Staff Report

ARB Review of the San Joaquin Valley 2016 Plan for the 2008 8-Hour Ozone Standard

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EXECUTIVE SUMMARY

This report presents the Air Resources Board (ARB or Board) staff's assessment of the San Joaquin Valley Air Pollution Control District's 2016 Plan for the 2008 8-Hour Ozone Standard (2016 Ozone SIP). The 2016 Ozone SIP addresses the federal 8-hour ozone standard of 75 parts per billion (ppb), representing the next building block in planning efforts to meet increasingly health protective air quality standards. Over the past decade ozone levels in the Valley have shown significant improvement in response to accelerated reductions in emissions of oxides of nitrogen (NOx). Current control programs will continue this pace, and NOx emissions are projected to decline a further 50 percent over the next fifteen years through ongoing implementation of ARB and District control programs. These reductions will provide for attainment of the standard by the District's attainment deadline of 2031.

ARB staff has concluded that the 2016 Ozone SIP meets all requirements of the Clean Air Act (Act), including attainment demonstration, reasonably available control measure demonstration, reasonable further progress demonstration, contingency measures for progress and attainment, transportation conformity budgets, and vehicle miles travelled offset demonstration. The Board is scheduled to consider the Plan on July 21, 2016. If approved, the ARB will submit the 2016 Ozone SIP to the U.S. Environmental Protection Agency (U.S. EPA) as a revision the California State Implementation Plan (SIP).

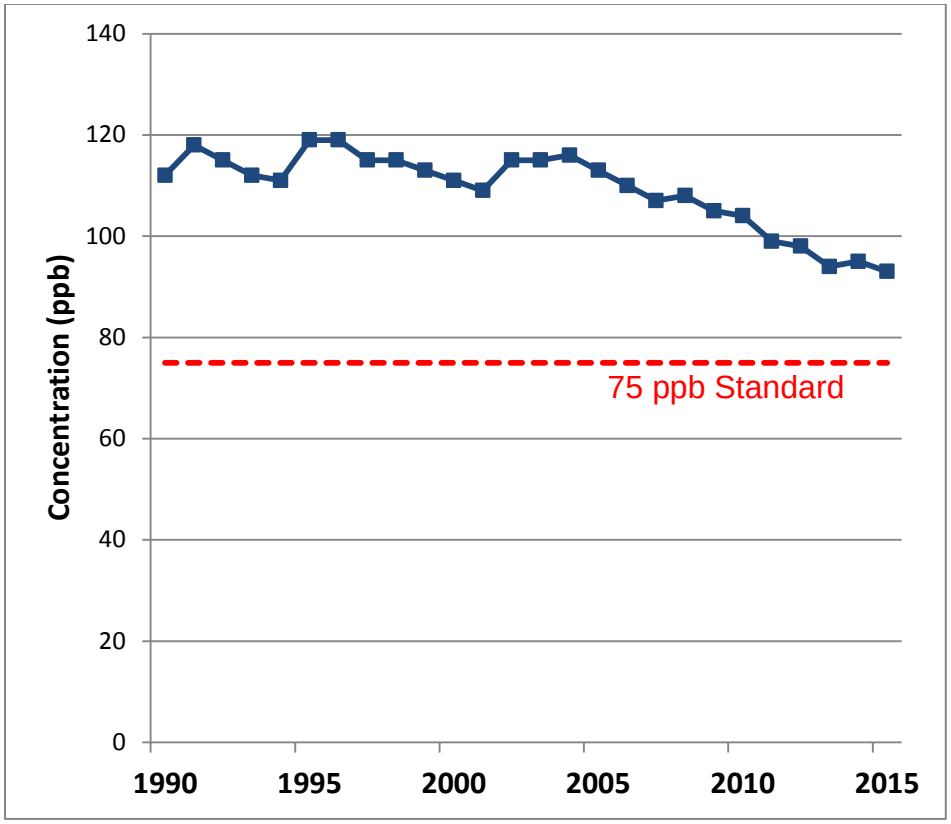
The Act requires U.S. EPA to set air quality standards and periodically review the latest health research to ensure that standards remain protective of public health. Based on research demonstrating adverse health effects at lower exposure levels, EPA has set a series of increasingly health protective ozone standards, beginning with a 1-hour ozone standard in 1979. Subsequent health studies demonstrated the greater effects of exposure to ozone over longer time periods, resulting in U.S. EPA establishing an 8-hour ozone standard of 80 ppb in 1997, and the 75 ppb standard in 2008. ARB and the District have developed a series of SIPs defining the actions needed to meet these standards, with each SIP and the corresponding control programs providing the foundation for subsequent planning efforts. The SIP process established under the Act has been effective, and an important driver for air quality progress in the Valley.

The design of effective control strategies has been informed by substantial research investments to provide an improved understanding of the nature and sources of ozone formation in the Valley, including comprehensive field studies, data analyses, and air quality modeling. This work has demonstrated the importance of NOx reductions to achieve ozone progress. As a result of comprehensive control programs that have reduced NOx emissions over 50 percent over the last decade, the Valley attained the 1-hour standard in 2014.[1] It is making steady progress in reducing 8-hour ozone levels

[1] 81 FR 31206 Proposed rule: Determination of Attainment of the 1-hour Ozone National Ambient Air Quality Standards in the San Joaquin Valley Nonattainment Area in California https://www.gpo.gov/fdsys/pkg/FR-2016-05-18/pdf/2016-11630.pdf

and is projected to attain the 80 ppb standard by the 2023 attainment deadline. Since 2004, 8-hour ozone concentrations have decreased by nearly 20 percent, and the number of days exceeding the 75 ppb the standard has dropped by over 40 percent. Figure 1 highlights this ongoing progress.

Figure 1. 8-Hour Ozone Design Value Trend



Building on this progress, air quality modeling conducted as part of the 2016 Ozone SIP demonstrates that the substantial NOx reductions that continue to accrue from implementation of the existing control program will provide for attainment of the 75 ppb 8-hour ozone standard by 2031. This modeling also indicates that NOx reductions will become increasingly effective as NOx emissions continue to decrease, leading to accelerated ozone progress over time.

