Chapter 2

Air Quality In the Valley: Challenges and Progress

This page intentionally blank.

TABLE OF CONTENTS

TABLE OF FIGURES

TABLE OF TABLES

Chapter 2: Air Quality in the Valley: Challenges and Progress

The San Joaquin Valley (Valley) faces significant challenges in attaining ever-tightening federal air quality standards (National Ambient Air Quality Standards, or NAAQS). The Valley's natural environment (including topography, meteorology, drought and wildfires) favors the formation and retention of ozone air pollution in the Valley. The Valley tends to experience the highest ozone concentrations from June to September, due to increased frequency of high pressure systems that influence Valley meteorological and dispersion conditions. Emissions from wildfires, which often occur during the peak of the Valley's ozone season, can further impact public health and exacerbate the region's attainment challenges.

There are also social aspects to the Valley's air quality changes. The Valley is experiencing more population growth than most other areas of California, and increased population can contribute to increases in air pollutant emissions as people drive more and use more consumer projects. The Valley is home to major transportation corridors for goods movement. State and federal law limits the San Joaquin Valley Air Pollution Control District's (District) ability to regulate the vast majority of air pollutant emissions in the region.

Despite these challenges, the innovative control measures and strategies adopted by the District and the California Air Resources Board (CARB) have resulted in substantial emissions reductions and corresponding ozone concentration improvements. Over the last 30 years, the District has observed tremendous reductions in the design value for 8-hour ozone, days exceeding the federal 8-hour ozone standards, along with other metrics. In 2019, the Valley experienced another record-setting ozone season, with the lowest number of days exceeding the federal 70, 75, and 84 parts per billion (ppb) 8-hour ozone standards.

This chapter discusses the life cycle of ozone formation, the Valley's unique challenges, and the Valley's progress in reducing ozone concentrations.

2.1 OZONE LIFE CYCLE

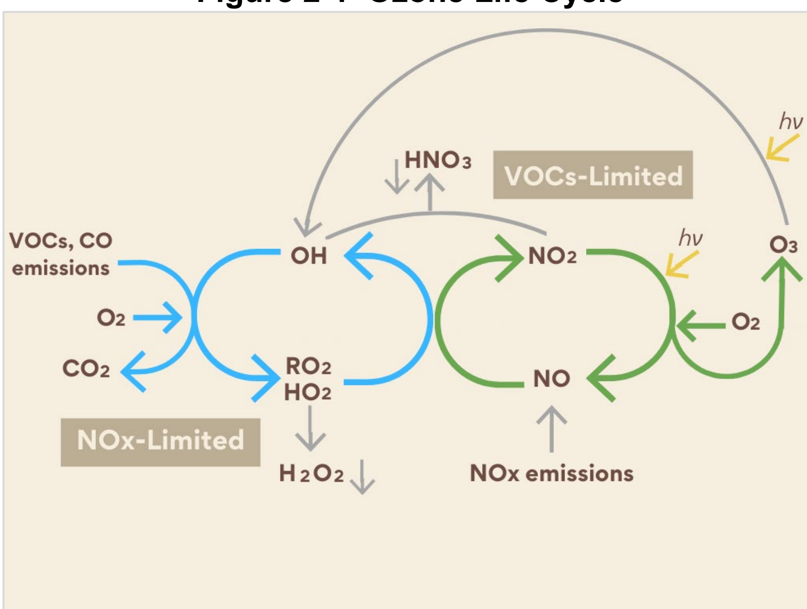
The Valley's ozone levels are a function of geography and natural environment (including meteorology), the production and presence of ozone precursors (e.g. nitrogen oxide (NOx) and volatile organic compounds (VOC)), the atmospheric chemistry that controls the ozone life cycle, and the import of non-Valley emissions into the Valley. Many of these factors vary throughout the year, but during the summer months, they combine to account for the Valley's highest annual ozone concentrations.

In a balanced atmosphere, where precursor VOC and NOx emissions are relatively low, ground-level ozone is created and destroyed at the same rate. This regulates diurnal ozone levels and would keep ozone at an acceptable background concentration. This ozone life cycle occurs continuously while sunlight is present, but ends at nightfall.

Unfortunately, ideal equilibrium in the Valley is rarely reached as the ozone life cycle becomes unbalanced in the presence of elevated VOC and NOx emissions. Biogenic VOC emissions are especially high during the Valley's summer ozone season. However, while biogenic VOC emissions are prevalent throughout the Valley, additional VOC emissions from the combustion of fossil fuels combined with NOx emissions from the same mobile and stationary sources found in metropolitan areas helps give rise to the highest concentrations of ground-level ozone in the Valley. Additionally, wildfires can further overwhelm the equilibrium of the ozone cycle, as discussed further in Chapter 2.

Both VOC and NOx emissions contribute to the formation of ozone. Under high-NOx and low-VOC conditions, the reaction is more sensitive to the amount of VOCs, also considered as a *NOx-rich regime*. Alternatively, when the atmosphere is under high-VOC and low-NOx conditions, a *NOx-limited regime* influences the formation of ozone, which means ozone formation is sensitive to changes in NOx concentration. Figure 2-1 summarizes the ozone life cycle process in both NOx-limited and VOC-limited situations, and further information can be found in the modeling protocol discussion in Appendix F.

Figure 2-1 Ozone Life Cycle



Determination of an ozone formation regime requires an understanding of chemical kinetics and the ability to model the spatial and temporal intricacies of the interactions between reactants and products. To date, grid-based photochemical models remain the best available tool to determine relative precursor limitations. Extensive modeling and weight of evidence analysis shows that the Valley is a *NOx-limited regime*, so NOx reductions are most effective for reducing Valley ozone concentrations. The Valley's significant improvements in ozone concentrations, following CARB's and the District's stringent NOx-reducing regulations, validates the conclusion that the Valley is NOx limited. For these reasons, CARB and the District continue to focus emissions reductions efforts on NOx reductions, as they are the most effective in reducing Valley ozone concentrations.

