Chapter 2

Air Quality in the Valley: Challenges and Progress

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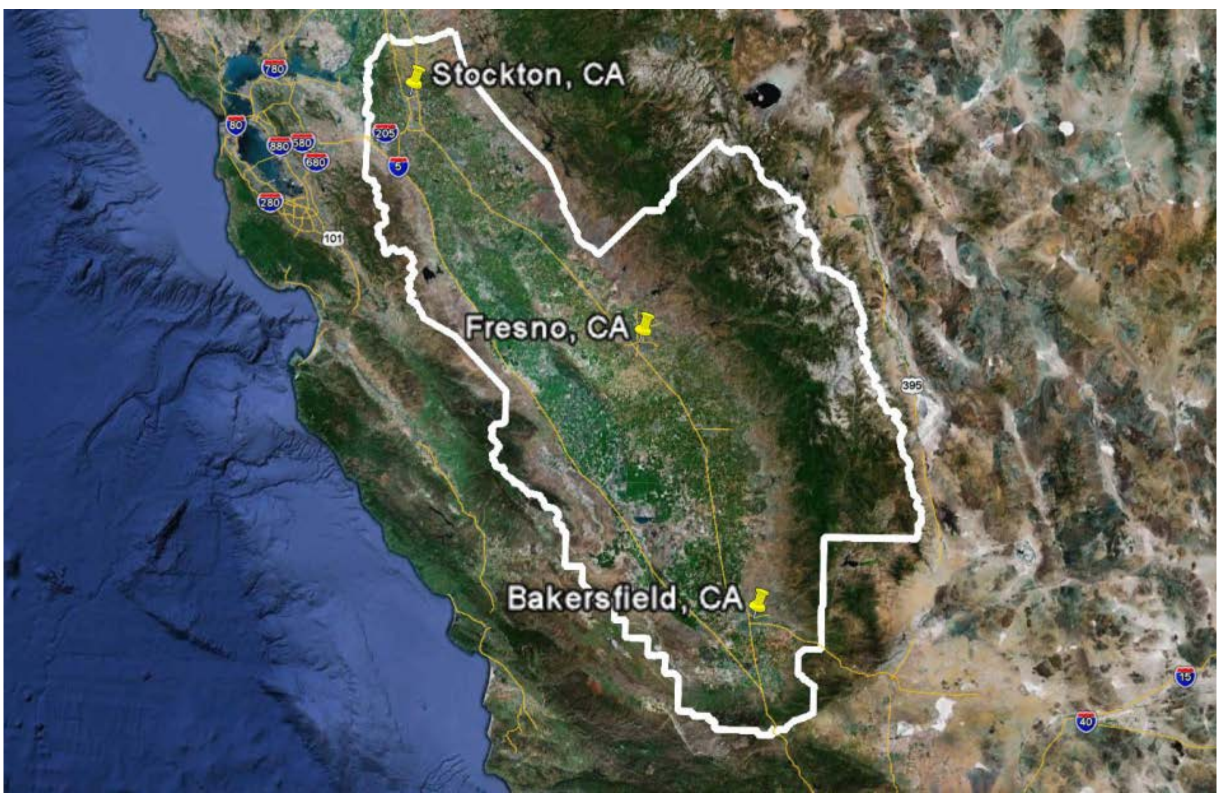
2.1 CHALLENGES OF THE NATURAL ENVIRONMENT

The challenges that the San Joaquin Valley (Valley) faces in attaining ever-tightening federal standards are unmatched by any other region in the nation. These challenges include the Valley's unique geography, topography, and meteorology combined with a rapidly growing population and jurisdictional and regulatory authority limits as discussed in this chapter.

2.1.1 Natural Conditions

The challenge of attainment in the Valley is grounded in the unique topographical and meteorological conditions found in the region. The Valley, as seen in Figure 2-1, 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.