In addition to current control programs, in May 2016, ARB staff released the Proposed 2016 State Strategy for the State Implementation Plan[2] (State SIP Strategy). The State SIP Strategy describes ARB staff's proposed measures for mobile sources to attain federal air quality standards throughout the State over the next fifteen years. As part of the strategy, ARB staff will propose an additional emission reduction commitment beyond the current program for the San Joaquin Valley for Board consideration in September. The new measures identified in the strategy will provide additional

[2] ARB, 2016, Proposed 2016 State Strategy for the State Implementation Plan http://www.arb.ca.gov/planning/sip/2016sip/2016statesip.pdf

reductions in the Valley to accelerate progress towards meeting the 75 ppb ozone standard. In addition, in 2015, U.S. EPA further strengthened the 8-hour ozone standard to 70 ppb. Air quality modeling indicates this will require a further 15 percent reduction in NOx emissions from 2031. Coupled with the ongoing control program, reductions from the State SIP Strategy are expected to provide the basis for meeting the 70 ppb standard by the District's attainment deadline of 2037.

Looking forward, meeting PM2.5 standards in the Valley within the next decade will present the greater air quality challenge. Modeling efforts are underway to evaluate the magnitude of reductions needed for attainment. The PM2.5 attainment strategy for the Valley will need to consider the diversity of sources that contribute to PM2.5, as well as the specific timeframes of meeting both the annual and 24-hour PM2.5 standards. Additional reductions from sources of directly emitted PM2.5 under local district control will be critical based on their contribution to ambient PM2.5 levels in the Valley. Given the earlier attainment dates for PM2.5 compared to ozone, accelerating the pace of NOx reductions will also be necessary. Ongoing mobile source NOx reductions will provide for significant regional improvement, but strategic use of incentive funding will be essential to achieve earlier penetration of cleaner technologies. Efforts to accelerate NOx reductions to address PM2.5 attainment needs will also provide ongoing benefits for continued progress in reducing ozone.

I. BACKGROUND

Ozone is a highly reactive gas that can damage the tissues of the respiratory tract, causing inflammation and irritation, and resulting in symptoms such as coughing, chest tightness and worsening of asthma symptoms. Ozone exposure can also lead to decreased lung function.

The Act requires U.S. EPA to set air quality standards and periodically review the latest health research to ensure that standards remain protective of public health. Based on research demonstrating adverse health effects at lower exposure levels, EPA has set a series of increasingly health protective ozone standards, beginning with a 1-hour ozone standard in 1979. Subsequent health studies demonstrated the greater effects of exposure to ozone over longer time periods, resulting in U.S. EPA establishing an 8-hour ozone standard of 80 ppb in 1997, and the 75 ppb standard in 2008. In May 2012, U.S. EPA designated nonattainment areas for the 75 ppb ozone standard, effective July 20, 2012.[3] Ozone nonattainment areas are classified according to the severity of their air pollution problem. Areas with higher pollution levels are given more time to meet the standard (attainment date), but are also subject to more stringent control requirements. The South Coast and San Joaquin Valley are the only two extreme areas in the nation, with an attainment deadline of 2031.

ARB and the District have developed a series of SIPs defining the actions needed to meet these standards, with each SIP and the corresponding control programs providing the foundation for subsequent planning efforts. On June 16, 2016, the District adopted the 2016 Ozone SIP to address the 75 ppb standard. The 2016 Ozone SIP must demonstrate the Valley will attain the standard by 2031. The 2016 Ozone SIP also addresses Act requirements applicable to an extreme 8-hour ozone nonattainment area, consistent with U.S. EPA's 2015 Implementation Rule for the 2008 8-hour ozone standard (Implementation Rule).[4]

II. NATURE OF THE OZONE PROBLEM IN THE SAN JOAQUIN VALLEY

Ozone forms in the atmosphere through complex chemical reactions between oxides of nitrogen (NOx) and reactive organic gases (ROG) emitted from motor vehicles, factories and other industrial sources, consumer products, and other off-road equipment. The relative mixture of these precursor gases in a region drives the nature of the needed control strategy.

The San Joaquin Valley, encompassing 25,000 square miles in the central portion of California, is characterized by unique topography and meteorology. Mountains bound the area on the west (Coastal Mountain range), the east (Sierra Nevada range), and the south (Tehachapi Mountains) which limit air flow. The Valley's hot, dry weather conditions during the summer cause poor air dispersion and stagnation, which are conducive to ozone formation. The northern portion of the Valley borders the

[3] 77 FR 3088 http://www.gpo.gov/fdsys/pkg/FR-2012-05-21/pdf/2012-11618.pdf
[4] 80 FR 12264 http://www.gpo.gov/fdsys/pkg/FR-2015-03-06/pdf/2015-04012.pdf

Sacramento Valley and Delta lowland. Because of the marine influence, which extends into this area through gaps in the Coastal Range to the west, the northern Valley's more temperate climate results in the lower ozone concentrations. The highest ozone concentrations occur in the central and southern portion of the Valley due to higher temperatures and dominant summer wind flow patterns that recirculate pollutants within these sub-regions.

Table 1 lists the current 8-hour ozone design values (the official metric used to determine compliance with the standard), by region throughout the Valley. Over the last 20 years, the site with the highest 8-hour ozone levels in the Valley has alternated between the southern and central regions. Currently, the highest design value is recorded in the central region at the Clovis monitoring site.

