in the 2017 U.S. EPA *Integrated Science Assessment (ISA) for Sulfur Oxides - Health Criteria*.[34] This document presents a review of the available scientific studies and conclusions on the causal determination of the health effects of SO_2. A summary of health effects information and additional references can also be found in Appendix I: Health Effects.

The most recent ISA concludes that there is a causal relationship between short-term SO_2 exposure and respiratory effects, particularly in individuals with asthma. The clearest evidence for this conclusion comes from controlled human exposure studies showing lung function decrements and respiratory symptoms in individuals with asthma exposed to SO_2 (0.2 to 0.6 ppm) for 5−10 minutes. Increased resistance to air flow and reduction in breathing capacity leading to severe breathing difficulties, are observed after acute high exposure to SO_2 in asthmatics. This is supported by epidemiologic evidence reporting positive associations for asthma hospital admissions and emergency department visits with short-term SO_2 exposures,

[34] U.S. EPA. (2017). Integrated Science Assessment (ISA) for Sulfur Oxides - Health Criteria (Final Report). U.S. Environmental Protection Agency, Washington, DC, EPA/600/R-17/451. https://www.epa.gov/isa/integrated-science-assessment-isa-sulfur-oxides-health-criteria.

specifically for children. In contrast, healthy individuals do not exhibit similar acute responses even after exposure to higher concentrations of SO_2.

Animal studies suggest that SO_2 at ambient concentrations can cause allergic sensitization and airway inflammation. Some population-based studies indicate that the mortality and morbidity effects associated with fine particles show a similar association with ambient SO_2 levels. In these studies, efforts to separate the effects of SO_2 from those of fine particles have not been successful. It is not clear whether the two pollutants act synergistically or one pollutant alone is the predominant factor.

For long-term SO_2 exposure and respiratory effects, the evidence is suggestive of, but not sufficient to infer, a causal relationship. There are a limited number of new epidemiologic studies showing associations between long-term SO_2 exposure and increases in asthma incidence among children and results of animal toxicological studies that provide a pathophysiologic basis for the development of asthma. However, uncertainty remains regarding the influence of other pollutants or mixtures of pollutants on the observed associations with SO_2 because these new epidemiologic studies have not examined the potential for co-pollutant confounding. Some epidemiologic evidence regarding respiratory symptoms and/or respiratory allergies among children also provides limited support for a possible relationship between long-term SO_2 exposure and the development of asthma.

Air Quality, SO_2

No exceedances of federal or State standards for sulfur dioxide occurred in 2020, or in any recent year, at any of the four South Coast AQMD ambient monitoring locations. The annual and 24-hour federal standards were last exceeded in the 1960's and the State standards were last exceeded in 1990. Though sulfur dioxide concentrations remain well below the standards, sulfur dioxide is a precursor to sulfate, which is a component of fine particulate matter. Table 2-22 summarizes the 2020 maximum 1-hour concentrations of SO_2 by air basin and county. Sulfur dioxide was not measured at any of the Orange County or Coachella Valley sites in 2020. Historical measurements and source emission profiles show that expected concentrations in the Orange County or Coachella Valley will be well below State and federal standards.

TABLE 2-22

2020 MAXIMUM 1-HOUR SO_2 CONCENTRATIONS AND 2018-2020 DESIGN VALUES BY BASIN AND COUNTY

Basin/County	2020 Maximum SO_2 1-Hour Average (ppb)	2018-2020 SO_2 1-Hour Design Value (ppb)	Percent of SO_2 1-Hour NAAQS (75 ppb)	Area of Design Value Max	Percent of SO_2 1-Hour State Standard (0.25 ppm = 250 ppb)
South Coast Air Basin					
Los Angeles	**6.0**	**4**	**5**	**Southwest Coastal LA County**	**2**
Orange	N.D.	N.D.	N.D.	North Coastal Orange County	N.D.
Riverside	2.2	2	3	Metropolitan Riverside County	1
San Bernardino	2.5	2	3	Central San Bernardino Valley	1
Salton Sea Air Basin					
Riverside	N.D.	N.D.	N.D.	Coachella Valley	N.D.

Bold text denotes the peak value.
N.D. = No Data. Historical measurements and lack of emissions sources indicate concentrations are well below standards.
The 1-hour SO_2 design value is the annual 99th percentile 1-hour daily maximum concentration, averaged over 3 years at a station.

Sulfates (SO_4^{2-})

Health Effects, SO_4^{2-}

In 2002, CARB reviewed and retained the State standard for sulfates, retaining the concentration level (25 µg/m^3) but changing the basis of the standard from a Total Suspended Particulate (TSP) measurement to a PM10 measurement. In their 2002 staff report,[35] CARB reviewed the health studies related to exposure to ambient sulfates, along with particulate matter, and found an association with mortality and the same range of morbidity effects as PM10 and PM2.5, although the associations were not as consistent as with PM10 and PM2.5. The 2019 U.S. EPA Integrated Science Assessment for Particulate Matter[36] and the

[35] CARB. (2002). Staff Report: Public Hearing to Consider Amendments to the Ambient Air Quality Standards for Particulate Matter and Sulfates. California Air Resources Board, Sacramento, CA. http://www.arb.ca.gov/regact/aaqspm/isor.pdf.

[36] U.S. EPA. (2019). Integrated Science Assessment for Particulate Matter (Final Report). U.S. Environmental Protection Agency, Washington, DC, EPA/600/R-19/188. https://www.epa.gov/isa/integrated-science-assessment-isa-particulate-matter.

Supplement to the 2019 Integrated Science Assessment for Particulate Matter[37] also review sulfate studies.

Most of the health effects associated with fine particles and SO_2 at ambient levels are also associated with sulfates. These include reduced lung function, aggravated asthmatic symptoms, and increased risk of emergency department visits, hospitalizations, and death in people who have chronic heart or lung diseases. Groups having higher risk of experiencing adverse health effects with sulfates exposure include children, asthmatics, and older adults who have chronic heart or lung diseases. Both mortality and morbidity effects have been observed with an increase in ambient sulfate concentrations. However, efforts to separate the effects of sulfates from the effects of other pollutants have generally not been successful.

Air Quality, SO_4^{2-}

Sulfates, as measured from FRM PM10 filters, were sampled at 7 stations in 2020 in the South Coast AQMD jurisdiction, including one location in the Coachella Valley. Since the sulfate measurement is analyzed in the laboratory from the collected 24-hour PM10 filters, the sulfate network is only conducted at locations in the FRM PM10 monitoring network. The measurements are done every sixth day, except that two stations in Metropolitan Riverside County (Rubidoux and Mira Loma) and one in the Coachella Valley (Indio) measure every third day.