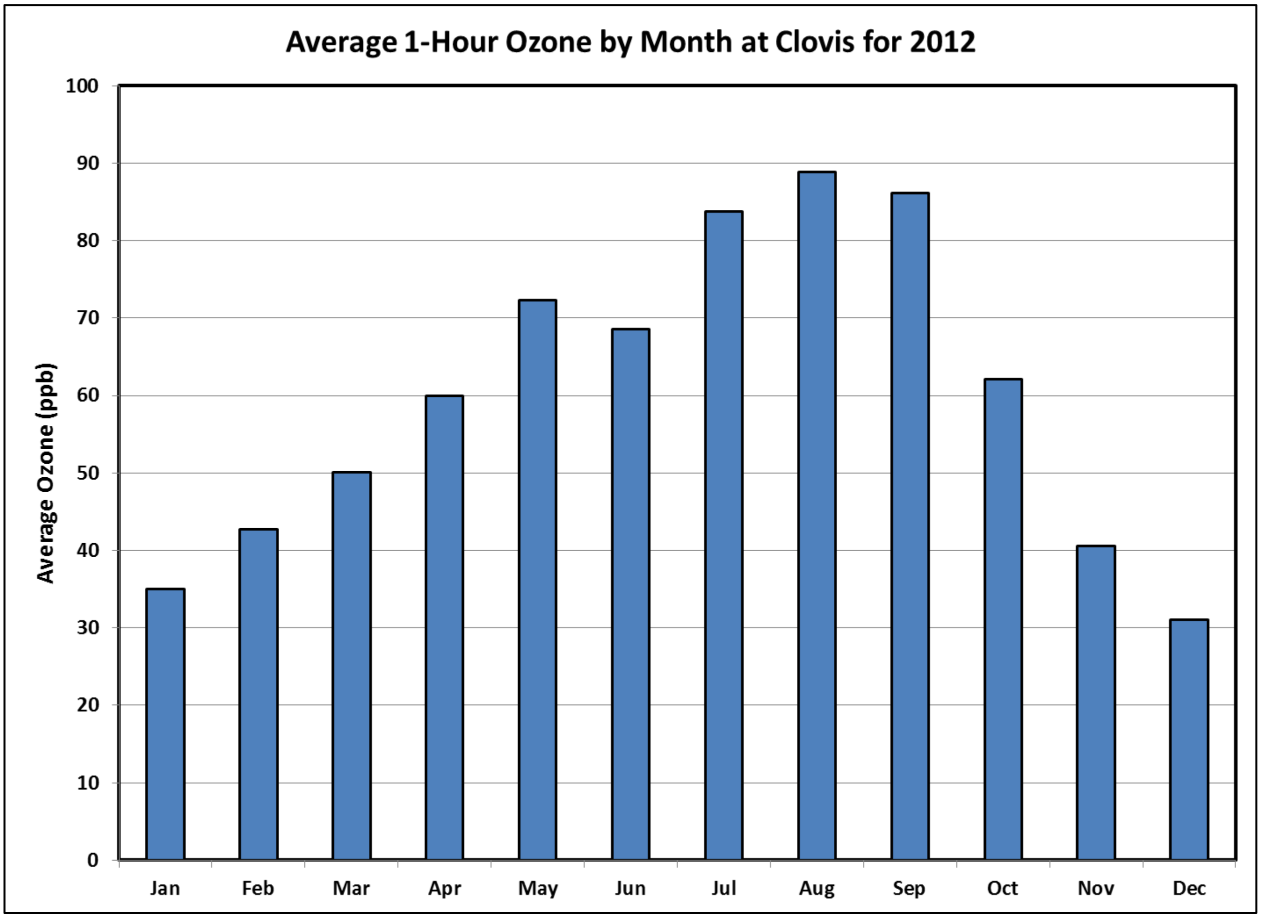
Figure 2 - 1 San Joaquin Valley Air Basin



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.

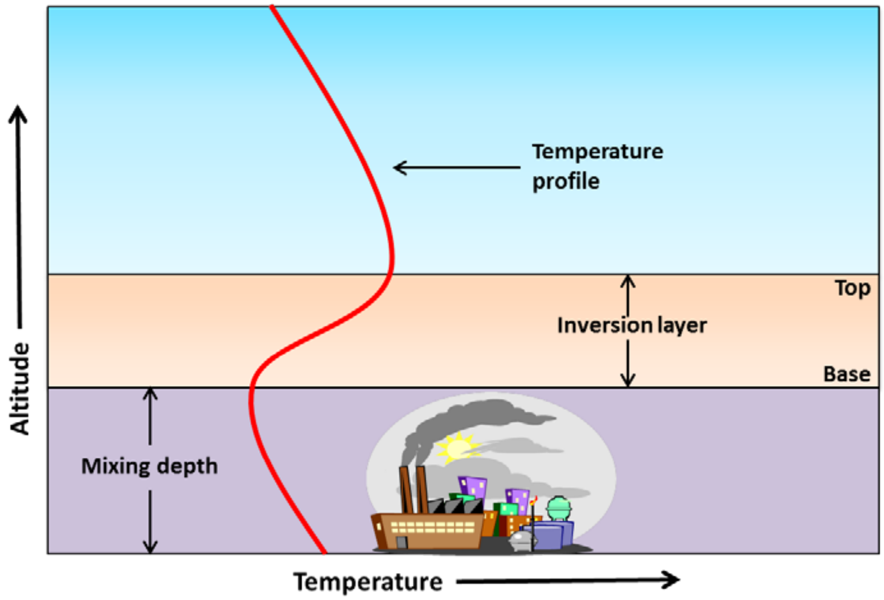
Ozone concentrations tend to be the highest from June to September, because high pressure systems that influence Valley meteorological and dispersion conditions occur most frequently during the summer months. As an example, Figure 2-2 shows the average 1-hour ozone concentration per month during 2012 for the Clovis air monitoring site. 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.

Figure 2 - 2 2012 Monthly Average Ozone at Clovis



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



While these inversions are common in the Valley throughout the year, they have been further exacerbated by the extreme drought conditions experienced since 2013. 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.

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.

2.1.2 Summer Wildfires

California's summer wildfires have historically affected ozone levels in the Valley. These fires emit ozone precursors that can be transported by wind to the Valley. Although particulates in the smoke plume can sometimes reduce ozone formation rates by blocking sunlight, the precursors often react to form ozone. For example, during the summer of 2008, California experienced a record number of wildfires and the resulting emissions caused serious public health impacts and unprecedented ozone levels in the Valley.

In the summer of 2015, the Valley's air quality was also impacted by a number of wildfires in the region. The largest fire impacting the Valley in 2015, the Rough Fire, was fast-moving, and consisted of heavy fuel loads with high emissions estimates per acre of fuel burned. As compared to the Valley's emissions, PM10 emissions from the Rough Fire at its peak day were 25 times greater than the PM10 emissions from the District's entire stationary, area, and mobile source inventories combined. Similarly, the Rough Fire's PM2.5, NOx and VOC emissions were 105, 8, and 16 times larger than the District's entire emissions inventory, respectively. Clearly, the emissions from a large wildfire can easily surpass emissions from all sources in the Valley, including all industrial, farming, and mobile sources, and overwhelm even the most robust emissions control programs.

Emissions from these wildfires, which often occur during the peak of the Valley's ozone season, can challenge the region's ability to attain federal ozone air quality standards. If the current drought affecting the western U.S. continues, wildfires may continue to become more severe, having an even larger effect on the Valley's air quality in the future.