Table 1. 2015 8-Hour Ozone Design Values (ppb)[(1)(2)]

	County	Site	2015
Northern	Merced	Merced-S Coffee Avenue	82
	San Joaquin	Stockton-Hazelton Street	68
	San Joaquin	Tracy-Airport	76
	Stanislaus	Modesto-14th Street	79
	Stanislaus	Turlock-S Minaret Street	82
Central	**Fresno**	**Clovis-N Villa Avenue**	**93**
	Fresno	Fresno-1st Street/Fresno-Garland	87
	Fresno	Fresno-Drummond Street	86
	Fresno	Fresno-Sierra Skypark #2	87
	Fresno	Parlier	91
	Fresno	Tranquility-32650 West Adams Avenue	75
	Kings	Hanford-S Irwin Street	85
	Madera	Madera-28621 Ave 14	83
	Madera	Madera-Pump Yard	82
Southern	Kern	Arvin-Di Giorgio	87
	Kern	Bakersfield-5558 California Avenue	85
	Kern	Bakersfield-Municipal Airport	90
	Kern	Edison	84
	Kern	Maricopa-Stanislaus Street	79
	Kern	Oildale-3311 Manor Street	79
	Kern	Shafter-Walker Street	80
	Tulare	Porterville-1839 Newcomb Street	82
	Tulare	Sequoia and Kings Canyon Natl Park	89
	Tulare	Sequoia Natl Park-Lower Kaweah	85
	Tulare	Visalia-N Church Street	79

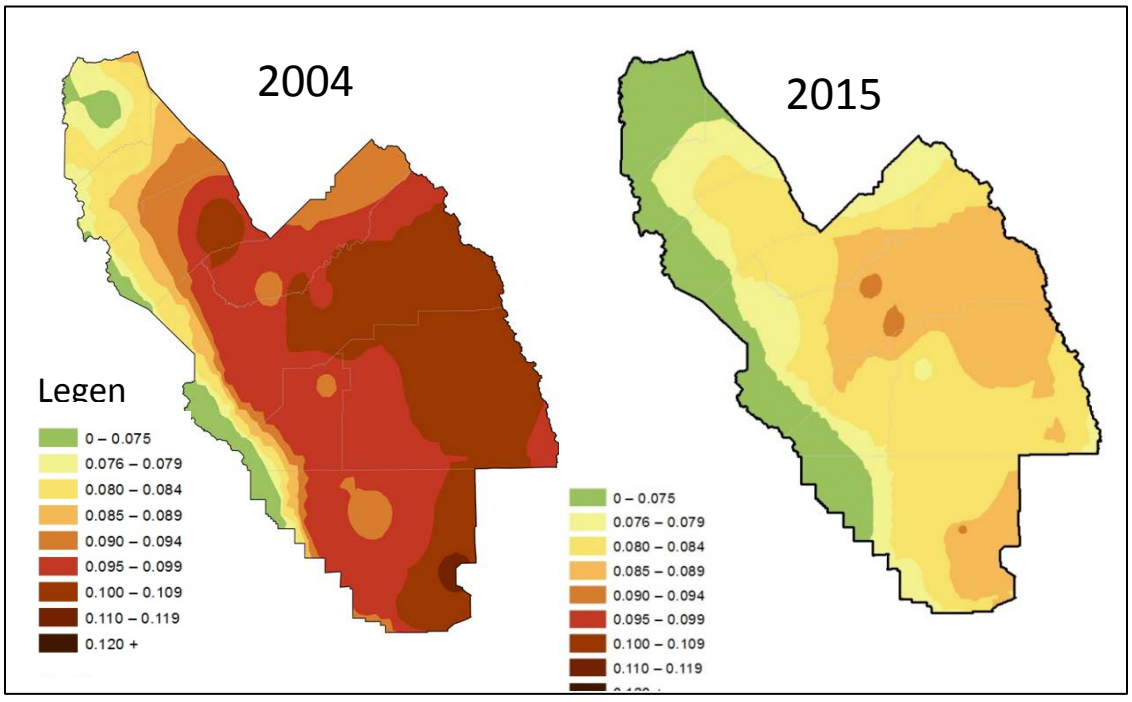
(1) The design value is the official metric used to determine compliance with the standard. The 8-hour ozone design value for a specific monitoring site is the average of the fourth highest daily maximum 8-hour concentration measured in each of three consecutive years (e.g., the 2015 design value equals the average of the fourth highest 8-hour ozone concentration measured in each 2013, 2014, and 2015).
(2) Accounting for rounding, the 80 ppb 8-hour standard is met when the design value is less than or equal to 84 ppb and the 75 ppb standard is met when the design value is less than or equal to 75 ppb.

The San Joaquin Valley is one of the most extensively studied regions in the world, and the current understanding of ozone formation in the Valley is based on this comprehensive scientific foundation. This includes an extensive network of routine ozone monitors located throughout the Valley, as well as targeted field studies supported by local, state, and federal agencies as well as academic institutions. Two core efforts include the Central California Ozone Study (CCOS) conducted during the summer of 2000, and the CalNex climate and air quality study, conducted during 2010.

This research has shown that the majority of ozone in the Valley is generated from emissions within the Valley. In addition, given the large emissions of ROG from biogenic sources in the region, reducing NOx emissions is the most effective approach for improving ozone air quality. Air quality modeling also indicates that NOx reductions will become increasingly effective as NOx emissions continue to decrease, leading to accelerated ozone progress over time. These research efforts have provided the basis for development of necessary control strategies for meeting ozone standards.

Figure 2 illustrates the progress accomplished in reducing the level and spatial extent of 8-hour ozone design values in the Valley between 2004 and 2015. In 2004, almost the entire Valley violated the 75 ppb standard, with concentrations exceeding the standard on 140 days. However, over the last decade, ozone levels have shown significant improvement in response to accelerated reductions in NOx emissions, which have decreased over 50 percent through implementation of ARB and District control programs.

Figure 2. Reduction in Level and Spatial Extent of 8-Hour Ozone Design Values in the San Joaquin Valley



Today, ozone design values have decreased 20 percent, and the severity and spatial extent of the ozone problem is diminishing. The Valley met the 1-hour ozone standard in 2014 and is expected to attain the 80 ppb 8-hour ozone standard by 2023. This incremental progress establishes a trajectory for meeting the more health protective 75 ppb ozone standard over the next fifteen years.

III. DEMONSTRATING ATTAINMENT

SIPs must identify both the magnitude of reductions needed and the actions necessary to achieve those reductions as part of demonstrating attainment of the standard. ARB and the District have prepared an attainment demonstration that provides for expeditious attainment of the 75 ppb ozone standard. The attainment demonstration includes the benefits of ARB and District control programs that provide ongoing emission reductions. Continued implementation of these control programs provides new emission reductions each year, resulting in a 60 percent decrease in NOx emissions between 2012 and 2031. ARB's mobile source control program contributes 90 percent of the total NOx reductions. These measures provide the necessary control strategy, demonstrating the Valley will attain the standard by 2031.