In 2020, the State 24-hour PM10-sulfate standard (25 µg/m^3) was not exceeded anywhere in the Basin or the Coachella Valley, nor has it been exceeded since 1990. The peak Basin sulfate concentration of 5.2 µg/m^3 (21 percent of the State standard) was measured in Metropolitan Riverside. There is no corresponding federal standard for sulfates. Maximum 24-hour concentrations and 3-year maximum State designation values by air basin and county are summarized in Table 2-23.

[37] U.S. EPA. (2021). Supplement to Integrated Science Assessment for Particulate Matter (Final Report). U.S. Environmental Protection Agency, Washington, DC, EPA/600/R-21/198. https://cfpub.epa.gov/ncea/isa/recordisplay.cfm?deid=352823.

TABLE 2-23

2020 MAXIMUM 24-HOUR AVERAGE SULFATE (SO_4^{2-} FROM PM10) CONCENTRATIONS BY BASIN AND COUNTY

Basin/County	2020 Maximum SO_4^{2-} 24-Hour Average (µg/m³)	2018-2020 SO_4^{2-} 24-Hour State Designation Value (µg/m³)	2020 Percent of SO_4^{2-} State Standard (25 µg/m³)	Area of Max
South Coast Air Basin				
Los Angeles	**3.3**	**6.9**	**28**	**Metropolitan Los Angeles County**
Orange	3.3	4.2	17	Central Orange County
Riverside	5.2	4.2	17	Metropolitan Riverside County
San Bernardino	3.0	4.6	18	Central San Bernardino Valley
Salton Sea Air Basin				
Riverside	2.7	2.6	10	Coachella Valley (Indio)

Bold text denotes the peak value.

Lead (Pb)

Health Effects, Lead

The adverse effects of ambient lead exposures on health were reviewed in the 2013 U.S. EPA document, *Integrated Science Assessment for Lead: Final Report*.[38] This document presents a review of the available scientific studies and conclusions on the causal determination of the health effects of lead. A summary of health effects information and additional references can also be found in Appendix I: Health Effects.

Fetuses, infants, and children are more sensitive than others to the adverse effects of lead exposure. Long-term exposure to low levels of lead can adversely affect the development and function of the central nervous system, leading to learning disorders, distractibility, inability to follow simple commands, and lower intelligence quotients. In adults, increased lead levels are associated with increased blood pressure and risk of coronary heart disease. Lead is linked to important hematological effects, such as impaired red blood cell function. Disorders of various body systems and the role of inflammation due to lead exposure has been shown in various recent studies. These studies indicate that lead exposure may cause respiratory, neurologic, digestive, cardiovascular and urinary diseases. The increased inflammatory cells and mediators due to lead exposure including cytokines and chemokines due to lead exposure may cause

[38] U.S. EPA. (2013). Integrated Science Assessment for Lead (Final Report). U.S. Environmental Protection Agency, Washington, DC, EPA/600/R-10/075F. http://cfpub.epa.gov/ncea/cfm/recordisplay.cfm?deid=255721#Download.

these various organ disorders. Additionally, several recent studies also indicate negative effects on the male reproductive system from lead exposure.

Lead poisoning can cause anemia, lethargy, seizures, and death. Lead can be stored in the bone from early-age environmental exposure, and elevated blood lead levels can occur due to breakdown of bone tissue during pregnancy, hyperthyroidism (increased secretion of hormones from the thyroid gland), and osteoporosis (breakdown of bony tissue). Fetuses and breast-fed babies can be exposed to higher levels of lead because of previous environmental lead exposure of their mothers.

Air Quality, Lead

Lead (Pb), as analyzed from Total Suspended Particulate (TSP) samples, was measured at eight ambient locations and an additional four source-specific stations in the Basin in 2020. Based on the review of the NAAQS for lead, the U.S. EPA established the current standard of 0.15 µg/m^3 for a rolling 3-month average, effective October 15, 2008. There have been no violations of the lead standards at the South Coast AQMD's regular population-based ambient air monitoring stations since 1982, primarily as a result of removal of lead from gasoline. However, monitoring at two stations immediately adjacent to stationary sources of lead recorded exceedances of the current standard in Los Angeles County over the 2007-2009 time period. These data were used for designations under the revised standard that also included new requirements for near-source monitoring. As a result, a nonattainment designation was finalized for much of the Los Angeles County portion of the Basin when the current standard was implemented.

Table 2-24 summarizes the Basin's maximum 3-month rolling average lead concentrations recorded in 2020 and in the 2018-2020 design value period, by county. The current lead concentrations in Los Angeles county are now well below the NAAQS, including the monitoring at the source-oriented locations, the highest of which is now 40 percent of the NAAQS for the maximum 3-month rolling average occurring near the beginning of the 3-year design value period. More recent lead data from the source-specific locations have been even lower due, in part, to the implementation of stricter South Coast AQMD rules for these sources. The peak 3-month average in 2020 (0.02 µg/m^3) was only 13 percent of the NAAQS. The other three counties in the Basin have also remained well below the NAAQS. The less-stringent State 30-day standards for lead were not exceeded in any area of the South Coast AQMD in 2020, or in recent years.

The current design values are all less than the NAAQS. However, filter-based measurements for lead from March 28, 2020 to June 26, 2020 are not available due to the COVID-19 Pandemic thus, the values for 2020 are considered invalid since they fail the completeness requirement. It will not be possible to request redesignation as attainment until there are three complete years of data. The earliest this can happen is after 2023. The South Coast AQMD plans to petition the U.S. EPA for redesignation as attainment for lead after data completeness requirements are met.

TABLE 2-24

2020 MAXIMUM 3-MONTH ROLLING AVERAGE LEAD (PB) CONCENTRATIONS AND 2018-2020 DESIGN VALUES BY BASIN AND COUNTY *

Basin/ County	2020 Max Pb 3-Month Rolling Average (µg/m³)	2018-2020 Max Pb 3-Month Rolling Average Design Value (µg/m³)	Percent of Current Pb NAAQS (0.15 µg/m³)	Area of Design Value Max	2020 Max Pb 30-Day Average (µg/m³)	Percent of State Pb Standard (1.5 µg/m³)
South Coast Air Basin						
Los Angeles**	**0.02**	**0.06**	**40**	**Metropolitan Los Angeles**	**0.025**	**4**
Orange	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Riverside	0.01	0.010	7	Metropolitan Riverside County	0.016	1
San Bernardino	0.01	0.01	7	Central San Bernardino Valley	0.010	1
Salton Sea Air Basin						
Riverside	N.D.	N.D.	N.D.	Coachella Valley	N.D.	N.D.