2.1.3 Higher than Average Population Growth

To further exacerbate current air quality challenges, the Valley is one of the fastest growing regions in the state. The Population Research Unit of the California Department of Finance (DOF) released revised population growth projections in December 2014 that demonstrate how significantly the Valley's population is expected to grow in the coming years.

Based on the revised 2015 to 2030 DOF data, the Valley's population is expected to increase by 25.3% (Table 2-1). In contrast, the total population for the State of California is projected to increase by only 13.3% over the 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). In addition to increased VMT resulting from increased Valley population, the Valley will also see increased vehicular traffic along the State's major goods and people movement arteries, both of which run the length of the Valley.

Table 2-1 Estimated Valley Population by County, 2015-2030[1]

County	Projected 2015	Projected 2020	Projected 2025	Projected 2030
Fresno	981,681	1,055,106	1,130,406	1,200,666
Kern*	894,492	989,815	1,088,711	1,189,004
Kings	155,122	167,465	180,355	192,562
Madera	157,722	173,146	189,267	204,993
Merced	269,572	288,991	313,082	337,798
San Joaquin	723,506	766,644	822,755	893,354
Stanislaus	538,689	573,794	611,376	648,076
Tulare	467,170	498,559	537,015	578,858
Total	***4,187,954***	***4,513,520***	***4,872,967***	***5,245,311***

** This reflects the population for all of Kern County, not just the portion monitored by the District.*

Although reducing mobile source emissions is critical to the Valley's attainment of air quality standards, the District does not have direct regulatory authority to reduce motor vehicle tailpipe emissions. These emissions are regulated by the U.S. Environmental Protection Agency (EPA) and the California Air Resources Board (ARB). The District collaborates with its interagency partners and uses innovative and non-regulatory approaches to reduce mobile source emissions, or a combination of regulatory and non-regulatory approaches such as District Rule 9610 (State Implementation Plan Credit for Emission Reductions Generated through Incentive Programs) and District Rule 9510 (Indirect Source Review).

2.1.4 Jurisdictional Limits in Regulatory Authority

Attainment of air quality standards and the reduction of precursor emissions in the Valley require the cooperation of local and/or regional, state, and federal governments. At the federal level, the EPA is responsible for establishing federal motor vehicle emission standards. The 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.

ARB establishes emission standards for on-road motor vehicles and some off-road sources. ARB 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 Automotive Repair also have responsibility for certain mobile and mobile-related emissions sources.

Air districts have authority to regulate stationary sources and some area sources of emissions. Districts cooperate with Regional Transportation Planning Agencies (TPAs)

[1] California Department of Finance. Retrieved on 2015, June 29) from: http://www.dof.ca.gov/research/demographic/reports/projections/view.php

to develop measures affecting local transportation activity that are included in an attainment plan. In turn, the TPAs 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 primary jurisdiction of the District is therefore limited to less than 15% of the total NOx emissions inventory.

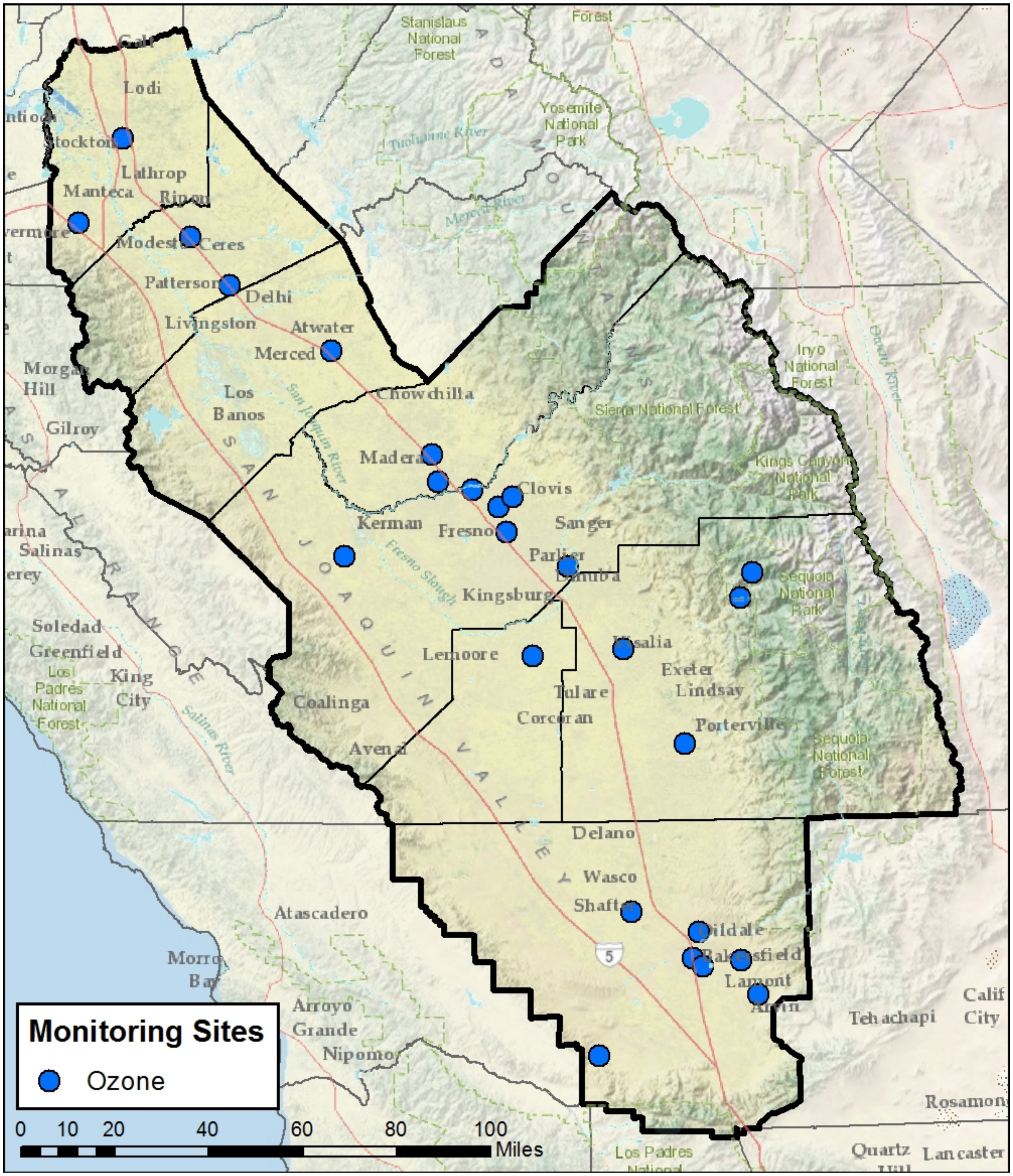
Although the responsibility for establishing the tailpipe emissions standards for the mobile sources belongs to state and federal governments, additional reductions are needed from mobile sources to reach attainment. Therefore, the District implements creative measures, such as trip reduction, green 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.