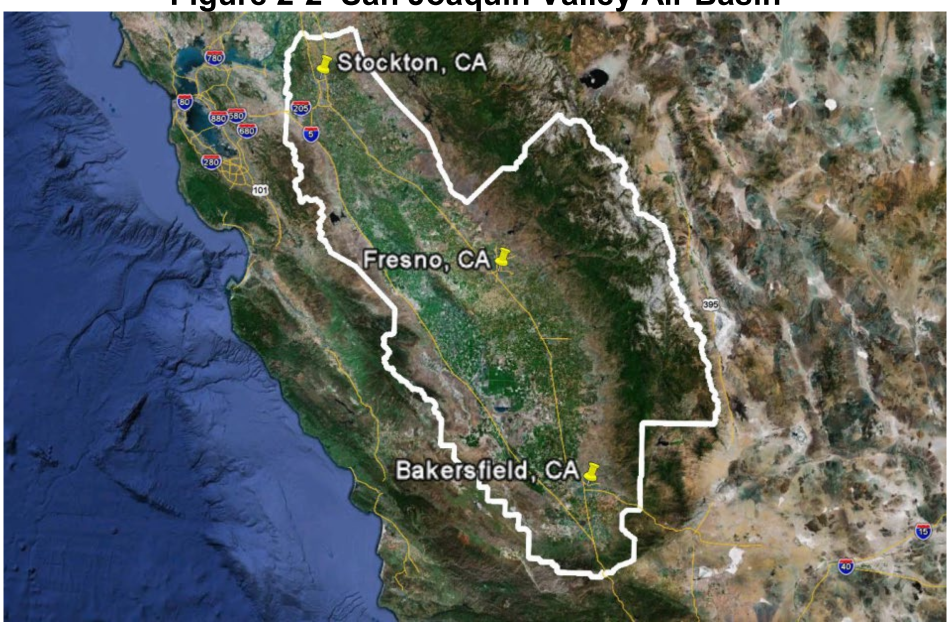
2.2 AIR QUALITY CHALLENGES

2.2.1 Challenges of the Valley's Natural Environment

2.2.1.1 Topography

The challenge of ozone attainment in the Valley is grounded in the unique topographical and meteorological conditions found in the region. The Valley, as seen in Figure 2-2, is an intermountain basin comprised of nearly 25,000 square miles. The Valley's geography and meteorology exacerbate the formation and retention of high levels of air pollution. Surrounding mountains and consistently stagnant weather patterns prevent the dispersal of pollutants that accumulate within the Valley.

Figure 2-2 San Joaquin Valley Air Basin

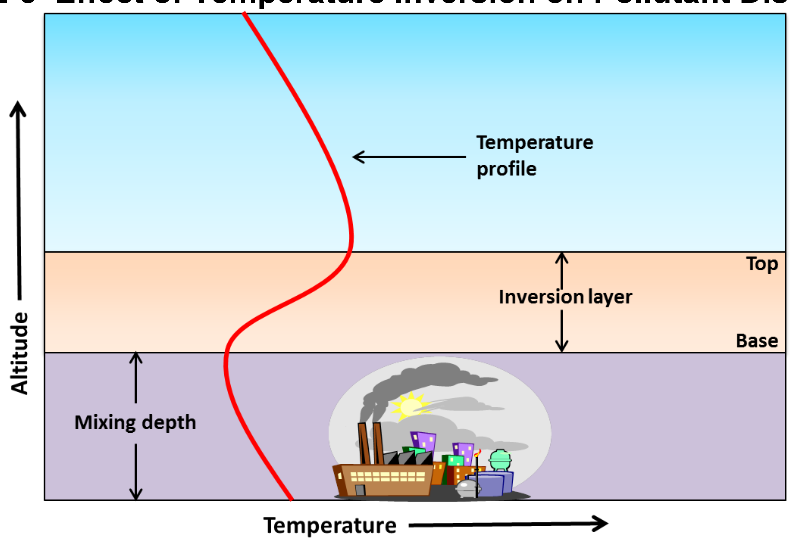


During the summer months, high temperatures, atmospheric stagnation, and temperature inversions create an environment conducive for the formation of elevated ozone levels. The Valley averages over 260 sunny days per year. Nearly 90% of the annual precipitation in the Valley falls between the months of November through April, with little to none occurring during the summer months. Section 2.2.1.2 in this Chapter further discusses annual precipitation and drought in the San Joaquin Valley.

Ozone concentrations tend to be the highest from June to September, because high pressure systems that influence Valley meteorological and dispersion conditions occur most frequently during the summer months. Ozone concentrations rise from the beginning of the year toward the summer where levels reach their peak by August when temperatures are usually the warmest and when high pressure and stagnation over the Valley are most common.

Temperature inversions, or increasing temperature with increasing height (Figure 2-3), can prohibit vertical mixing of an air mass, thus trapping pollutants near the earth's surface. Put simply, the base of the inversion acts as a lid on the atmosphere, trapping pollution. During the ozone season, inversion events caused by high pressure systems cause air pollutant emissions to build up. Ozone precursors then react to form ozone, which can in turn build up concentrations from day to day under a prolonged period of atmospheric stagnation.

Figure 2-3 Effect of Temperature Inversion on Pollutant Dispersion



Drought conditions are caused by circulating high pressure systems. High pressure systems create temperature inversions and limit not only precipitation but clouds from forming overhead. Without clouds, the Valley experiences even more hot days throughout the year, which assists ozone formation and has led to even longer periods of high ozone concentrations.

2.2.1.2 Drought in the San Joaquin Valley

Through daily forecasting as well as through longer-term analysis, the District tracks the ongoing drought and its impact on air quality across the Valley.[1] In general, drought conditions often bring warmer temperatures and longer periods of poor dispersion, which can lead to higher concentrations of pollutants in the Valley.

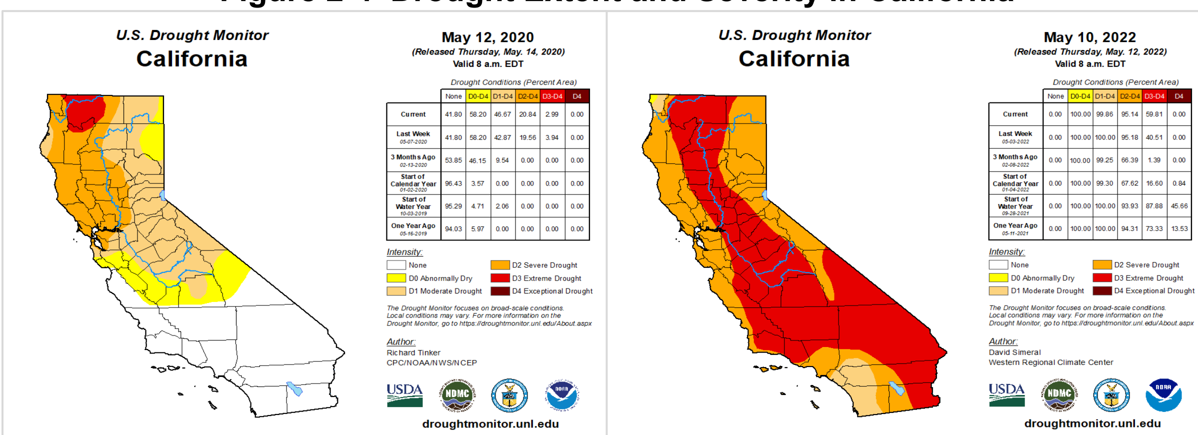
Beginning in April 2021, the Governor of California signed a set of emergency proclamations directing state agencies to take immediate action to bolster drought

[1] See, for example, the District's April 21, 2022 "Report on the 2021-2022 Winter Residential Woodsmoke Reduction Strategy," pages A-7 through A-9, available at https://www.valleyair.org/Board_meetings/GB/agenda_minutes/Agenda/2022/April/final/11.pdf

resilience across the state, and declared a State of Emergency due to severe drought conditions.[2,3,4]

According to the National Oceanic and Atmospheric Administration (NOAA) National Centers for Environmental Information (NCEI) statewide climatological rankings[5], the January 2022 to April 2022 period was the driest on record for California, with a -9.7 inch precipitation deficit. Further, the May 2020 to April 2022 period was the 2nd driest on record. Figure 2-4 depicts the worsening of the California drought between May 2020 and May 2022. The District will continue to monitor these drought conditions for potential impacts to ozone and particulate matter concentrations.