Bold text denotes the peak value.

N.D. = No Data. Historical measurements and emissions profiles indicate concentrations would be well below standards.

* Filter-based measurements for lead from March 28, 2020 to June 26, 2020 have limited availability due to the COVID-19 Pandemic. As a result, none of the values presented here meet the U.S. EPA completeness criteria except for the near-source ATSF station.

** The maximum 3-month average design value was measured at a near-source station in Los Angeles County (Uddelholm).

Air Quality Compared to Other U.S. Metropolitan Areas

Despite significant improvements, the Basin continues to experience some of the worst air quality in the nation. In 2020, nine of the country's top ten locations most frequently exceeding the 2015 8-hour ozone NAAQS were located within the Basin, including stations in San Bernardino, Riverside and Los Angeles Counties.[39] The location with the highest number of days over the 2015 8-hour ozone NAAQS was in the Basin's Eastern San Bernardino Valley (141 days at the Redlands station). The Basin exceeded the 2008 8-hour ozone NAAQS on 142 days, more days than any other areas in the country. The Basin exceeded the 2015 ozone NAAQS on 157 days. The Basin also recorded the highest 8-hour average ozone concentrations of any area in the nation, with stations in the Basin making up all of the country's top ten locations with the highest fourth maximum 8-hour average ozone concentrations (0.105-0.125 ppm). The single highest maximum 8-hour average ozone concentration recorded in 2020 was also measured at a Basin station (0.139 ppm in the Central San Bernardino Mountains area, almost 200 percent of the 2015 ozone NAAQS).

Figures 2-11 and 2-12 show the number of days exceeding federal standards by Air Quality Index (AQI) category for ozone, PM2.5, and PM10 in the Basin compared to other major metropolitan areas in the U.S. and California air basins, respectively. These totals include days influenced by exceptional events, such as wildfires and high wind dust events, which may be excluded with the U.S. EPA concurrence when calculating regulatory design values. All areas recorded at least one exceedance of the 2015 8-hour ozone NAAQS, with the Basin, San Joaquin Valley, and South Central Coast all recording at least one Very Unhealthy AQI (8-hour average concentration ≥ 0.106 ppm) day. Similarly, all areas recorded at least one exceedance of the 24-hour PM2.5 standard, with much higher exceedance totals in California air basins and Phoenix metro area compared to other areas. Some of the days with the highest recorded PM2.5 concentrations in these areas were influenced by the particularly severe wildfire season throughout the western U.S. in 2020. In California, the 2020 wildfire season was the largest in modern history to date, with a total burn area of more than 4 million acres, or 4 percent of California's total land area. The 24-hour PM10 standard was exceeded in the Basin, Phoenix, and Chicago, as well as in all California air basins shown. As for PM2.5, wildfire smoke likely contributed to PM10 exceedances throughout California. High wind dust events may have also impacted PM10 levels, particularly in the Phoenix metro area.

Exceedances of CO, NO2, and SO2 federal standards are generally rare in California and other major metropolitan areas in the U.S. Of the areas shown in Figures 2-11 and 2-12, the only exceedance of the 1-hour NO2 NAAQS in 2020 was recorded in the Basin at the Ontario near-road station, and the only exceedances of the 1-hour SO2 standard were recorded in Chicago (five exceedances) and San Francisco Bay Area (one). Federal CO standards were not exceeded at any station in the U.S. in 2020. Nationwide,

[39] The top ten stations in the nation for number of exceedances of the 2015 8-hour ozone NAAQS in 2020 include Basin stations in the areas of East San Bernardino Valley (Redlands), Central San Bernardino Mountains (in the Crestline-Lake Gregory community), Central San Bernardino Valley (San Bernardino and Fontana), Northwest San Bernardino Valley (Upland), Pomona/Walnut Valley (Pomona), East San Gabriel Valley (Glendora) and Metropolitan Riverside County (Riverside-Rubidoux and Mira Loma), as well as one station in the San Joaquin Valley Air Basin (Sequoia and Kings Canyon National Park).

the federal lead standard (not shown) was exceeded at two locations in 2020 at source-oriented monitoring stations in Missouri.

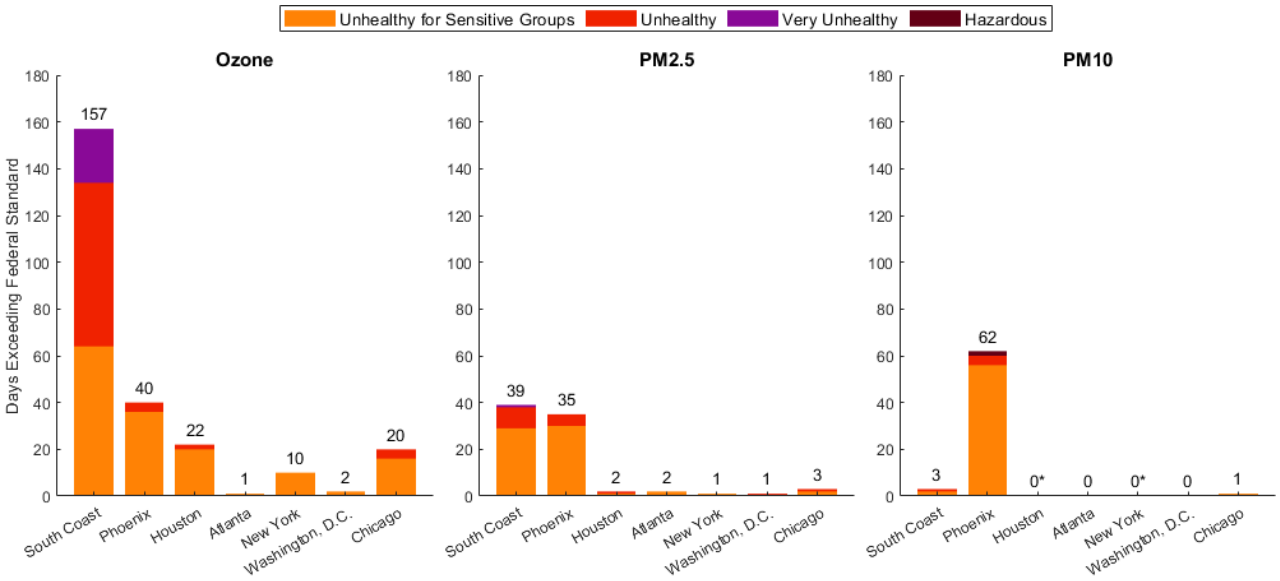

FIGURE 2-11

2020 SOUTH COAST AIR BASIN AIR QUALITY COMPARED TO OTHER U.S. METRO AREAS

(DAYS EXCEEDING FEDERAL STANDARD BY MAXIMUM POLLUTANT-BASED AQI RECORDED IN AREA. AIR QUALITY DATA FOR METRO AREAS WAS COLLECTED FROM ALL STATIONS WITHIN CORE-BASED STATISTICAL AREAS AS DEFINED BY THE U.S. CENSUS BUREAU. ASTERISKS INDICATE AREAS WHERE DAILY MEASUREMENTS ARE NOT AVAILABLE AND ANNUAL EXCEEDANCES HAVE BEEN ESTIMATED FROM 1-IN-3 DAY OR LESS FREQUENT SAMPLING.)