A. Photochemical Modeling Approach and Results

The Act requires the use of air quality modeling to relate ozone levels to emissions in a region and simulate future air quality based on changes in emissions. ARB staff conducted the modeling for the 2016 Ozone Plan. The modeling approach draws on the products of large-scale scientific studies in the region, as well as collaboration between technical staff of ARB and the District. This modeling uses emission inventories, with measurements of meteorology and air quality, to establish the relationship between emissions and air quality. This modeling is used to identify the benefits of controlling different ozone precursors and the most expeditious attainment date.

ARB staff followed U.S. EPA modeling guidance[5] to demonstrate attainment of the 75 ppb 8-hour ozone standard. The year 2012 was chosen as the modeling base (or reference) year based on analysis that meteorology in 2012 was particularly favorable for ozone formation and buildup, and the availability of a detailed emissions inventory. The future year modeled was 2031, the year attainment must be demonstrated for an extreme ozone nonattainment area. The attainment demonstration modeling includes the benefits of all adopted regulations. Table 2 summarizes the 2012 and 2031 emissions modeled in the attainment demonstration.

[5] U.S. EPA, 2014, Draft Modeling Guidance for Demonstrating Attainment of Air Quality Goals for Ozone, PM2.5 and Regional Haze, available at https://www.epa.gov/ttn/scram/guidance/guide/Draft_O3-PM-RH_Modeling_Guidance-2014.pdf

Table 2. 2012 and 2031 Summer Emission Inventories (tpd)

Source	NOx				ROG		
	2012 (tpd)	2031 (tpd)	Percent Difference		2012 (tpd)	2031 (tpd)	Percent Difference
Stationary	42	30	-30		85	100	17
Area	5	5	4		147	153	4
On-road Mobile	188	45	-76		60	18	-70
Off-road Mobile	105	52	-50		45	26	-42
Total	340	132	-61		337	297	-12

Results of the attainment demonstration modeling are shown on Table 3. The 2031 design values are predicted to be below the 75 ppb standard at all sites, with values that range between 57 and 74 ppb. Similar to today, the highest concentrations are expected to remain in the central portion of the Valley. Complementary analysis of unmonitored areas required under U.S. EPA's modeling guidance also demonstrates that all regions in the Valley will attain the standard by 2031.

Further information on the modeled attainment demonstration is included in Appendix A of this report and Appendices H, I and J of the 2016 Ozone SIP.

Table 3. 2031 Modeled 8-hour Ozone Design Values (DVs) Demonstrating Attainment

	County	Site	Weighted 2012 DV (ppb)[(1)]	2031 DV (ppb)
Northern	**Stanislaus**	**Turlock-S Minaret Street**	**86.0**	**69**
	Merced	Merced-S Coffee Avenue	81.7	65
	San Joaquin	Tracy-Airport	79.3	66
	Stanislaus	Modesto-14th Street	76.0	61
	San Joaquin	Stockton-Hazelton Street	68.3	57
Central	**Fresno**	**Clovis-N Villa Avenue**	**95.7**	**74**
	Fresno	Fresno-Drummond Street	92.3	71
	Fresno	Parlier	92.0	69
	Fresno	Fresno-Garland	90.7	70
	Fresno	Fresno-Sierra Skypark #2	89.0	68
	Kings	Hanford-S Irwin Street	86.0	64
	Madera	Madera-28621 Ave 14	84.7	65
	Madera	Madera-Pump Yard	79.3	61
	Fresno	Tranquility	76.3	60
Southern	**Tulare**	**Sequoia and Kings Canyon Natl Park**	**93.0**	**65**
	Kern	Arvin-Di Giorgio	89.3	64
	Kern	Edison	87.7	64
	Kern	Bakersfield-5558 California Avenue	86.7	65
	Tulare	Porterville-1839 Newcomb Street	86.3	63
	Kern	Oildale-3311 Manor Street	84.7	65
	Tulare	Sequoia Natl Park-Lower Kaweah	84.0	61
	Kern	Maricopa-Stanislaus Street	83.3	63
	Kern	Shafter-Walker Street	83.0	62
	Tulare	Visalia-N Church Street	82.3	60

(1) For the modeling attainment demonstration, U.S. EPA guidance recommends using an average of three design values to account for year-to-year variability in meteorology. In this case the average of 2012, 2013, and 2014 design values were used, which represents a weighted average of the 2012 base year design value.

B. Weight of Evidence

U.S. EPA modeling guidance requires that the modeled attainment demonstration be accompanied by a weight of evidence analysis (WOE) to provide a set of complementary analyses. Examining an air quality problem in a variety of ways provides a more informed basis for the attainment strategy as well as a better understanding of the overall problem and the level and mix of emissions controls needed for attainment. ARB staff prepared the WOE, which is provided in Appendix B. WOE analyses include assessment of trends in ozone air quality, ozone precursor concentrations, and ozone precursor emissions; meteorology impacts on ozone air quality trends; and summary of corroborating analyses. The WOE analysis draws on

the wealth of data collected in the Valley from both the routine network and special studies. This assessment demonstrated the increasing effectiveness of NOx emission reductions in the Valley. The substantial NOx reductions from implementation of the ongoing control program are consistent with past progress, and the results predicted in the modeled attainment demonstration.

IV. CONTROL STRATEGY

The ongoing emission reductions from continued implementation of ARB and District control strategies developed to meet prior standards provide the attainment control strategy for the 2016 Ozone SIP. By 2031, implementation of the mobile source control program will reduce NOx emissions by 196 tons per day (tpd) and the stationary source control program will reduce NOx emissions by 12 tpd. The following sections highlight ongoing ARB control programs and District measures that provide the emission reductions included in the attainment demonstration. Further information on mobile source control programs and a comprehensive listing of ARB regulations are included in Chapter 5 and Appendix D of the 2016 Ozone SIP.