Figure 2-4 Drought Extent and Severity in California[6]



May 12, 2020	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	41.80	58.20	46.67	20.84	2.99	0.00
Last Week 05-07-2020	41.80	58.20	42.87	19.56	3.94	0.00
3 Months Ago 02-13-2020	53.85	46.15	9.54	0.00	0.00	0.00
Start of Calendar Year 01-02-2020	96.43	3.57	0.00	0.00	0.00	0.00
Start of Water Year 10-03-2019	95.29	4.71	2.06	0.00	0.00	0.00
One Year Ago 05-16-2019	94.03	5.97	0.00	0.00	0.00	0.00

May 10, 2022	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	0.00	100.00	99.86	95.14	59.81	0.00
Last Week 05-03-2022	0.00	100.00	100.00	95.18	40.51	0.00
3 Months Ago 02-08-2022	0.00	100.00	99.25	66.39	1.39	0.00
Start of Calendar Year 01-04-2022	0.00	100.00	99.30	67.62	16.60	0.84
Start of Water Year 09-28-2021	0.00	100.00	100.00	93.93	87.88	45.66
One Year Ago 05-11-2021	0.00	100.00	100.00	94.31	73.33	13.53

2.2.1.3 Summer Wildfires

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

For example, in 2020, over 9,900 wildfires were recorded in California, with nearly 4.3 million acres burned across the state, more than doubling the previous statewide record

---

[2] Executive Department, State of California. State of Emergency Proclamation. April 2021. Retrieved from: https://www.gov.ca.gov/wp-content/uploads/2021/04/4.21.21-Emergency-Proclamation-1.pdf
[3] Executive Department, State of California. State of Emergency Proclamation. May 2021. Retrieved from: https://www.gov.ca.gov/wp-content/uploads/2021/05/5.10.2021-Drought-Proclamation.pdf
[4] Executive Department, State of California. State of Emergency Proclamation. October 2021. Retrieved from: https://www.gov.ca.gov/wp-content/uploads/2021/10/10.19.21-Drought-SOE-1.pdf
[5] National Oceanic and Atmospheric Administration National Centers for Environmental Information. California Precipitation Rankings, April 2022. Retrieved from: https://www.ncdc.noaa.gov/cag/statewide/rankings/4/pcp/202204
[6] National Drought Mitigation Center. U.S. Drought Monitor. Retrieved from: https://droughtmonitor.unl.edu/CurrentMap/StateDroughtMonitor.aspx?CA

of approximately 2 million acres burned in 2018.[7] In addition, six of the "Top 20" largest wildfires in California history all occurred during the 2020 season, highlighting the severity of this past season. The 2021 wildfire season was also significant, with over 8,800 fires burning 2,568,948 acres across the state.[8] The District compiles up-to-date wildfire information on its website to keep the public informed about real-time air quality impacts from wildfires.[9] The District and CARB also assess long-term impacts through the attainment planning process.

2.2.1.4 Ozone Transport

The Valley is also greatly affected by pollution transport. Winds, at ground level or at higher altitudes, transport pollutants from other regions into the Valley, within the Valley to areas downwind, and from the Valley into other regions. The amount of pollution transported from other areas into the Valley varies. Typically during an average ozone season day, surface winds pick up ozone precursors emitted in regions to the north of the Valley and transport them southeast toward the central and southern end of the Valley where ozone levels have the potential to form at their highest concentrations. Air flow also moves upslope along the Sierra Nevada Mountains during the day as the air heats up, and then moves downslope as the air cools in the evening. Further exacerbating these difficulties, the Valley is also being increasingly more affected by international ozone transport from China.

2.2.2 Regional Challenges and Regulatory Limits

2.2.2.1 Population Growth

Although California remains, by far, the most populous state in the U.S., its population has been decreasing slightly over the past couple of years. In fiscal year 2020-2021, only 20 California counties grew, including seven in the San Joaquin Valley (San Joaquin, Fresno, Merced, Tulare, Kern, Kings, and Madera).[10] Fresno and Kern Counties are currently the 10th and 11th largest counties in California, respectively.

The District will continue to monitor these short-term population trends, though short-term trends cannot replace longer-term trends for planning purposes. The Population Research Unit of the California Department of Finance (DOF) periodically releases population counts and growth estimates. The DOF's most recent population growth projections, which are based on a 2019 baseline, demonstrate how significantly the Valley's population is expected to grow in the coming years. Based on the DOF data shown in Table 2-1, the Valley's population is expected to increase by 13.9% from 2020

---

[7] See, e.g., the District's June 17, 2021 "Update on 2021 Wildfire Season," available at https://www.valleyair.org/Board_meetings/GB/agenda_minutes/Agenda/2021/June/final/13.pdf

[8] CalFire 2021 Incident Archive, https://www.fire.ca.gov/incidents/2021/

[9] San Joaquin Valley Air District, Wildfire Prevention and Response, https://ww2.valleyair.org/air-quality-information/wildfire-information/

[10] State of California, Department of Finance, E2. California County Population Estimates and Components of Change by Year, July 1, 2010-2021. Sacramento, California, December 2021, Press Release Page 5, available at https://dof.ca.gov/wp-content/uploads/Forecasting/Demographics/Documents/July-2021-Press-Release.pdf

to 2035. Additionally, the total population for the State of California is projected to increase 7.4% over this same time period.

Increasing population generally means increases in air pollutant emissions as a result of increased consumer product use and more automobile and truck vehicle miles traveled (VMT). To offset any growth in emissions from growth in VMT or numbers of vehicle trips, Clean Air Act (CAA) Section 182(d)(1)(A) requires states to submit enforceable transportation control strategies and transportation control measures for severe and extreme nonattainment areas (VMT emissions offset demonstration).[11] The Valley satisfied this requirement through a CARB submittal to the U.S. Environmental Protection Agency (EPA) in July 2020.[12]

While increased population can lead to increased emissions that offset some of the benefits of regulation, ozone precursor emissions have decreased significantly under CARB and District regulations. These emissions reductions have resulted in measurable improvements for the Valley's ozone concentrations, as is discussed later in this chapter. As ozone concentrations decrease, Valley's public health improves.