2.2 OZONE AIR QUALITY PROGRESS

2.2.1 Ozone Monitoring Network

The District, ARB, and the National Park Service (NPS) together operate extensive air monitoring networks 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, ARB, and NPS currently operate 25 ozone monitoring sites throughout the Valley (see Figure 2-4).

Figure 2 - 4 Ozone Monitoring Sites within the Valley



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 within the District's ozone monitoring network.

Table 2-2 Ozone Monitoring Site Types

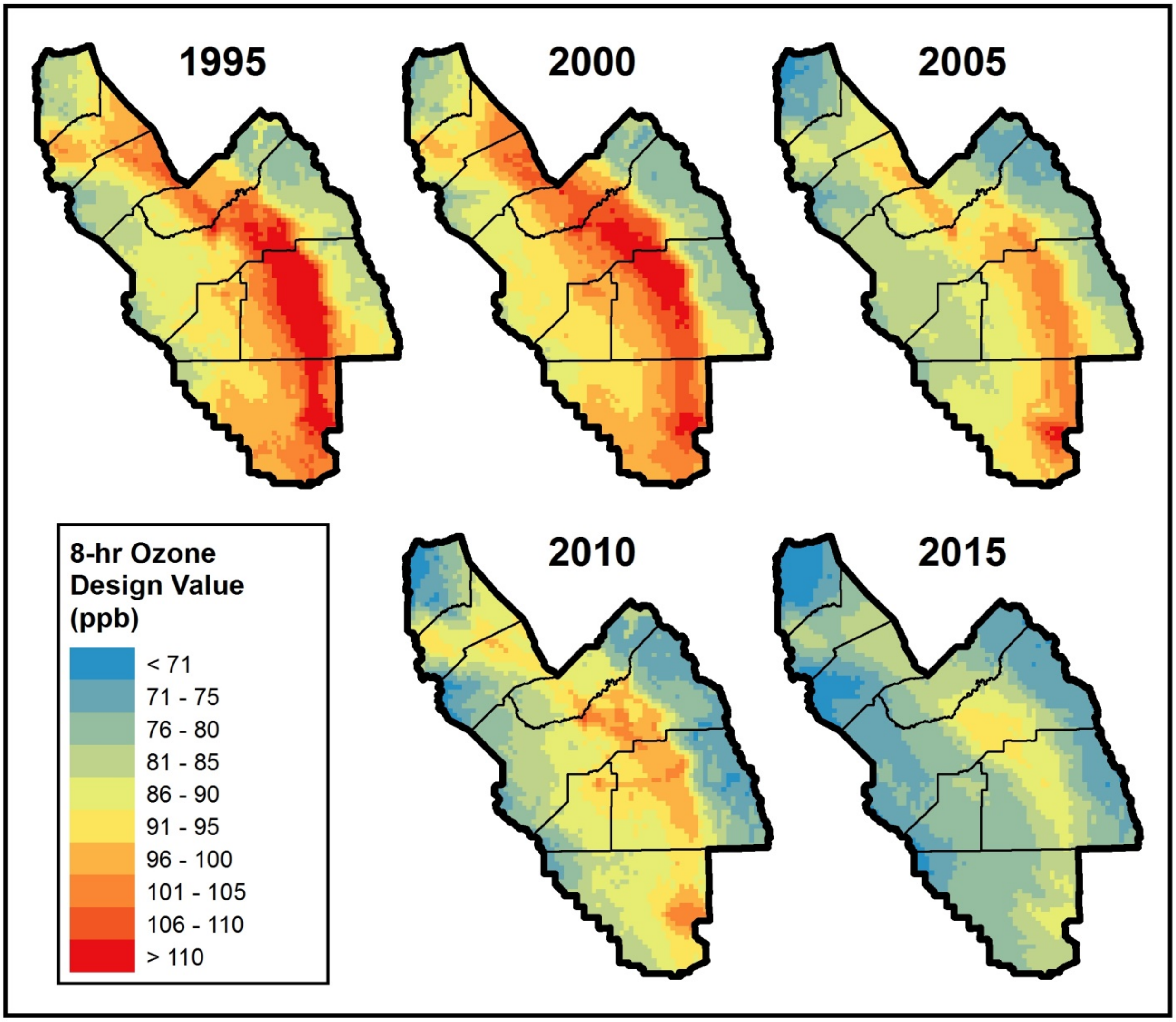
Site Name	Population Exposure	Highest Concentration	Regional Transport	Background Levels
Stockton–Hazelton*	✓			
Tracy–Airport		✓	✓	
Modesto–14th St*	✓			
Turlock	✓	✓		
Merced–Coffee	✓			
Madera–City	✓	✓		
Madera–Pump Yard				✓
Tranquility	✓			
Fresno–Sky Park	✓		✓	
Clovis–Villa	✓	✓		
Fresno-Garland*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

^ Monitor operated by the National Park Service
* Monitor operated by ARB

2.2.2 Air Quality Progress

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 1995 the Valley has experienced a drastic improvement of overall exposure to ozone (see Figure 2-5). 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.