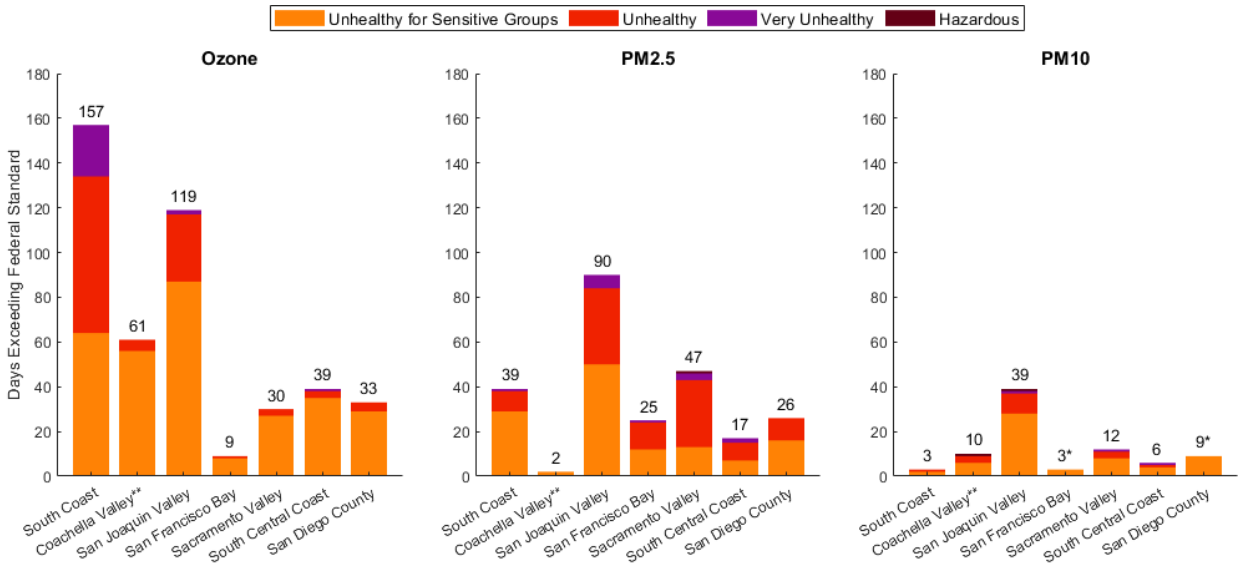

FIGURE 2-12
2020 SOUTH COAST AIR BASIN AIR QUALITY COMPARED TO OTHER CALIFORNIA AIR BASINS
*(DAYS EXCEEDING FEDERAL STANDARD BY MAXIMUM AQI RECORDED IN AREA. ASTERISKS INDICATE AREAS WHERE DAILY MEASUREMENTS ARE NOT AVAILABLE AND ANNUAL EXCEEDANCES HAVE BEEN ESTIMATED FROM 1-IN-3 DAY OR LESS FREQUENT SAMPLING. **COACHELLA VALLEY IS DEFINED AS THE RIVERSIDE COUNTY PORTION OF THE SALTON SEA AIR BASIN.)*

As noted previously, federal standard exceedances do not necessarily indicate NAAQS violations and subsequent attainment/nonattainment designation changes, which is determined by the design value form of the NAAQS. Figures 2-13 and 2-14 show the 2018-2020 3-year design values for the Basin compared to other urban areas in the U.S. and California, respectively. These design values reflect monitoring data as of May 2021, but values may be updated as the U.S. EPA concurs on exceptional event demonstrations submitted by local air agencies.

For the 2018-2020 period, 8-hour ozone design values in most urban areas and California air basins exceeded the 2015 8-hour federal standard. Design values in the San Francisco Bay Area basin and Atlanta were at or just below the standard, with values of 0.069 and 0.07 ppm, respectively. For the revoked 1979 1-hour ozone NAAQS, only the Basin had a design value over the federal standard for the 2018-2020 period. The design values for annual averaged PM2.5 were over the 2012 annual PM2.5 NAAQS for the Basin, Phoenix metro area, San Joaquin Valley, and Sacramento Valley. The 24-hour PM2.5 design values exceeded the 24-hour NAAQS in the Basin, San Joaquin Valley, San Francisco Bay Area, and Sacramento Valley. However, after removing PM2.5 exceedances caused by the Bobcat and El Dorado Fires in September 2020, the Basin meets the 24-hour federal standard. PM2.5 design values in other California air basins affected by wildfires may also decrease after the exceptional event process is completed. PM10 design values exceeded the 24-hour federal standard in the Basin and all other California air basins shown in Figure 2-14, as well as in the Phoenix metro area. These values will likely decrease as the exceptional

event process is completed. Design values for NO_2, SO_2, and CO (not shown) did not violate the NAAQS in any of the urban areas or air basins shown for the 2018-2020 period.