Table 2-1 Estimated Valley Population by County, 2020-2035[13]

County	Estimated 2020	Projected 2025	Projected 2030	Projected 2035
Fresno	1,026,358	1,053,955	1,096,638	1,135,837
Kern*	912,975	961,629	1,019,221	1,075,952
Kings	154,745	159,733	165,752	171,517
Madera	158,794	168,293	178,070	187,842
Merced	284,761	298,184	314,690	330,805
San Joaquin	776,068	810,495	853,661	891,642
Stanislaus	555,955	581,308	606,128	627,883
Tulare	480,788	496,657	516,810	535,463
Total	***4,350,444***	***4,530,254***	***4,750,970***	***4,956,941***
California	***39,782,419***	***40,808,001***	***41,860,549***	***42,718,403***

** Reflects the population for all of Kern County, not just the portion within the San Joaquin Valley Air Basin.*

2.2.2.2 Environmental Justice Areas

Not all populations face the same environmental challenges. The EPA defines environmental justice (EJ) as the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the

[11] CAA §182(d)(1)(A). https://www.govinfo.gov/content/pkg/USCODE-2013-title42/html/USCODE-2013-title42-chap85-subchapI-partD-subpart2-sec7511a.htm
[12] CARB. *70 ppb Ozone SIP Submittal*. Released May 22, 2020. Retrieved from: https://ww3.arb.ca.gov/planning/sip/2017eivmt/ozone_sip_staff_report.pdf
[13] California Department of Finance. Demographic Research Unit. Report P-2A: Total Population Projections, California Counties, 2010-2060 (baseline 2019 Population Projections; Vintage 2020 Release). Retrieved on May 16, 2022, from: https://dof.ca.gov/wp-content/uploads/Forecasting/Demographics/Documents/P2A_County_Total.xlsx

development, implementation and enforcement of environmental laws, regulations and policies[14]. Environmental injustices occur when a group of people bears a disproportionate share of negative environmental consequences.

Air pollution can have localized impacts in disadvantaged communities throughout California and beyond. Studies show that certain communities, including communities of color and low-income communities, tend to have higher air pollution burden. As identified by the California Office of Environmental Health Hazard Assessment's (OEHHA) CalEnviroScreen, 7 of the 10 most disadvantaged communities in California are located in the San Joaquin Valley.

Federal, state, and regional agencies are all putting more focus on Environmental Justice issues than in the past. At the federal level, Executive Order 12898 directed federal agencies to develop EJ strategies to help federal agencies address disproportionately high and adverse human health or environmental effects of their programs on minority and low-income populations. At the state level, Senate Bill (SB) 535 and Assembly Bill (AB) 1550 designated CalEPA as the agency responsible for identifying "Disadvantaged Communities" (DACs) and established specific requirements for minimum funding levels allocated to DACs.

Several initiatives provide opportunities to improve air quality in the Valley's EJ areas. California Assembly Bill (AB) 617 requires CARB and air districts to develop and implement additional emissions reporting, monitoring, reduction plans and measures in an effort to reduce air pollution exposure in disadvantaged communities. The District continues to work closely with four Valley communities— South Central Fresno, Shafter, Stockton, and Arvin/Lamont— to focus resources and implement community-identified clean air measures to impact air pollution and community engagement at the local level. Additionally, the District established the Environmental Justice Advisory Group (EJAG) to work collaboratively to educate the public and stakeholders about current District activities and air quality awareness and to review and provide feedback on overarching District programs and strategies.

Attainment plans like this *2022 Ozone Plan* are, per federal legal requirements, focused on regional attainment of federal standards. However, air quality improvements under this plan will yield air quality benefits for the Valley's AB 617 and other environmental justice communities.

2.2.2.3 Jurisdictional Limits in Regulatory Authority

Local, regional, state, and federal governments all play a role in regulating sources of ozone precursor emissions. Although reducing mobile source emissions is critical to the Valley's attainment of air quality standards, the District does not have direct regulatory

[14] EPA. "Learn About Environmental Justice". Retrieved from: https://www.epa.gov/environmentaljustice/learn-about-environmental-justice

authority to reduce motor vehicle tailpipe emissions. These emissions are regulated by EPA and CARB.

At the federal level, EPA is responsible for establishing federal motor vehicle emission standards. EPA is also responsible for reducing emissions from locomotives, aircraft, heavy duty vehicles used in interstate commerce, and other sources such as off-road engines that are either preempted from state control or best regulated at the national level.

Although most states are prohibited from setting mobile source emissions standards, CAA section 209 allows California to seek a waiver from this preemption. EPA must approve this waiver where CARB shows the state needs additional emissions reductions from mobile sources and satisfies other requirements.[15] CAA section 117 gives other states the option of adopting California standards as well, and 17 other states have indeed exercised that option.[16] Together, these states constitute about 40% of new light duty vehicle sales in the U.S.[17]

EPA approved the majority of CARB's waiver requests over the years, but in 2019, EPA withdrew its approval of California's 2013 waiver. Several states impacted by this reversal pursued litigation over this EPA action. However, in March 2022, EPA reconsidered this withdrawal and reinstated the 2013 waiver.[18] Reinstatement of this waiver is extremely important for many regions, including the San Joaquin Valley.

Considering the continuing emissions reductions from sources regulated by the District and CARB, and the remaining challenges under federal ozone standards, it is increasingly critical that federal government also take action to reduce emissions from sources under federal regulatory control, such as interstate trucks, locomotives, aircraft, and other mobile sources. Encouragingly, on March 3, 2022, EPA proposed a rule to reduce emissions from heavy-duty vehicles and engines nationwide starting in model year 2027.[19] The District will continue to monitor these federal regulatory activities and advocate for the federal government to do its fair share to improve Valley air quality.

In addition to the emissions standards discussed above, CARB also establishes fuel specifications and develops consumer product standards for meeting air quality goals in California. Other state agencies such as the Department of Pesticide Regulation (DPR), California Department of Transportation (CalTrans), and the Bureau of

[15] EPA. "Vehicle Emissions California Waivers and Authorizations". Retrieved from: https://www.epa.gov/state-and-local-transportation/vehicle-emissions-california-waivers-and-authorizations

[16] CARB. *States that have Adopted California's Vehicle Standards under Section 177 of the Federal Clean Air Act*. (May 13, 2022). Retrieved from: https://ww2.arb.ca.gov/sites/default/files/2022-05/%C2%A7177_states_05132022_NADA_sales_r2_ac.pdf

[17] See footnote 12.

[18] EPA. *California State Motor Vehicle Pollution Control Standards; Advanced Clean Car Program; Reconsideration of a Previous Withdrawal of a Waiver of Preemption; Notice of Decision*. 87 Fed. Reg. 49, pp. 14,332-14,379. (March 14, 2022). Retrieved from: https://www.govinfo.gov/content/pkg/FR-2022-03-14/pdf/2022-05227.pdf

[19] EPA. "Proposed Rule and Related Materials for Control of Air Pollution from New Motor Vehicles: Heavy-Duty Engine and Vehicle Standards". Retrieved from: https://www.epa.gov/regulations-emissions-vehicles-and-engines/proposed-rule-and-related-materials-control-air-1

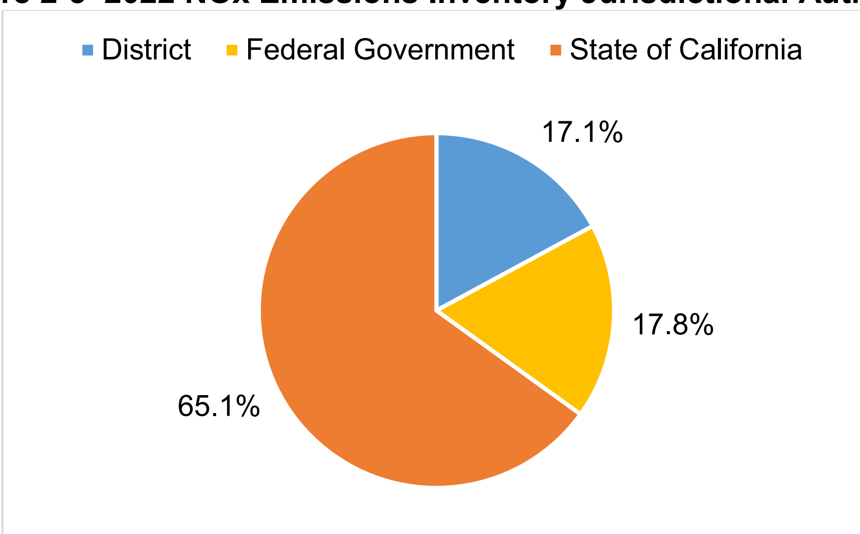
Automotive Repair also have responsibility for certain mobile and mobile-related emissions sources.