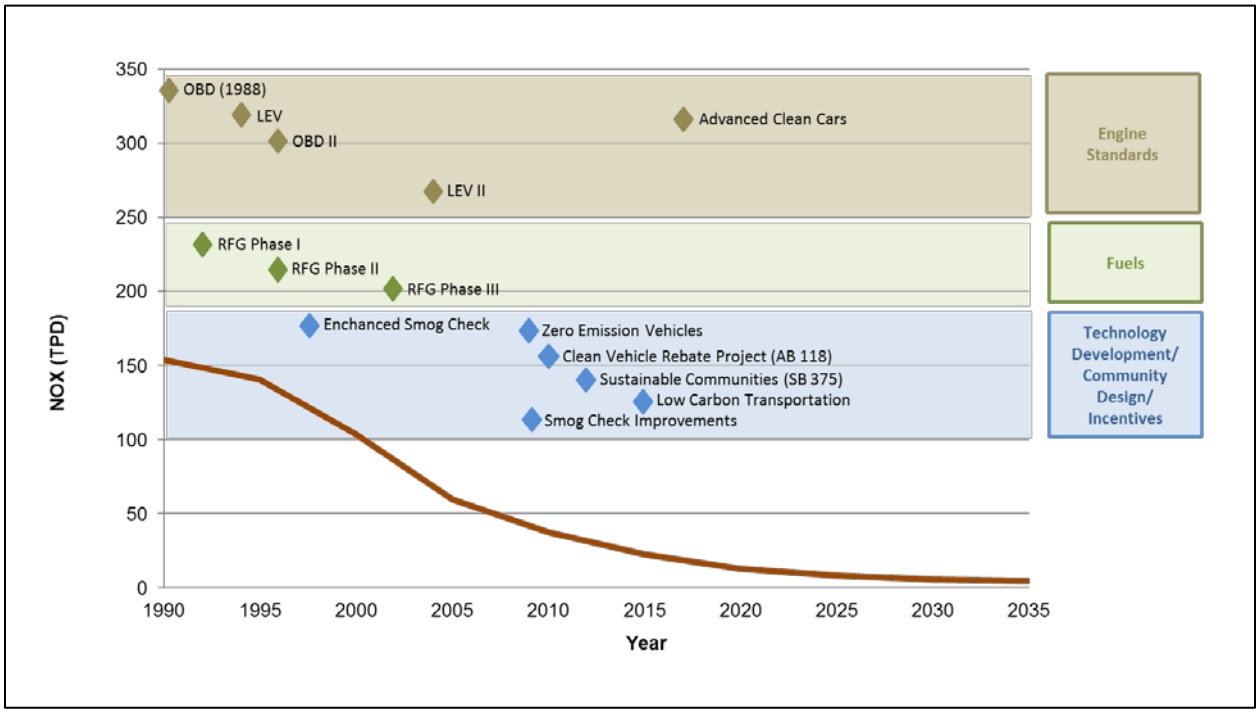
A. Mobile Source Control Program

Given the severity of California's air quality challenges, ARB has implemented the most stringent mobile source emissions control program in the nation. ARB's comprehensive strategy to reduce emissions from mobile sources consists of emissions standards for new vehicles, in-use programs to reduce emissions from existing vehicle and equipment fleets, cleaner fuels, and incentive programs to accelerate the penetration of the cleanest vehicles beyond that achieved by regulations alone. The following sections highlight key programs for both on-road and off-road mobile sources.

1. Light-Duty Vehicles

Figure 3 illustrates the trend in NOx emissions from light-duty vehicles and key programs contributing to those reductions. As a result of these efforts, light-duty vehicle emissions in the Valley have been reduced significantly since 1990, with a further 70 percent reduction form today's levels by 2031. Key light-duty programs include Advanced Clean Cars, On-Board Diagnostics, Reformulated Gasoline, Incentive Programs, and the Enhanced Smog Check Program, and incentive programs.

Figure 3. Key Programs to Reduce Light-Duty NOx Emissions(1)



(1) Diamonds refer to implementation dates.

Emission Standards

Since setting the nation's first motor vehicle exhaust emission standards in 1966, California has dramatically tightened emission standards for light-duty vehicles. The Board established California's Low Emission Vehicle (LEV) program in 1990 and the LEVII program in 1998. Additionally, ARB's Zero Emission Vehicle (ZEV) regulation which affects passenger cars and light -duty trucks, has spurred commercialization of advanced clean cars and light-duty trucks. Today's cars are 99 percent cleaner than they were 25 years ago.

Advanced Clean Cars Program

Light-and medium-duty vehicles are currently regulated under California's Advanced Clean Cars (ACC) program including the LEV III and ZEV programs. The ACC program combines the control of smog and soot causing pollutants, and greenhouse gas emissions, into a package of requirements for passenger car model years 2015 through 2025.

Additional Programs

Other programs, including California's Reformulated Gasoline (RFG) program and the State's goal to put 1.5 million zero-emission vehicles on the road by 2025, will produce substantial and cost-effective emission reductions from gasoline-powered vehicles. Many additional programs are currently in place to reduce emissions from the passenger car legacy fleets and accelerate fleet turn over. California's Enhanced Smog

Check Program, administered by the Bureau of Automotive Repair (BAR), ensures that passenger vehicles stay clean as they age and on-board diagnostic systems identify smog control problems.