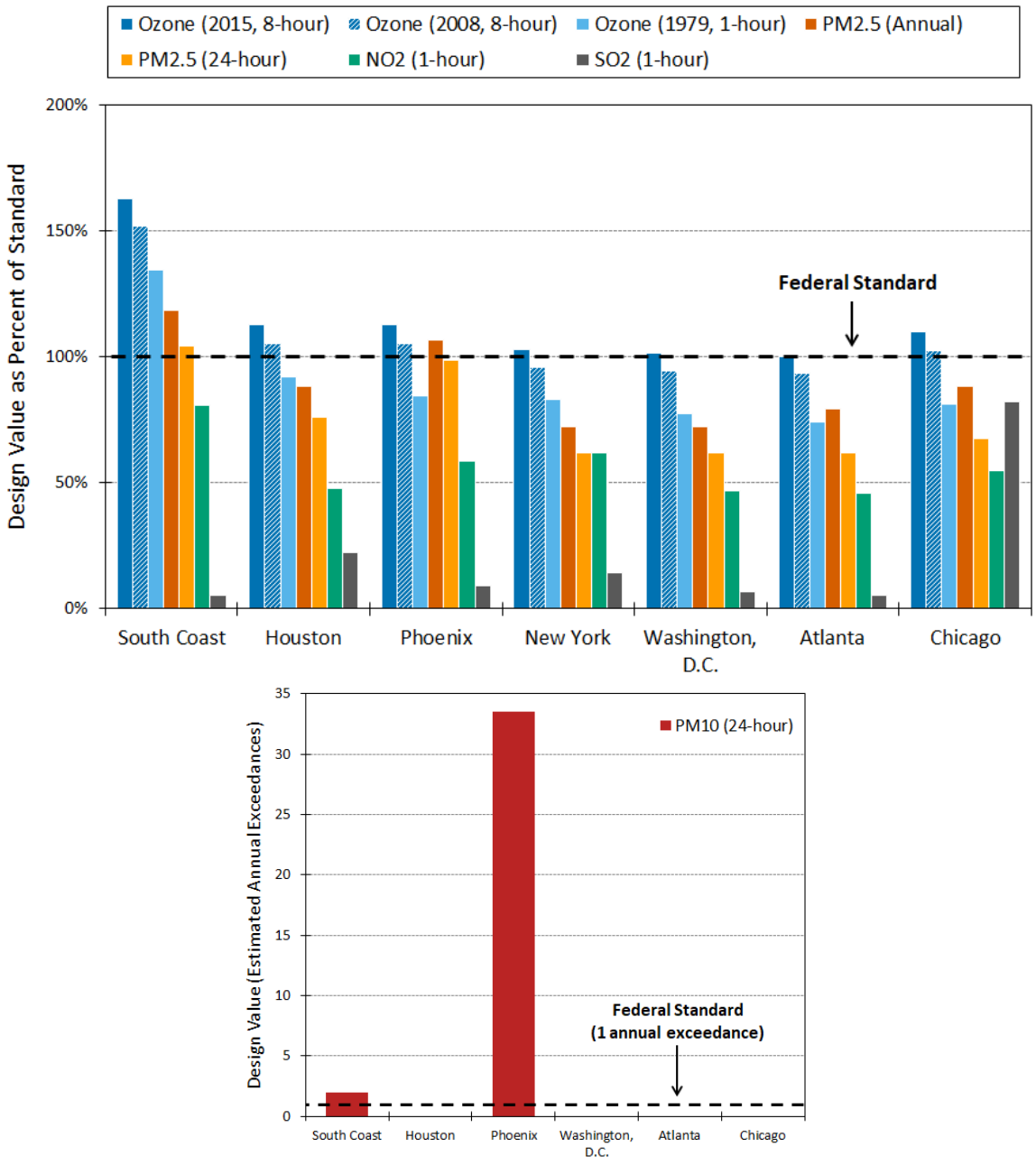

FIGURE 2-13

2018-2020 SOUTH COAST AIR BASIN DESIGN VALUES COMPARED TO OTHER U.S. METRO AREAS

(TOP PANEL SHOWS MAXIMUM 3-YEAR DESIGN VALUE CONCENTRATIONS AS PERCENTAGES OF THE CORRESPONDING NAAQS; BOTTOM PANEL SHOWS MAXIMUM 3-YEAR DESIGN VALUES FOR PM10, WHICH ARE BASED ON THE NUMBER OF AVERAGE ANNUAL EXCEEDANCES. NEW YORK IS NOT INCLUDED IN THE BOTTOM PANEL SINCE THERE ARE NO STATIONS WITH AVAILABLE PM10 DESIGN VALUES. FOR ALL POLLUTANTS, ONLY EXCEPTIONAL EVENTS THAT HAVE BEEN CONCURRED BY THE U.S. EPA HAVE BEEN REMOVED. DESIGN VALUES FOR METRO AREAS ARE BASED ON ALL STATIONS WITHIN CORE-BASED STATISTICAL AREAS AS DEFINED BY THE U.S. CENSUS BUREAU.)