Although the District does not have direct regulatory authority over mobile source emissions, the District collaborates with its interagency partners and uses innovative and non-regulatory approaches to reduce mobile source emissions. Districts cooperate with Metropolitan Planning Organizations (MPOs) to develop measures affecting local transportation activity that are included in an attainment plan. In turn, the MPOs coordinate the process to identify and evaluate potential control measures and compile local government commitments that will be included in the local or regional air quality plan.

The District also reduces mobile source emissions through Rule 9510 (Indirect Source Review) and its incentive programs.

The primary jurisdiction of the District is therefore limited to 17% of the total NOx emissions inventory. Figure 2-5 below illustrates this separation of jurisdictional authority in relation to the NOx emissions inventory in 2022.

Figure 2-5 2022 NOx Emissions Inventory Jurisdictional Authority



**Based on 2022 summer average, CEPAM 2019 Ozone SIP v1.04*

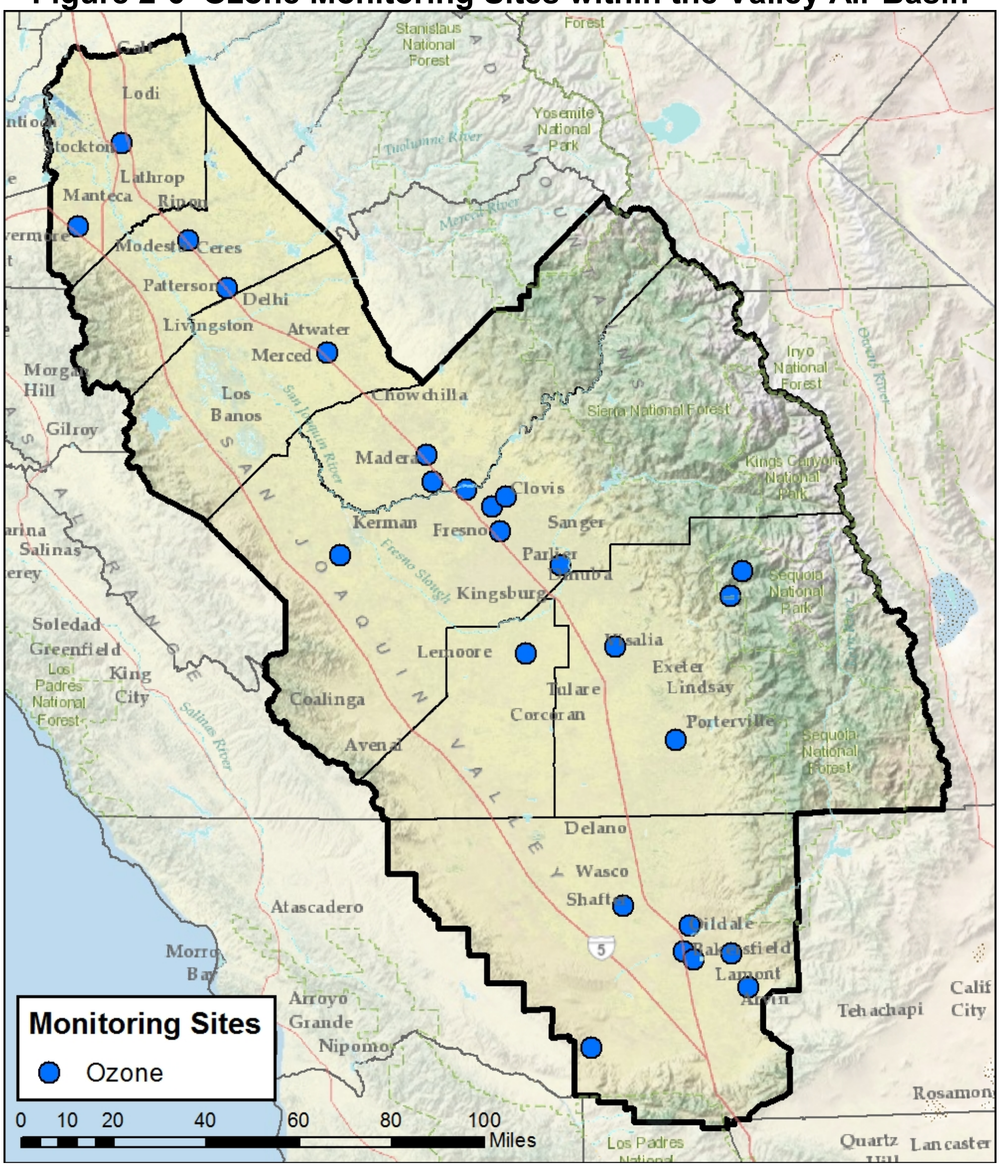
Although the responsibility for establishing the tailpipe emissions standards for mobile sources belongs to state and federal governments, additional reductions are needed from mobile sources to reach attainment. Therefore, the District implements creative measures, such as trip reduction, green contracting, and enhanced indirect source review, to provide additional mobile source emissions reductions for the Valley and will continue to use incentive programs to accelerate mobile source emissions reductions.

2.3 OZONE AIR QUALITY DATA AND PROGRESS

2.3.1 Ozone Monitoring Network

The District, CARB, and the National Park Service (NPS) together operate extensive air monitoring networks in the San Joaquin Valley Air Basin to measure progress towards attaining federal air quality standards. Ozone monitoring networks are designed to monitor areas with high population densities, areas with high pollutant concentrations, areas impacted by major pollutant sources, and areas representative of background concentrations. Together, the District, CARB, and NPS currently operate 25 ozone monitoring sites throughout the Valley (see Figure 2-6).

Figure 2-6 Ozone Monitoring Sites within the Valley Air Basin



EPA requires air monitoring agencies to include a variety of monitoring site types in their air monitoring networks. The monitoring site types within the District's ozone monitoring network measure concentrations for population exposure, highest concentrations, regional transport, and background levels. Often more than one monitoring site type applies to a given location. Table 2-2 identifies the monitoring site types for the ozone monitoring sites operating in the Valley Air Basin.