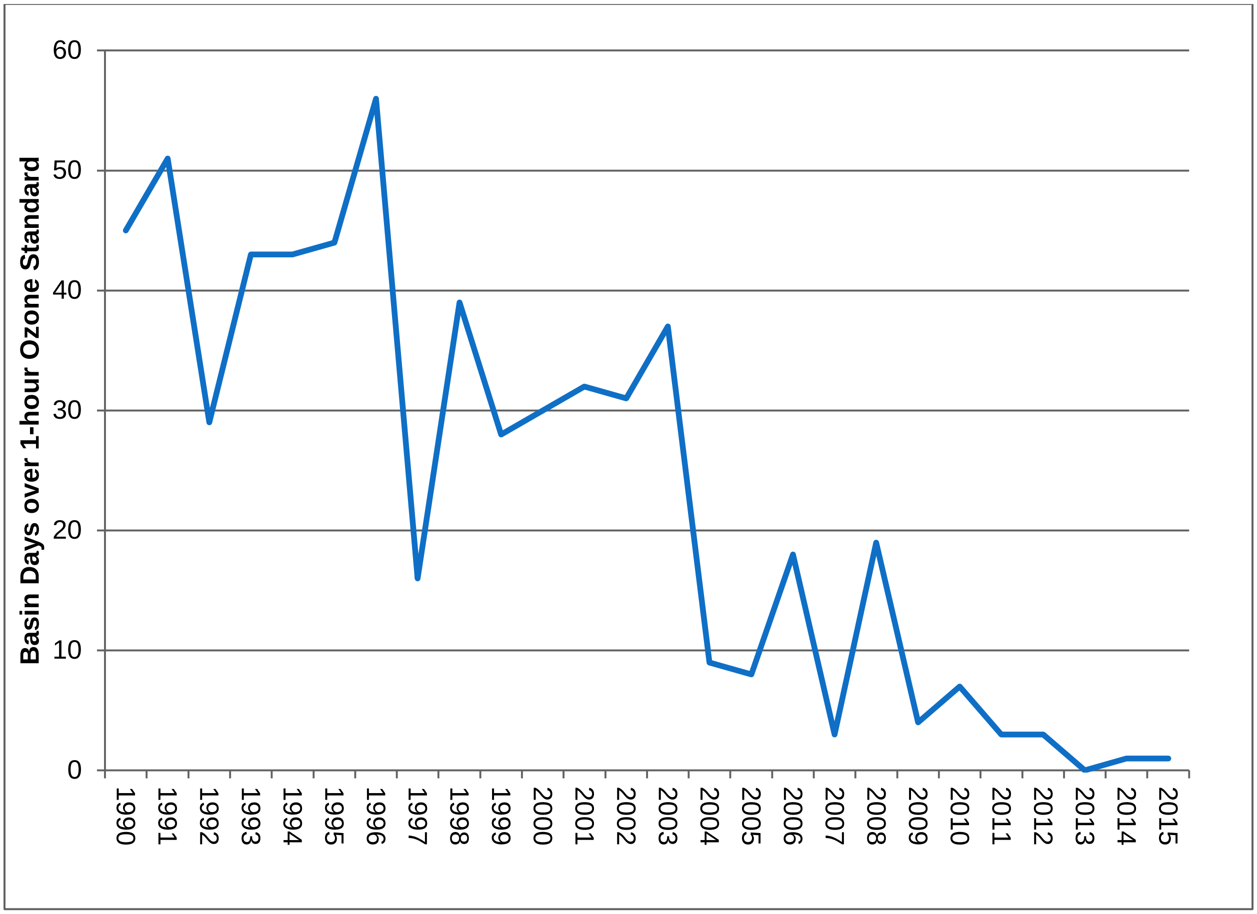
Figure 2 - 5 Improvement in 8-hour Ozone Design Values, 1995-2015



2.2.2.1 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 124 parts per billion (ppb) (see Figure 2-6). In fact, through the year 2015, the Valley has completed the third consecutive year without violating the 1-hour ozone standard.

Figure 2 - 6 Basin Days Over the 1979 1-hour Ozone Standard (124 ppb)



2.2.2.2 8-Hour Ozone Progress

In addition to the great improvements in 1-hour ozone concentrations across the Valley, significant improvements have also been achieved for 8-hour ozone as well. Over the last 25 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 the year 2015, despite strings of triple digit temperatures and multiple wildfires, the Valley had another record setting ozone season. In 2015, the Valley had the lowest number of days exceeding the current federal 75 ppb 8-hour ozone standard, and for the first time in recorded history, the Valley had zero Unhealthy AQI days in the month of July for ozone[2].