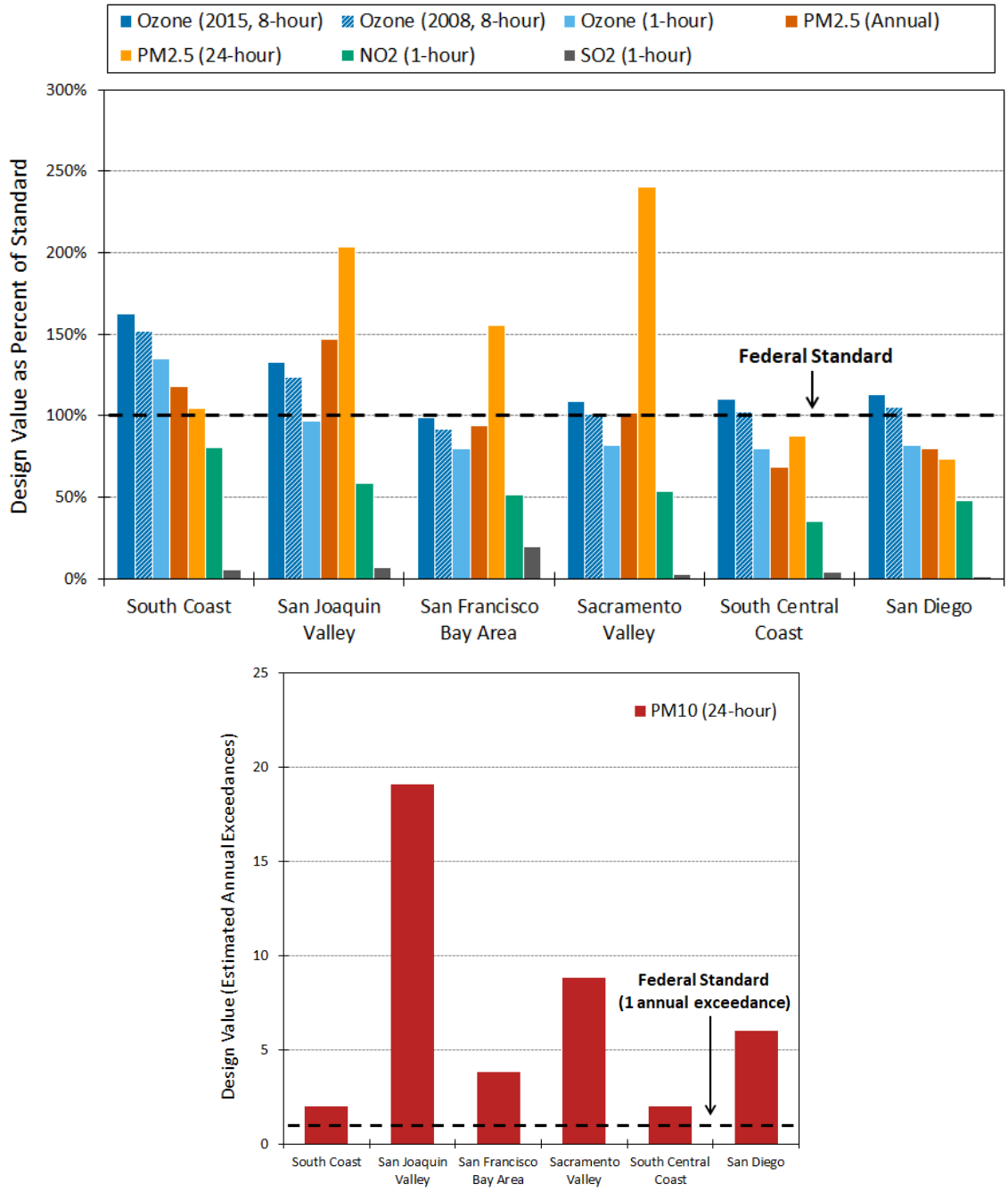

FIGURE 2-14
2018-2020 SOUTH COAST AIR BASIN DESIGN VALUES COMPARED TO OTHER CALIFORNIA AIR BASINS

(TOP PANEL SHOWS MAXIMUM 3-YEAR DESIGN VALUE CONCENTRATIONS AS PERCENTAGES OF THE CORRESPONDING NAAQS; BOTTOM PANEL SHOWS MAXIMUM 3-YEAR DESIGN VALUES FOR PM10, WHICH ARE BASED ON THE NUMBER OF AVERAGE ANNUAL EXCEEDANCES. FOR ALL POLLUTANTS, ONLY EXCEPTIONAL EVENTS THAT HAVE BEEN CONCURRED BY THE U.S. EPA HAVE BEEN REMOVED.)

Atypical Ozone in 2020: The COVID-19 Pandemic, Extreme Heat, and Wildfires

Ozone levels recorded in 2020 were higher than levels in the recent past. 2020 was unique on several fronts. The COVID-19 Pandemic influenced emissions, especially during the initial months of the "safer at home" orders. Record heat gripped the region throughout the ozone season and a record-setting wildfire season throughout the State led to increased emissions of ozone precursors.

The COVID-19 Pandemic Response

The COVID-19 Pandemic started to influence economic activity in March of 2020 in the South Coast AQMD region. During the initial months of "safer at home" orders, light duty vehicle traffic and aircraft activity were significantly curtailed. Activity at the ports of Los Angeles and Long Beach and heavy-duty vehicle traffic declined to a lesser extent. See Figure 2-15.

FIGURE 2-15
CHANGES IN MAJOR EMISSIONS INDICATORS IN 2020

(*THE LEFT-MOST BOX REPRESENTS THE APPROXIMATE CHANGE IN TEUS (TWENTY FOOT EQUIVALENT UNITS) COMPARING APRIL—JUNE 2020 TO APRIL—JUNE 2019. THE CENTER BOX REPRESENTS THE APPROXIMATE CHANGE IN AIRCRAFT OPERATIONS AT LAX, LGB, SNA, BUR, PSP, ONT FROM APRIL—JUNE 2020 TO APRIL—JUNE 2019 FROM FAA OPERATIONS NETWORK (OPSNET). THE RIGHT BOX REPRESENTS THE APPROXIMATE MAXIMUM REDUCTION IN CAR AND TRUCK FLOW FROM PRE-COVID ORDERS (FEB 1 - MAR 7) TO POST-COVID ORDERS (APR 9 TO AUG 6) CALCULATED FROM CALTRANS PEMS DATA.*)

The initial stage of the pandemic from early March to mid-April coincided with a period of frequent rainstorms and strong Basin ventilation that both washed out and dispersed air pollution (Figure 2-16). However, elevated ozone concentrations began during the last week of April when a heatwave affected the region. Periods of high ozone were recorded frequently throughout the late Spring, Summer, and early Fall. While NOx concentrations were likely depressed as compared to previous years due to the pandemic

response, it is unclear whether additional VOC emissions from increased use of cleaning or disinfecting supplies contributed to the elevated ozone levels. The South Coast AQMD's in-house chemical transport modeling analysis[40] indicates that changes in emissions from the COVID-19 mitigation measures likely lead to a 0-3 ppb 8-hour daily maximum ozone enhancement in metropolitan Los Angeles County and a 0-3 ppb ozone reduction in surrounding areas. A study recently conducted at CARB and described in a preprint publication[41] indicates that COVID-19 emission changes resulted in 8-hour daily maximum ozone increases up to 1.2 ppb from March to mid-April and up to a 2 ppb decrease from late-April to early July. Both of these analyses removed the influence of atypical meteorology in 2020, which is detailed below.