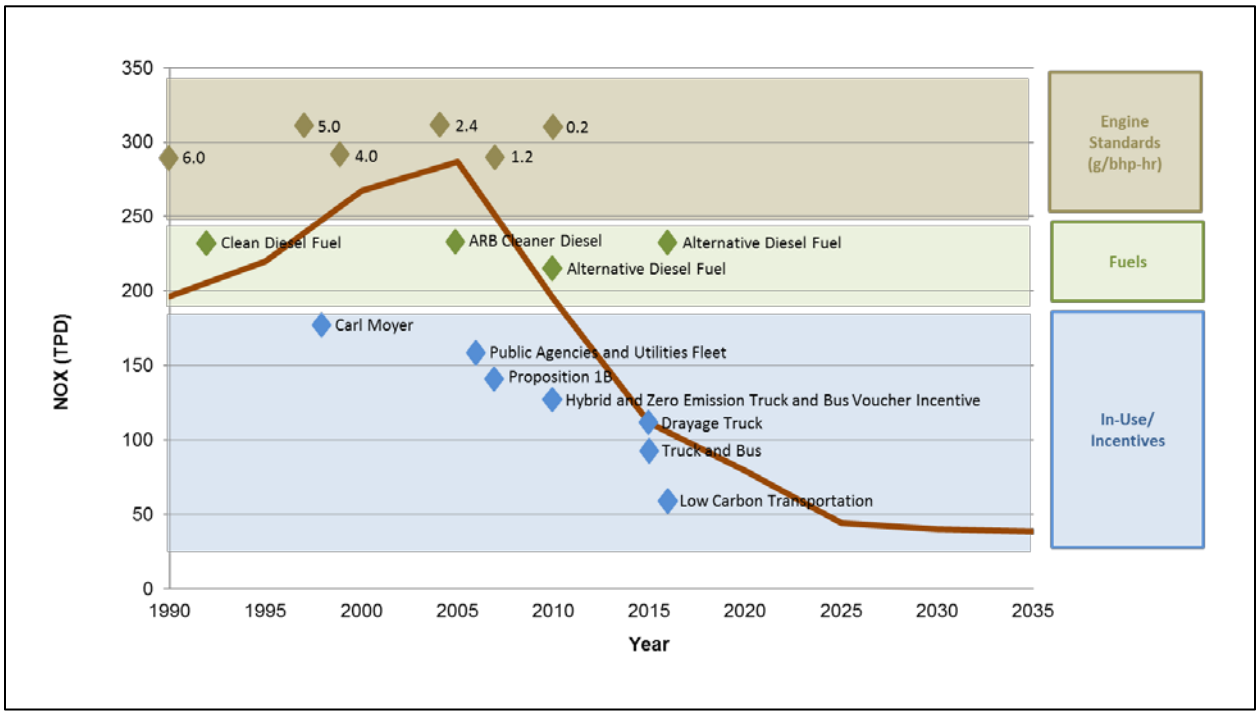
ARB is also active in implementing programs for owners of older dirtier vehicles to retire them early. The "car scrap" programs, like the Enhanced Fleet Modernization Program, and Clean Vehicle Rebate Project have provided monetary incentives to replace old vehicles with zero-emission vehicles.

2. Heavy-Duty Trucks

California's heavy-duty vehicle emissions control program includes requirements for increasingly tighter new engine standards and addresses vehicle idling, certification procedures, on-board diagnostics, emissions control device verification, and in-use vehicles.

Figure 4 illustrates the trend in NOx emissions from heavy-duty vehicles and key programs contributing to those reductions. As a result of these efforts, heavy-duty vehicle emissions in the San Joaquin Valley have been reduced significantly since 1990, with a further 60 percent from today's levels by 2031. Key programs include Heavy-Duty Engine Standards, Clean Diesel Fuel, Truck and Bus Regulation, and incentive programs.

Figure 4. Key Programs to Reduce Heavy-Duty Emissions(1)



(1) Diamonds refer to implementation dates.

Heavy-Duty Engine Standards

This program is designed to achieve an on-road heavy-duty diesel fleet with 2010 engines emitting 98 percent less NOx and PM2.5 than trucks sold in 1986. Since 1990, heavy-duty engine NOx emission standards have been reduced significantly, dropping from 6 grams per brake horsepower-hour (g/bhp-hr) in 1990 down to the current 0.2 g/bhp-hr standard, which took effect in 2010. In the ongoing efforts to go beyond federal standards and achieve further reductions, ARB adopted the Optional Reduced Emissions Standards for Heavy-Duty Engines regulation in 2014 that establishes the next generation of optional NOx emission standards for heavy-duty engines. Engine manufacturers can now certify to three optional NOx emission standards of 0.1 g/bhp-hr, 0.05 g/bhp-hr, and 0.02 g/bhp-hr. The optional standards allow local air districts and ARB to preferentially provide incentive funding to buyers of cleaner trucks, thereby encouraging the development of cleaner engines.

Cleaner In-Use Heavy-Duty Trucks (Truck and Bus Regulation)

The Truck and Bus Regulation, first adopted in in December 2008, represents a multi-year effort to turn over the legacy fleet of engines and replace them with the cleanest technology available. Starting in 2012, the Truck and Bus Regulation phases in requirements applicable to an increasingly larger percentage of the truck and bus fleet over time, so that by 2023 nearly all older vehicles must be upgraded to exhaust emissions meeting 2010 model year engine emissions levels. The regulation applies to nearly all diesel-fueled trucks and buses with a gross vehicle weight rating (GVWR) greater than 14,000 pounds that are privately or federally owned, including on-road and off-road agricultural vehicles, and privately and publicly owned school buses. Moreover, the regulation applies to any person, business, school district, or federal government agency that owns, operates, leases or rents affected vehicles. The regulation also establishes requirements for any in-state or out-of-state motor carrier, California-based broker, or any California resident who directs or dispatches vehicles subject to the regulation.

Additional Programs

Since 1993, ARB has required that diesel fuel have a limit on the aromatic hydrocarbon content and sulfur content of the fuel. In 2006, ARB required a low-sulfur diesel fuel, to be used not only by on-road diesel vehicles but also for off-road engines. The diesel fuel regulation allows alternative diesel formulations as long as emission reductions are equivalent to the ARB formulation.