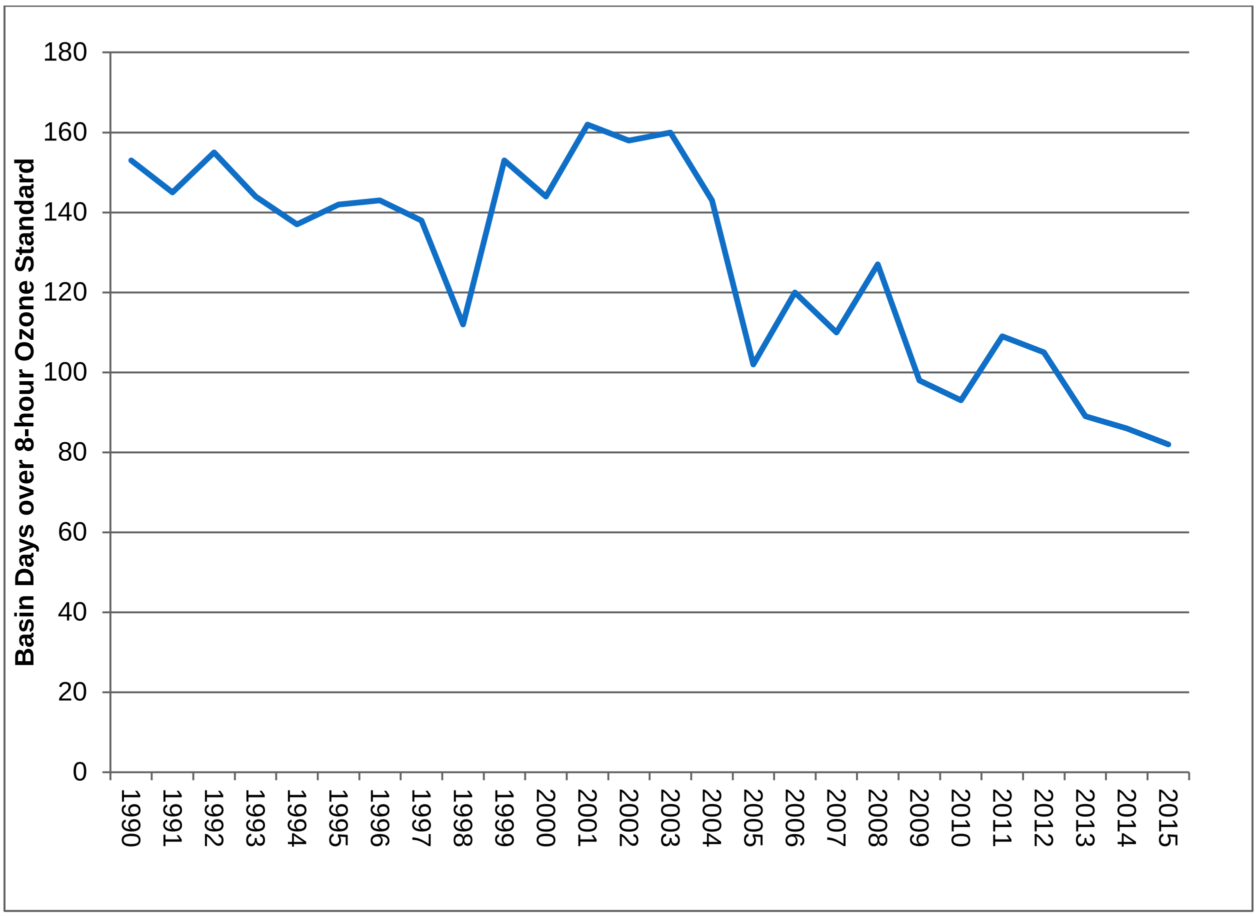
[2] Based on the 8-hour ozone AQI scale associated with the 75 ppb standard

Additionally in 2015, the Valley:

- Achieved the lowest 8-hour ozone design value on record for the Valley, the official metric used to measure progress towards meeting federal ozone standards.
- Completed the third consecutive year without violating the federal 1-hour ozone standard.
- Reduced the average number of days a resident experienced ozone levels above the 84 ppb and 75 ppb 8-hour ozone standards by 91% and 73%, respectively, since 2002.