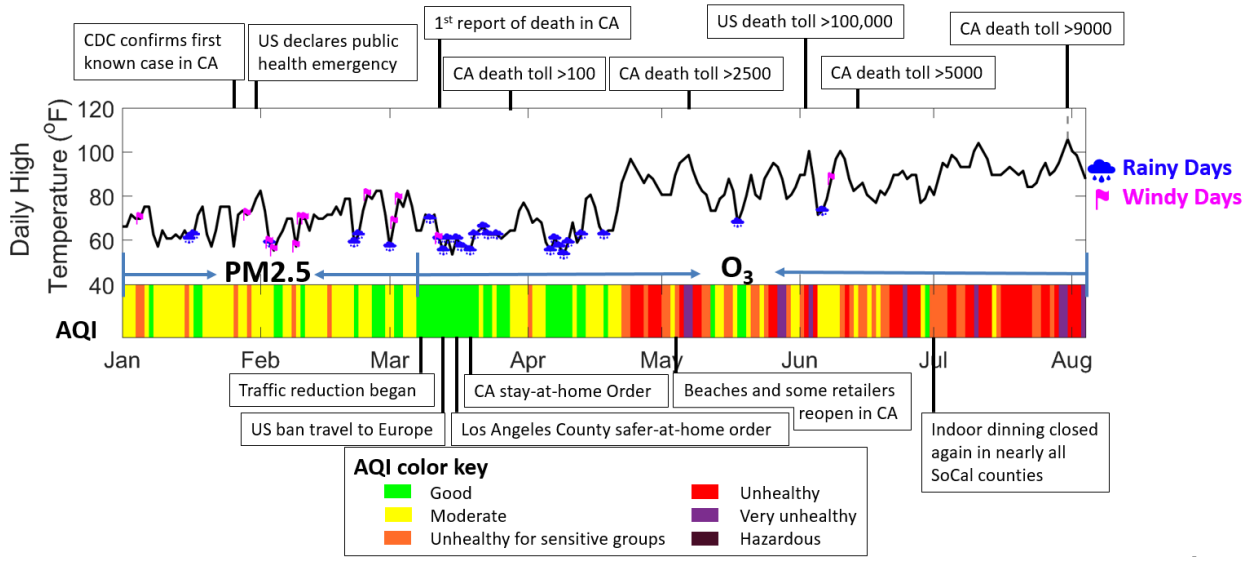

FIGURE 2-16
CHANGES IN AIR QUALITY, METEOROLOGY, AND IMPORTANT EVENTS DURING THE INITIAL PHASES OF THE COVID-19 PANDEMIC IN 2020

(*TEMPERATURE, WIND SPEED, AND RAINFALL ARE MEASURED AT ONTARIO INTERNATIONAL AIRPORT. DAYS WITH MORE THAN 0.01" OF PRECIPITATION ARE FLAGGED AS RAINY DAYS. DAYS WITH A HIGHEST HOURLY WIND SPEED OF GREATER THAN 20 MPH ARE FLAGGED AS WINDY DAYS.*)

Atypical Meteorology in 2020

The 2020 ozone season was atypically hot and stagnant. The summer of 2020 was the third hottest summer on record in the Basin and the hottest summer statewide. Several monthly average temperatures were much above normal or even set temperature records throughout the region (Figure 2-17).

[40] See http://www.aqmd.gov/home/news-events/meeting-agendas-minutes/agenda?title=stmpr-meeting-agenda-january-21-2021 and http://www.aqmd.gov/home/news-events/webcast/live-webcast?ms=CzOlqqL5bKA.

[41] Schroeder, J., Cai, C., Xu, J., Ridley, D., Lu, J., Bui, N., Yan, F., and Avise, J.: Changing Ozone Sensitivity in the South Coast Air Basin during the COVID-19 Period, Atmos. Chem. Phys. Discuss. [preprint], https://doi.org/10.5194/acp-2022-178, in review, 2022.

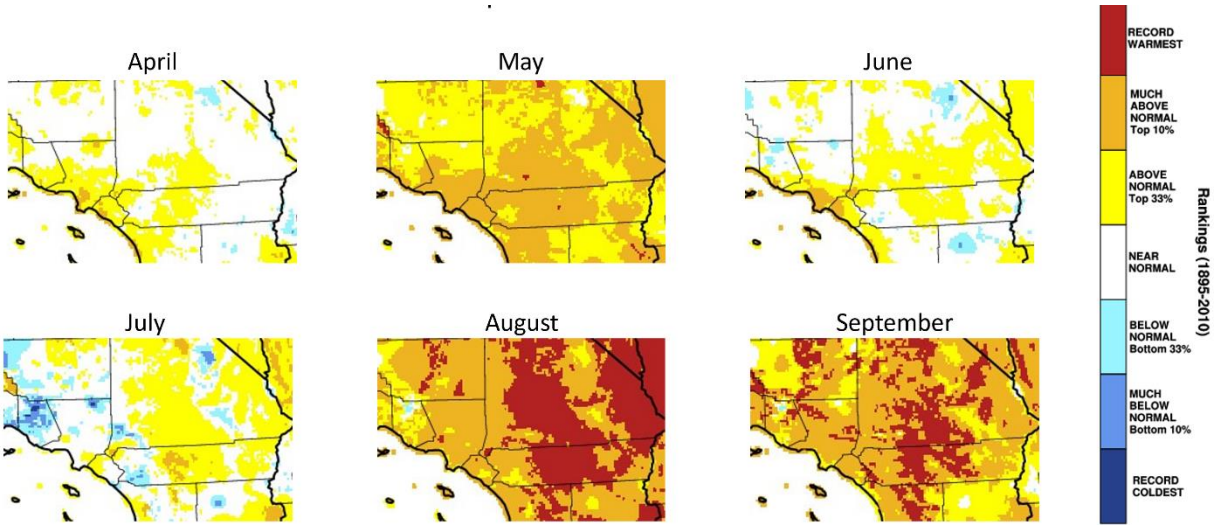

FIGURE 2-17
MEAN TEMPERATURE PERCENTILE IN SOUTHERN CALIFORNIA
(*DATA OBTAINED FROM WESTWIDE DROUGHT TRACKER, U IDAHO/WRCC DATA SOURCE: PRISM (PRELIM), CREATED 11 OCT 2020.*)

The highest ozone days in 2020 were also hotter and more stagnant than the highest ozone days in the previous five years. See Figure 2-18.

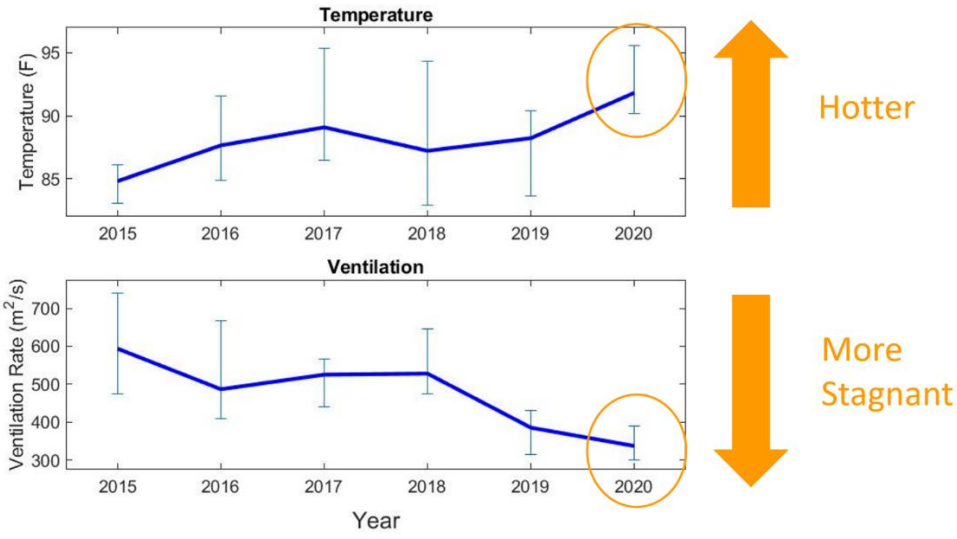

FIGURE 2-18
TEMPERATURE AND BASIN VENTILATION ON THE HIGHEST OZONE DAYS EACH YEAR IN LOS ANGELES[42]