Table 2-2 Ozone Monitoring Site Types in 2020

Site Name	Population Exposure	Highest Concentration	Regional Transport	Background Levels
Stockton-Hazelton*	✓	✓		
Tracy-Airport			✓	
Modesto-14th St*	✓	✓		
Turlock	✓	✓		
Merced-Coffee	✓	✓		
Madera-City		✓		✓
Madera-Pump Yard		✓		✓
Tranquility	✓			
Fresno-Sky Park	✓	✓	✓	
Clovis-Villa	✓	✓		
Fresno-Garland*	✓	✓		
Fresno-Drummond	✓	✓	✓	
Parlier		✓	✓	
Hanford-Irwin	✓	✓		
Visalia-Church St*				✓
Porterville	✓	✓		
Ash Mountain^		✓	✓	
Lower Kaweah^			✓	
Shafter*	✓			✓
Oildale*		✓	✓	
Bakersfield-California*		✓		✓
Edison*		✓	✓	
Bakersfield-Muni		✓		
Arvin-Di Giorgio*	✓	✓		
Maricopa		✓	✓	

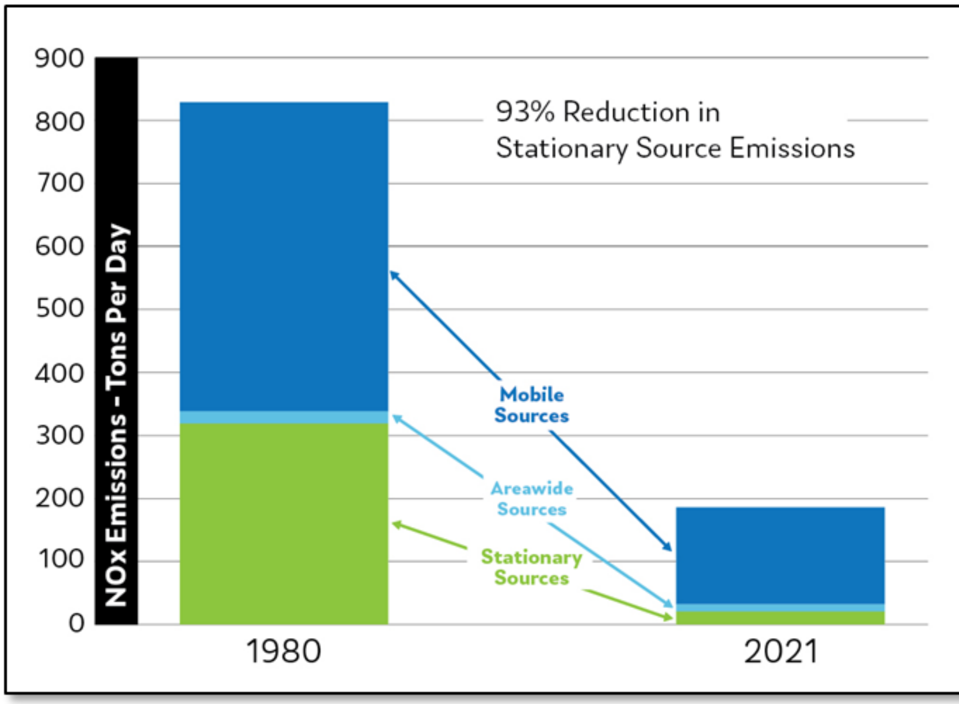
~ In November 2021 Stockton-Hazelton was replaced by Stockton-University Park and in 2022 Visalia-Church St. is being replaced by Visalia-Ashland
^ Monitor operated by the National Park Service
* Monitor operated by CARB

Additionally, the District annually participates in EPA's enhanced Photochemical Assessment Monitoring Stations (PAMS) program. PAMS sites measure ozone precursors, including NOx and VOC, in addition to a variety of meteorological parameters in serious, severe, or extreme ozone nonattainment areas.

2.3.2 Air Quality Progress

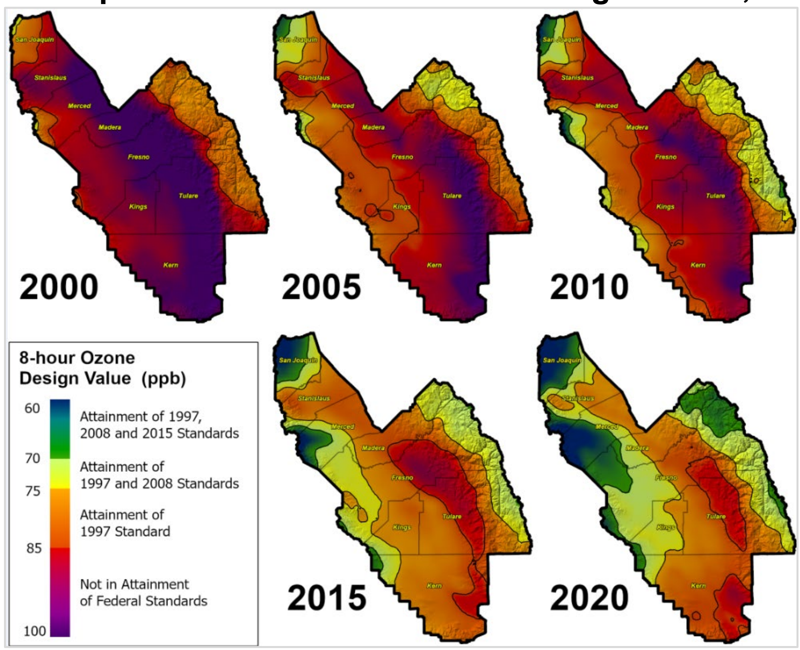
Since 1992, the District has adopted over 650 rules to implement aggressive on-going emissions controls to meet federal CAA requirements. Through the District's and CARB's efforts, Valley NOx emissions have been reduced significantly since 1980, with a 75% overall reduction in NOx and an 93% reduction in stationary source NOx (see Figure 2-7). These emissions reductions have resulted in ozone concentrations that have steadily improved over time.

Figure 2-7 NOx Emissions Reductions, 1980-2021



Ozone monitors yield hourly average concentrations of ozone, reported in parts per million (ppm) to three decimal places. The 1-hour ozone measurements collected by air monitors are also used to calculate 8-hour averages. Since 2000, the Valley has experienced a drastic improvement of overall exposure to ozone (see Figure 2-8). The District is continuing to implement emission control measures committed to in its most recent plans for attaining both the ozone and PM2.5 NAAQS.