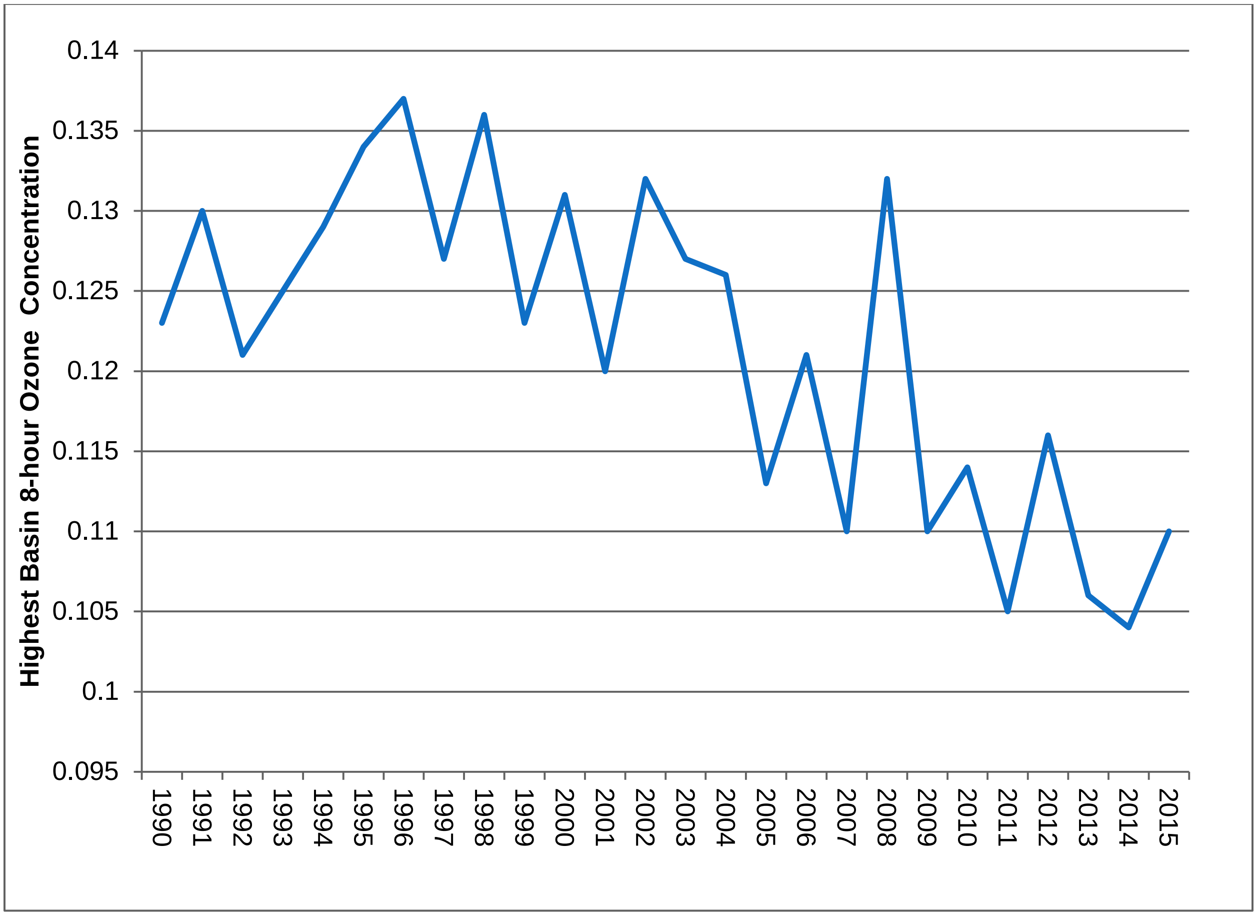
Since 1990, the Valley has experienced an over 40% decrease in the quantity of days with ozone concentrations above the 2008 8-hour ozone standard of 75 ppb (Figure 2-7).

Figure 2 - 7 Basin Days over the 2008 8-Hour Ozone Standard



Additionally, the Valley has undergone a 16% decrease in the maximum national 8-hour average ozone concentration since 1990 (Figure 2-8). The maximum national 8-hour average is the highest national 8-hour average ozone concentration in that year. The 8-hour average ozone value has lowered from 0.123 ppm in 1990 to 0.110 ppm in 2015.

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



2.2.2.3 8-hour Ozone Design Value

For a given year, the fourth highest value is selected from the daily 8-hour maxima (as such, the highest three daily maximum 8-hour average ozone values each year do not count towards the attainment determination) and then averaged with corresponding values for the previous two years to determine attainment. The result is the three-year average of the annual fourth-highest daily maximum 8-hour ozone concentration, which is also called the "design value" for 8-hour ozone and is also the form of the standard. Table 2-3 illustrates a sample calculation. The 8-hour ozone NAAQS is met at a given monitor when the design value for that monitor is less than or equal to 0.075 ppm.

Table 2-3 Sample Design Value Calculation (Clovis Villa, 2015)

Year	Highest Daily Maximum Concentrations (ppm)			
	1st Highest	2nd Highest	3rd Highest	4th Highest
2013	0.104	0.097	0.092	**0.091**
2014	0.103	0.098	0.097	**0.097**
2015	0.098	0.095	0.093	**0.093**
			3 - Year Average:	**0.093**

As a part of the positive trend in ozone air quality, the Valley is also on track to meet the federal 8-hour ozone standard of 84 ppb ahead of the projected 2023 attainment date included in the *2007 Ozone Plan* (Figure 2-9). With the ongoing improving trend in ozone air quality, EPA also recently approved the District's 1-hour ozone clean data finding request and analysis and has officially proposed to designate the San Joaquin Valley as attainment for the 1-hour ozone standard.