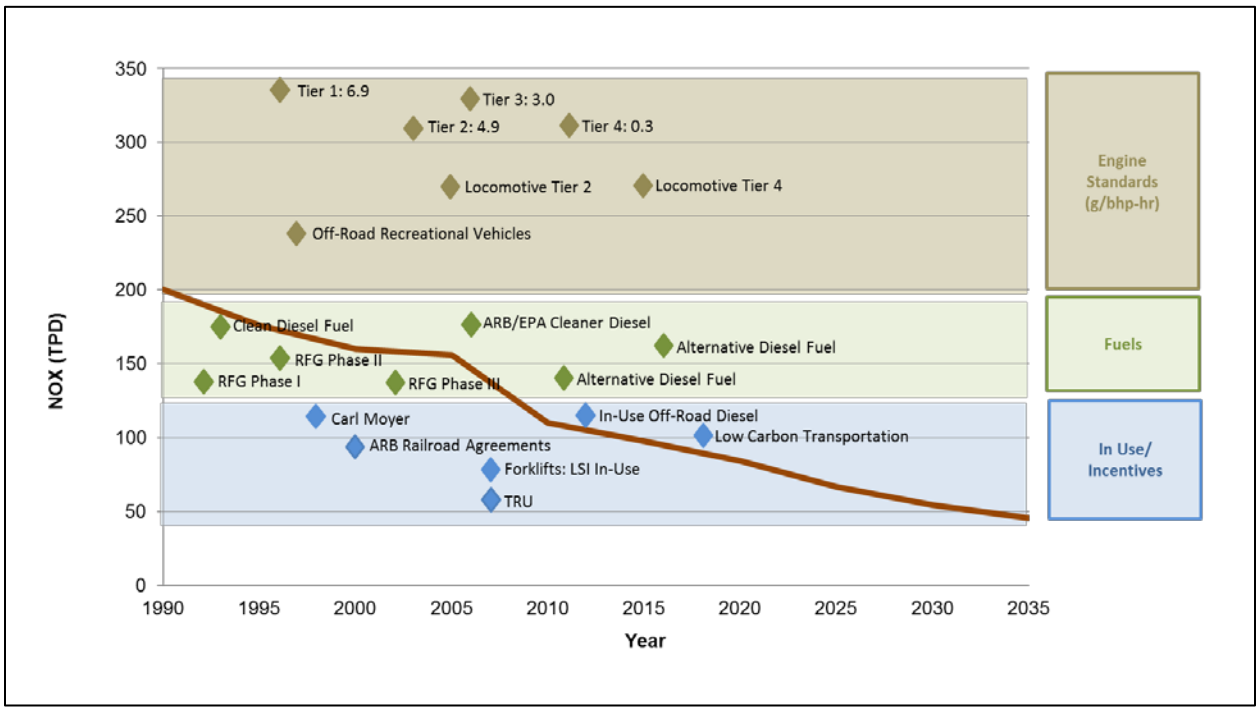
Incentive programs focusing on heavy-duty vehicles have also been instrumental in achieving further emission reductions beyond traditional regulations. These include the Carl Moyer Program, Goods Movement Emission Reduction Program funded by Proposition 1B, and the Air Quality Improvement Program that has funded the Hybrid and Zero-Emission Truck and Bus Voucher Incentive Project (HVIP). ARB has also administered a Truck Loan Assistance Program since 2009.

3. Off-Road Sources

Off-road sources encompass equipment powered by an engine that does not operate on the road and include locomotives, aircraft, tractors, harbor craft, off-road recreational vehicles, construction equipment, forklifts, and cargo handling equipment.

Figure 5 illustrates the trend in NOx emissions from off-road equipment and key programs contributing to those reductions. As a result of these efforts, off-road emissions in the San Joaquin Valley have been reduced significantly since 1990 and will be reduced a further 40 percent by 2031. Key programs include Off-Road Engine Standards, Locomotive Engine Standards, Clean Diesel Fuel, Cleaner In-Use Off-Road Regulation, In-Use LSI Fleet Regulation, and incentive programs.

Figure 5. Key Programs to Reduce Off-Road Emissions(1)



(1) Diamonds refer to implementation dates.

Off-Road Engine Standards

ARB has adopted three tiers of progressively more stringent exhaust emission standards for small off-road engines (SORE) such as lawn and garden equipment.

Forklifts are subject to new engine standards for both diesel and Large Spark Ignition (LSI) engines, with the most recent Tier 4 Final emission standards for off-road diesel engines phased in starting in 2013, and the cleanest emission standards for LSI engines phased-in starting in 2010.

Emissions from locomotive engines are under U.S. EPA jurisdiction. In 1998, U.S. EPA approved regulations that primarily emphasized NOx reductions through Tiers 0, 1, and 2 national locomotive emission standards. In 2008, U.S. EPA approved regulations emphasizing PM reductions through three tiers of standards, plus a fourth tier of NOx and PM emission standards.

Cleaner In-Use Off-Road Equipment (Off-Road Regulation)

The Off-Road Regulation, adopted in 2007 and amended in 2010, is an extensive program designed to accelerate the penetration of the cleanest equipment into California's fleets, and impose idling limits on off-road diesel vehicles. The program goes beyond emission standards for new engines through comprehensive in-use requirements for legacy fleets. These off-road vehicles are used in construction, manufacturing, the rental industry, road maintenance, airport ground support and landscaping. In December 2011, the Off-Road Regulation was modified to include on-road trucks with two diesel engines. The performance requirements of the Off-Road Regulation are phased in from January 1, 2014 through January 1, 2019.

Clean Diesel Fuel

Since 1993, ARB has required that diesel fuel have a limit on the aromatic hydrocarbon content and sulfur content of the fuel. In 2006, ARB required a low-sulfur diesel fuel to be used not only by on-road diesel vehicles but also for off-road engines. The diesel fuel regulation allows alternative diesel formulations as long as emission reductions are equivalent to the ARB formulation.

LSI In-Use Fleet Rule

Forklift fleets can be subject to either the LSI fleet regulation, if fueled by gasoline or propane, or the off-road diesel fleet regulation. Both regulations require fleets to retire, repower, or replace higher-emitting equipment in order to maintain fleet average standards. The LSI fleet regulation was originally adopted in 2007 with requirements beginning in 2009. While the LSI fleet regulation applies to forklifts, tow tractors, sweeper/scrubbers, and airport ground support equipment, it maintains a separate fleet average requirement specifically for forklifts. The LSI fleet regulation requires fleets with four or more LSI forklifts to meet fleet average emission standards.

Incentive Programs

Similar to programs targeted at on-road fleets, incentive programs have been instrumental in achieving additional emissions reductions. The Carl Moyer Program is one example that provides grant funding for cleaner-than-required off-road engines, agricultural equipment, and locomotives.

Engines and equipment used in agricultural processes are unique to each process and are often re-designed and tailored to their particular use. Fleet turnover to cleaner

engines is the focus for these engines. In the San Joaquin Valley, where agriculture has a larger impact on air quality than in other areas of the state, state incentive programs have been leveraged with federal and local incentives to provide farmers assistance to replace their older, higher-polluting equipment with the cleanest available technology. ARB is also working with the District on developing a pilot project that gives farmers opportunity to replace their high-emitting equipment through a trade-up system.