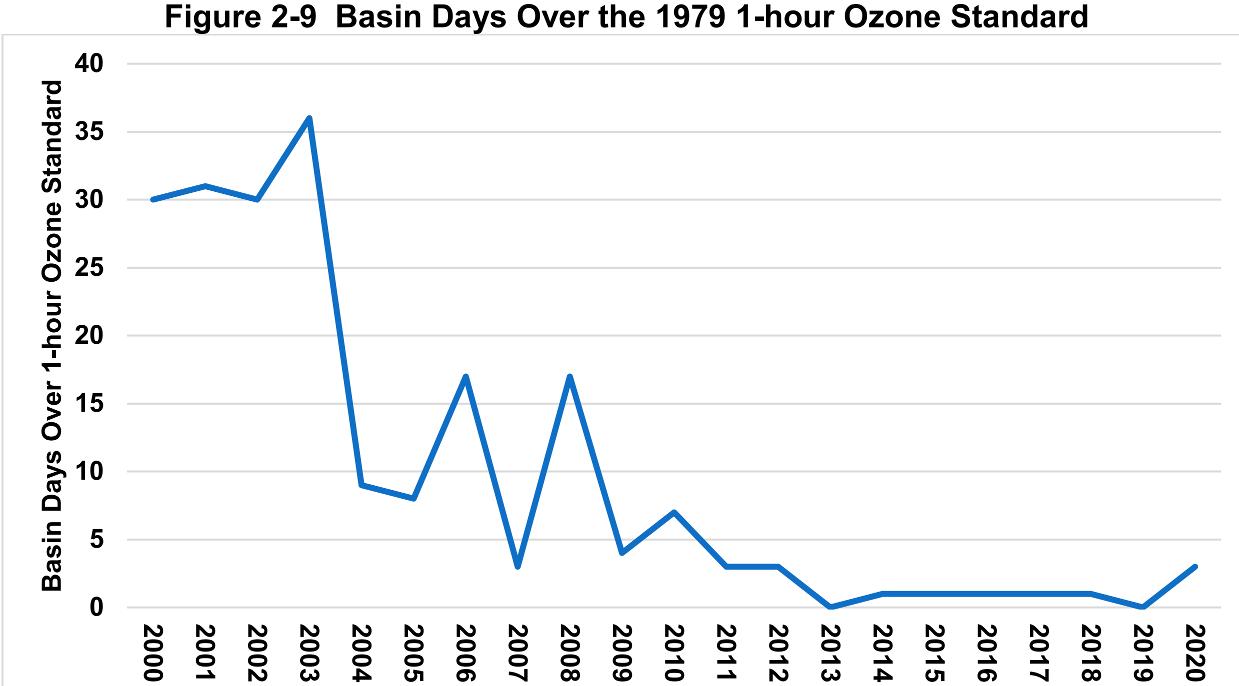
Figure 2-8 Improvement in 8-hour Ozone Design Values, 2000-2019



2.3.2.1 1-Hour Ozone Trends

1-hour ozone concentrations are indicative of the 8-hour ozone concentrations and provide insight as to the progress achieved for 8-hour ozone. The Valley has demonstrated tremendous progress in reducing exceedances of the federal 1-hour ozone standard of 0.12 ppm (see Figure 2-9).

Figure 2-9 Basin Days Over the 1979 1-hour Ozone Standard



On July 18, 2016, EPA approved the District's 1-hour ozone clean data finding request and analysis and determined that the Valley attained the 1-hour ozone NAAQS.[20]

2.3.2.2 8-Hour Ozone Progress

In addition to the great improvements in 1-hour ozone concentrations across the Valley, the District has achieved significant improvements for 8-hour ozone. Over the last 30 years of ozone monitoring, tremendous reductions have been observed in the design value for 8-hour ozone, days exceeding the federal 8-hour ozone standards, along with other metrics.

In 2019, despite strings of triple digit temperatures and multiple wildfires, the Valley had another record setting ozone season with the lowest number of days exceeding the federal 70, 75, and 84 ppb 8-hour ozone standards.

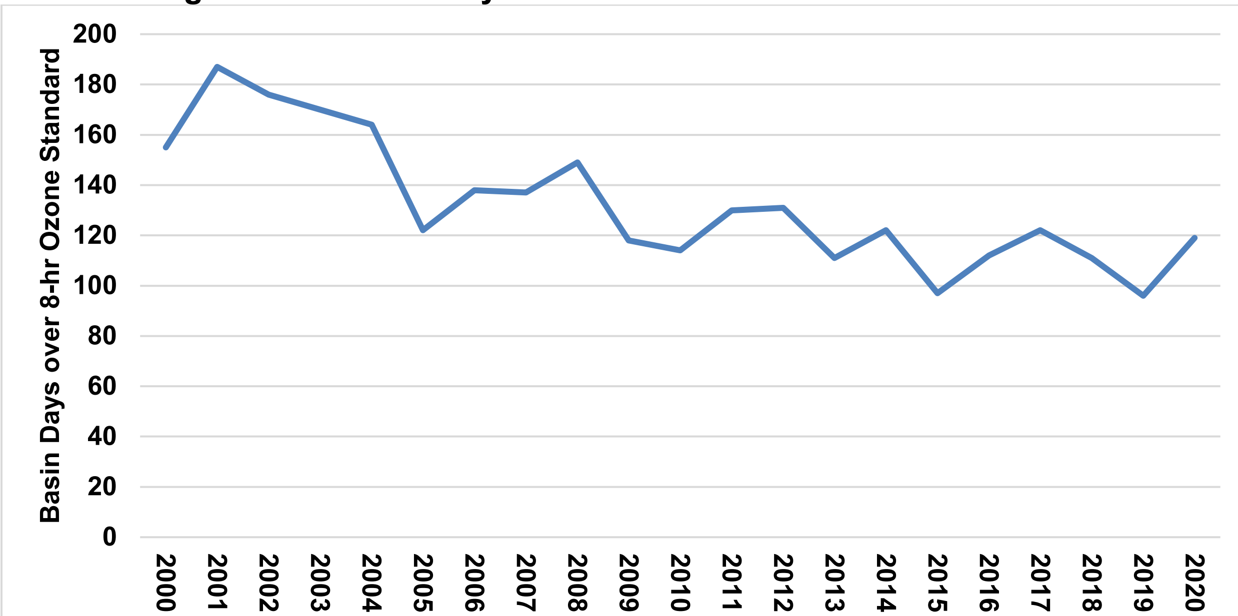
Additionally, in 2019, the Valley:

- Achieved the Valley's lowest 8-hour ozone design value on record, the official metric used to measure progress towards meeting federal ozone standards.
- Finished the year with zero days violating the federal 1-hour ozone standard.
- Completed the fifth consecutive 3-year averaging period without violating the federal 1-hour ozone standard.
- Reduced the average number of basin days a resident experienced ozone levels above the 70, 75, and 84 ppb 8-hour ozone standards by 49%, 63%, and 93%, respectively, since 2001.

From 2000 to 2019, the Valley has experienced a 38% decrease in the number of basin days with ozone concentrations above the 2015 8-hour ozone standard of 70 ppb (see Figure 2-10).