2020 Wildfire Season

Wildfires are a significant source of both fine particulate matter and VOCs. Additional VOC emissions from wildfire activity may lead to increases in ozone throughout the Basin. The 2020 fire season was extremely active, with a record amount of acreage burned. Over 4 million acres burned in 2020, more than double the previous modern record set in 2018 (see Figure 2-19). Both fires within the South Coast Air Basin such as the Bobcat, El Dorado, Silverado, Blue Ridge, Ranch2, Apple and Snow fires and fires in Northern and Central California affected air quality in 2020.

[42] Temperature (F) and ventilation rate (m^2/s) data were extracted from North American Mesoscale Forecast System (NAM) model weather data (which has a resolution of 12 km; https://www.ncei.noaa.gov/access/metadata/landing-page/bin/iso?id=gov.noaa.ncdc:C00630), at the grid cell containing the Central Los Angeles station. The median ventilation and temperature were calculated for the top 19 days with the highest ozone at Central Los Angeles for each year from 2015 through 2020. There were 19 exceedances of the 2015 8-hour ozone standard in 2020 at the Central Los Angeles station. Error bars represent the 95 percent Confidence Interval.

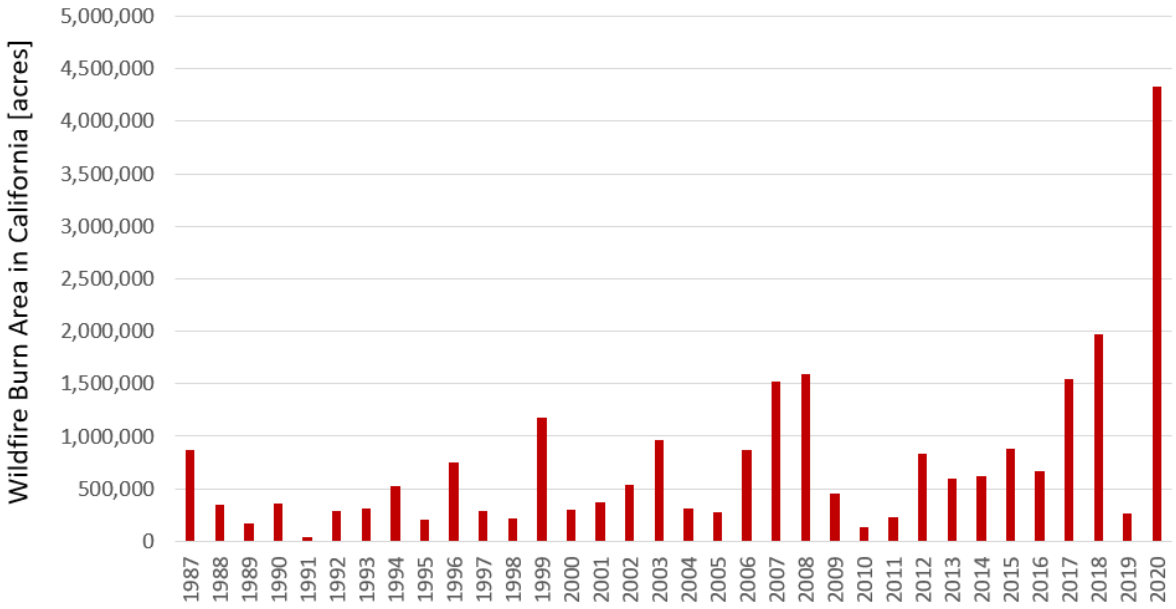

FIGURE 2-19
WILDFIRE BURN AREA IN CALIFORNIA SINCE 1987. SOURCE CALFIRE.

Summary

In the year 2020, the Basin exceeded the most recent federal standards on 49 percent of the days, mainly due to exceedances of ozone and to a lesser extent, PM2.5. The maximum measured concentrations for these pollutants in 2020 were among the highest in the country. In 2020, the Basin exceeded the level of the 2015 8-hour ozone NAAQS on 157 days, with exceedances in all four counties. It exceeded the 2008 and 1997 8-hour ozone NAAQS on 142 and 97 days, respectively. Nine of the top 10 stations in the nation most frequently exceeding the 8-hour federal ozone NAAQS in 2020 were located within the Basin, including stations in San Bernardino and Riverside Counties. While ozone trends had shown continual improvement historically, trends over the past decade have been mostly flat.

The Basin exceeded the PM2.5 24-hour standard on 39 days in 2020, including the near-road measurements (32 days for ambient stations only). Significant improvement has been seen over the past two decades for both 24-hour and annual PM2.5 concentrations. If the U.S. EPA concurs on certain exceptional events, the Basin could be in attainment for the 24-hour standard based on 2018-2020 data. However, the design value for the annual PM2.5 concentration is 108 percent of the standard.

The Coachella Valley area in the Riverside County portion of the Salton Sea Air Basin violated federal and State standards for ozone and PM10. However, the majority of high PM10 concentrations exceeding the federal 24-hour PM10 standard occurred on days influenced by high-wind natural events, which the South Coast AQMD has flagged in the U.S. EPA AQS database. For the stations in the Coachella Valley, the federal 3-year design values for 8-hour ozone have continued to exhibit downward trends through 2020.

The NO_2 concentrations in Los Angeles County exceeded the short-term (1-hour) federal standard on one day at one location in 2020 but did not exceed the standards anywhere on any other day in the Basin. The 98th percentile form of the federal NO_2 standard was not violated and the Basin's attainment status remains intact. The Los Angeles County lead nonattainment area portion of the Basin no longer exceeds the 3-month rolling average lead NAAQS as of the 2018-2020 design value period, including the source-specific monitors. Unfortunately, due to pandemic related monitor shutdowns, the lead data fails the U.S. EPA completeness requirements. A request to the U.S. EPA for re-designation to attainment will be prepared when monitoring requirements are satisfied. Maximum concentrations for SO_2, CO, and sulfate (measured from PM10) continued to remain below the State and federal standards.