Figure 2 - 9 Decrease in Valley's 8-hr Ozone Design Value

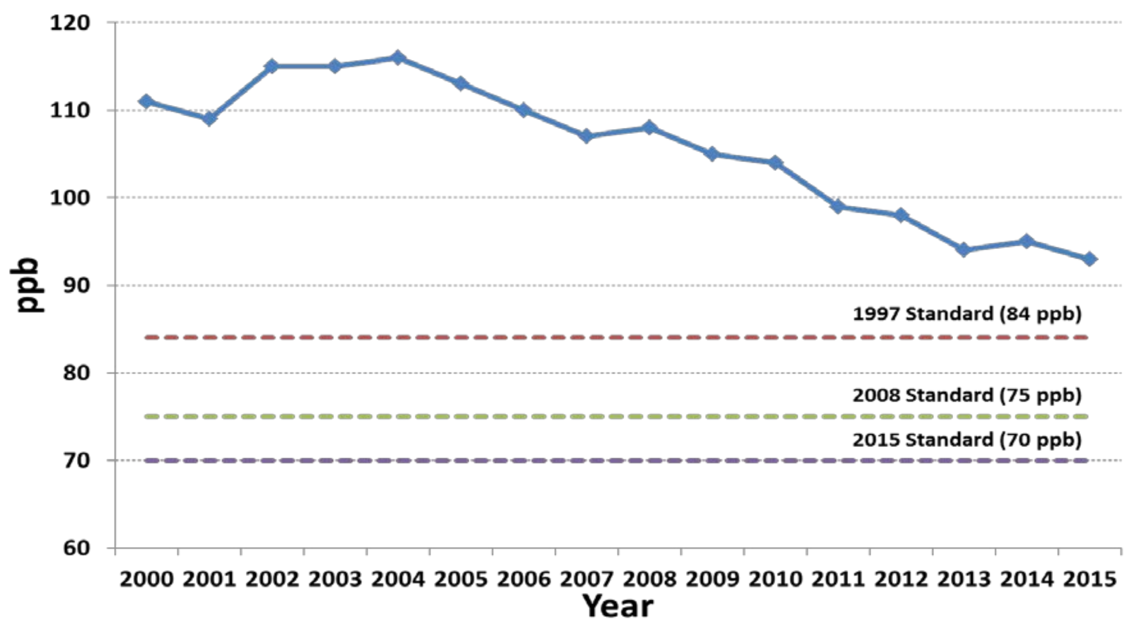
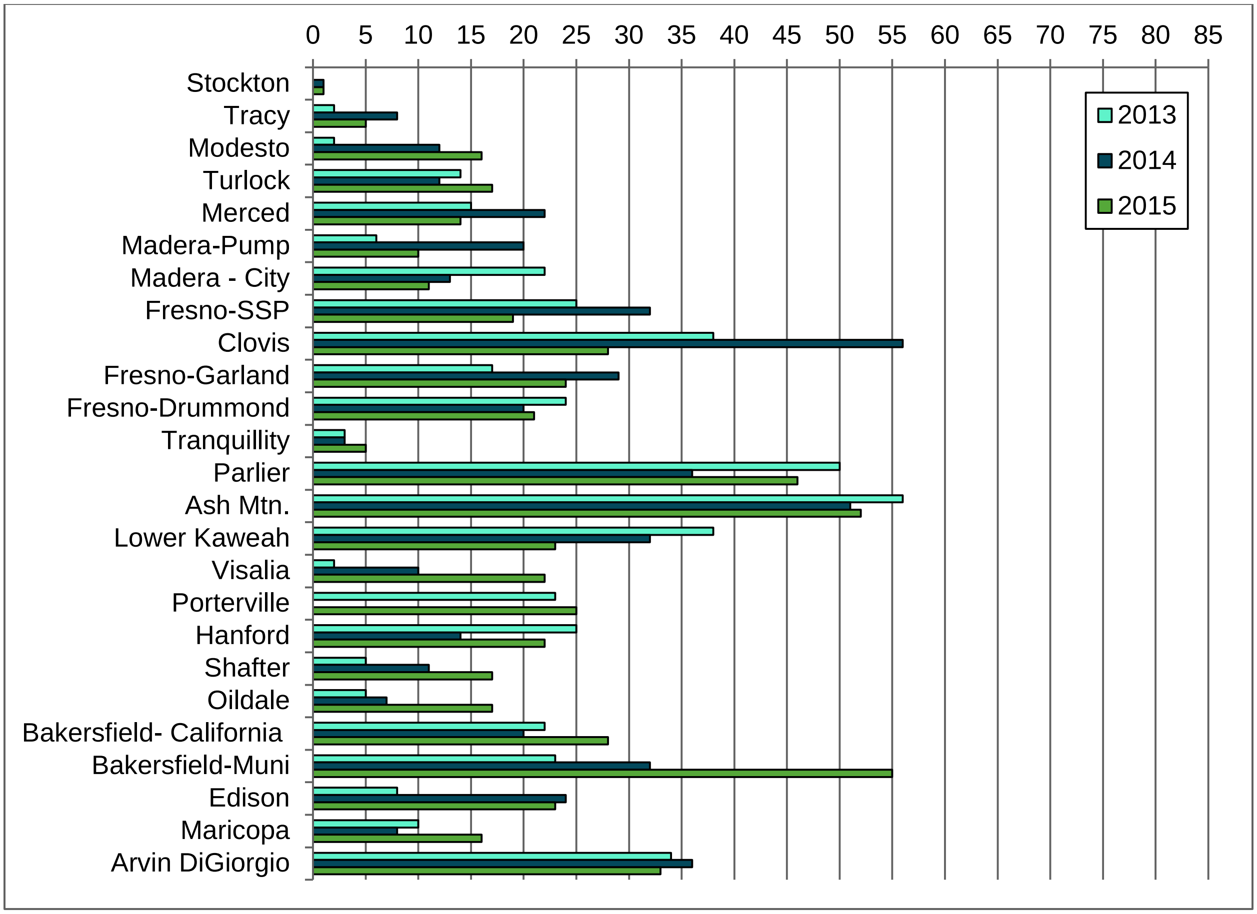


Figure 2-10 shows the number of days over the numeric value of the 8-hour standard by site for 2013, 2014, and 2015; although this is not used for attainment determinations, it illustrates that the areas of the Valley that tend to experience the greatest number of days above the 75 ppb ozone standard are Fresno/Clovis and its downwind area of Parlier, the elevated areas of Tulare County, and Bakersfield with its downwind area of Arvin. These areas will need to experience the greatest reduction in days exceeding the ozone standard for the Valley to reach attainment.

Figure 2 - 10 Quantity of Days Over the 2008 8-Hour Ozone Standard



2.3 CONCLUSION

In conclusion, although there are significant challenges in meeting the federal ozone standards, the control measures and strategies adopted by the District and ARB have resulted in substantial emissions reductions as reflected in the improving ozone metrics discussed above. Air quality will continue to improve as these measures and strategies are implemented in the coming years. In fact, current ozone trends project that the Valley will attain the 84 ppb standard before 2024, and ARB modeling analysis demonstrates that the Valley will attain the 75 ppb standard before 2031, without any further control measures other than what has already been committed to in previous plans.

Furthermore, as the District continues to develop new attainment plans to address the latest federal ozone and PM2.5 standards in the coming year, significant additional emissions reductions are expected, particularly with respect to mobile sources under ARB and EPA jurisdiction that make up over 85% of remaining Valley emissions.