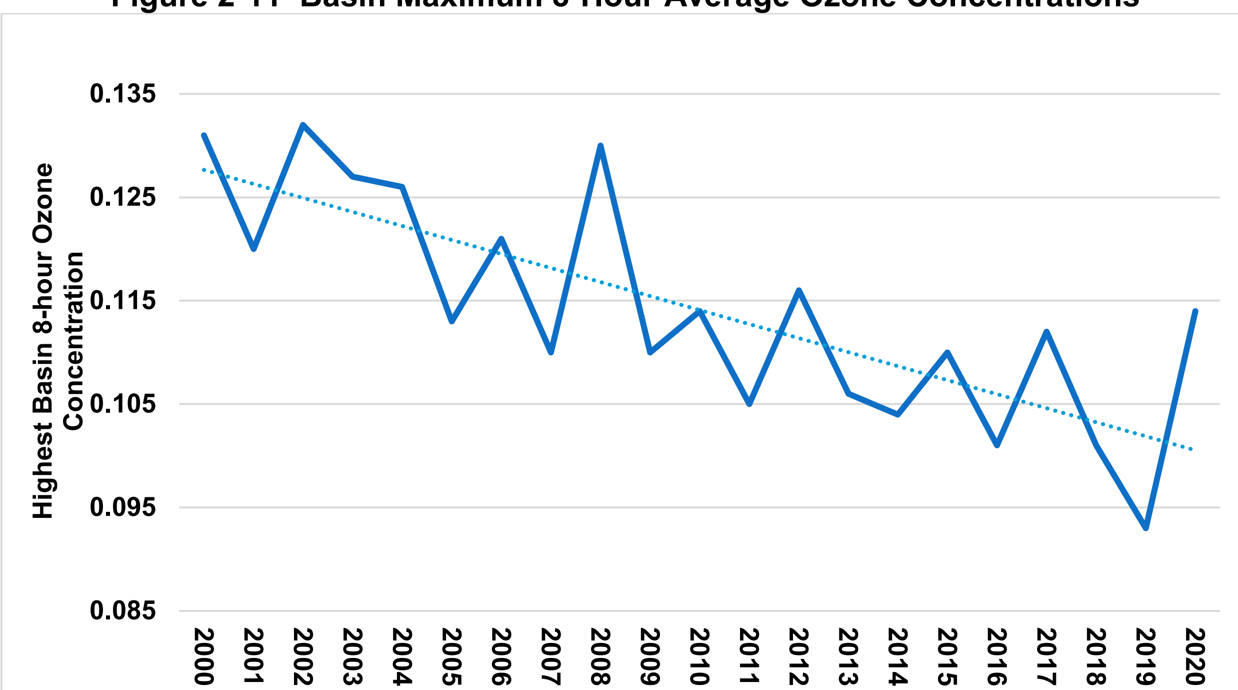
[20] EPA. *Determination of Attainment of the 1-hour Ozone National Ambient Air Quality Standard in the San Joaquin Valley Nonattainment Area in California; Final Rule.* 81 Fed. Reg. 137, pp. 46608-46612. (2016, July 18). https://www.gpo.gov/fdsys/pkg/FR-2016-07-18/pdf/2016-16792.pdf

Figure 2-10 Basin Days over the 2015 8-Hour Ozone Standard



Additionally, the Valley has experienced a 29% decrease in the maximum 8-hour average ozone concentration from 2000 to 2019 (Figure 2-11). In the period from 2000 to 2020, the maximum 8-hour average ozone concentration of 0.132 ppm was experienced by the Valley Basin in 2002. Though there was an increase in the maximum 8-hour average ozone concentration in 2020 compared to 2019, the average continues to trend downward, with a 14% decrease from 2002 to 2020.

Figure 2-11 Basin Maximum 8-Hour Average Ozone Concentrations



2.3.2.3 8-hour Ozone Design Value

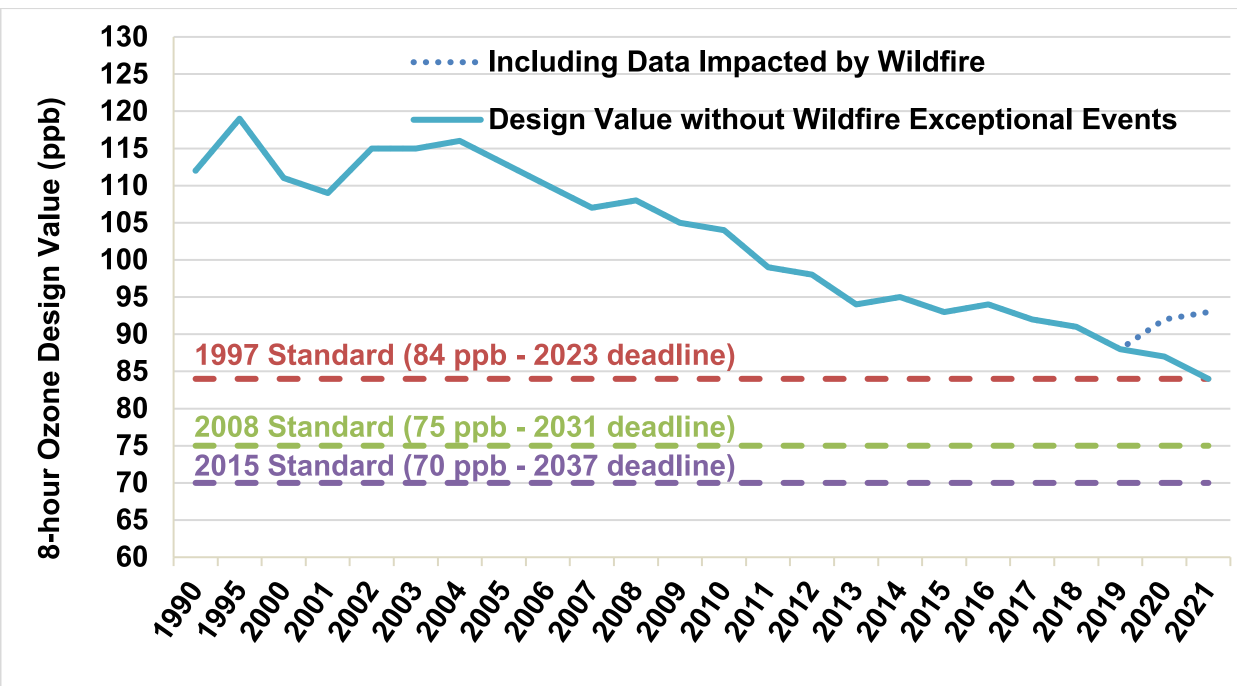
The design value for a given year and site is determined by selecting the fourth highest value from the daily maximum 8-hour average ozone concentrations for each monitoring site and then averaged with corresponding values for the previous two years (as such, the highest three daily maximum 8-hour average ozone values each year do not count towards the attainment determination). The result is the three-year average of the annual fourth-highest daily maximum 8-hour average ozone concentration, which is also called the "design value" for 8-hour ozone. Valley attainment is determined by comparing the highest design value from any site with the NAAQS. Table 2-3 illustrates a sample calculation. The 8-hour ozone NAAQS is met at a given monitoring site when the design value for that site is less than or equal to 0.070 ppm.

Table 2-3 Sample Design Value Calculation (Clovis-Villa, 2020)

Year	Highest Daily Maximum Concentrations (ppm)			
	1st Highest	2nd Highest	3rd Highest	4th Highest
2018	0.094	0.090	0.089	**0.088**
2019	0.079	0.079	0.078	**0.078**
2020	0.108	0.095	0.091	**0.088**
			2020 Design Value for Clovis-Villa:	**0.084**

As a part of the positive trend in improving ozone air quality, the Valley is also on track to meet the federal 1997 8-hour ozone standard of 84 ppb by the 2023 attainment date included in the *2007 Ozone Plan* (Figure 2-12).

Figure 2-12 Decrease in Valley's 8-hr Ozone Design Values



2.4 CONCLUSION

Although there are significant challenges in meeting the federal ozone standards, the control measures and strategies adopted by the District and CARB have resulted in substantial emissions reductions as reflected in the improving ozone metrics discussed above. Air quality will continue to improve as the measures and strategies discussed in this plan are implemented in the coming years.