B. District Control Program

Consistent with its regulatory authority, the District has adopted rules for reducing emissions from broad scope of stationary and area sources. Table 4 highlights District stationary source rules that achieve emission reductions in 2012 and beyond. The District has also adopted rules to reduce emissions due to mobile source activity associated with indirect sources and to reduce employer based trips.

Table 4. Adopted District Rules Achieving Emission Reductions in and After 2012

District Rule		Date Adopted or Last Amended
4103	Open Burning	4/15/210
4307	Boilers, Steam Generators, and Process Heaters 2 to 5 MMBtu/hr	5/19/11
4308	Boilers, Steam Generators, and Process Heaters 0.075 to <2 MMBtu/hr	11/14/13
4311	Flares	6/18/09
4306/ 4320	Boilers, Steam Generators, and Process Heaters > 5 MMBtu/hr	10/16/08
4352	Solid Fuel Fired Boilers, Steam Generators, and Process Heaters	12/15/11
4354	Glass Melting Furnaces	5/19/11
4565	Biosolids, Animal Manure, and Poultry Litter Operations	3/15/07
4566	Organic Material Composting Operations	8/18/11
4601	Architectural Coatings	12/17/09
4605	Aerosol Assembly and Component Coating Operations	9/20/07
4653	Adhesives and Sealants	9/16/10
4682	Polystyrene, Polyethylene, and Polypropylene Products Manufacturing	9/20/07
4684	Polyester Resin Operations	9/20/07
4702	Internal Combustion Engines	8/18/11
4905	Natural Gas-Fired, Fan-Type Residential Central Furnaces	1/22/15
9610	State Implementation Plan Credit for Emission Reductions Generated through Incentive Programs	6/20/13

In addition, the District operates an extensive voluntary incentives program for achieving further emission reductions needed for attainment. From 1992 to date, the District and grant recipients (through matching funds) have invested more than $1.4 billion in clean air projects. The District currently has $136 million available in incentive funds for 2015-2016.

Further information on District control programs are included in Chapter 5 and Appendix C of the 2016 Ozone SIP.

C. Further Efforts to Enhance Progress

Although the current ARB and District control strategies provide the emission reductions necessary to meet the 75 ppb 8-hour ozone standard by 2031, ARB and the District are pursuing efforts above and beyond those included in the attainment demonstration to continue to enhance ozone progress. These efforts are described below.

1. Proposed ARB SIP Strategy

In May 2016, ARB staff released the Proposed 2016 State Strategy for the State Implementation Plan (State SIP Strategy). The State SIP Strategy describes ARB staff's proposed measures for mobile sources to attain federal air quality standards throughout the State over the next fifteen years. The State SIP Strategy includes measures that combine technology-forcing fleet average standards for new vehicles, cleaner burning fuels, durability requirements and inspection programs to ensure clean in-use performance, sales requirements for advanced technologies, pilot programs to demonstrate technologies, and incentive programs and other actions to accelerate technology deployments. The proposed SIP measures identify the regulatory and programmatic approaches necessary to deploy these cleaner technologies and fuels.

As part of the strategy, ARB staff will propose an emission reduction commitment for the San Joaquin Valley for Board consideration in September. The new measures identified in the strategy will provide additional reductions in the Valley to enhance progress towards meeting the 75 ppb ozone standard. The strategy includes approximately 9 tpd of NOx emission reductions from measures under ARB direct regulatory authority, which when coupled with strong action at the federal level, could achieve a total of 22 tpd of NOx reductions in 2031. Measures providing reductions in the San Joaquin Valley are shown in Table 5.

Table 5. San Joaquin Valley Expected NOx Emission Reductions from State SIP Measures

All emission reductions in tpd

Proposed Measure	2031
On-Road Light-Duty	
Advanced Clean Cars 2	0.2
Total Category Reductions	**0.2**
On-Road Heavy-Duty	
Low-NOx Engine Standard – California Action	7
Low-NOx Engine Standard – Federal Action	8
Advanced Clean Transit	<0.1
Last Mile Delivery	0.2
Zero-Emission Airport Shuttle Buses	<0.1
Total Category Reductions	**16**
Off-Road Federal and International Sources*	
More Stringent National Locomotive Emission Standards	5
Total Category Reductions	**5**
Off-Road Equipment	
Zero-Emission Off-Road Forklift Regulation Phase 1	<0.1
Zero-Emission Airport Ground Support Equipment	<0.1
Small Off-Road Engines	0.3
Transport Refrigeration Units Used for Cold Storage	NYQ
Low-Emission Diesel Requirement	1
Total Category Reductions	**1**
Aggregate Emission Reductions	**22**

* Quantification of emission reductions are based on current growth forecasts, which are undergoing review.
"NYQ" denotes emission reductions are Not Yet Quantified
"—" denotes no anticipated reductions

In addition, in 2015, U.S. EPA further strengthened the 8-hour ozone standard to 70 ppb. Air quality modeling indicates this will require a further 15 percent reduction in NOx emissions from 2031. Coupled with the ongoing control program, reductions from the State SIP Strategy will provide the foundation for meeting the 70 ppb standard by the District's attainment deadline of 2037.

2. Additional District Measures

As part of the 2016 Ozone SIP, the District has committed to work with affected operators in amending the following rules:

Rule 4311 Flares

The District commits to amend the Rule 4311 by December 31, 2017, to include additional ultra-low NOx flare emission limits for existing and new flaring activities at Valley facilities, and to include additional flare minimization requirements to the extent that these controls are technologically and economically feasible.

Rule 4694 Wine Fermentation and Storage Tanks

Modeling shows that ozone formation in the Valley is NOx limited, especially in future years, and ROG emission reductions are not as effective. Thus, the District commits to first evaluate the technological and economic feasibility of control technologies to reduce ROG emissions from wine fermentation processes and potential benefit in reducing ozone. The District commits to then amend Rule 4694 by December 31, 2018.

V. CLEAN AIR ACT REQUIREMENTS

In addition to the elements related to the attainment demonstration, the Act also requires SIPs for ozone extreme areas to address the following elements:

- Base year emission inventories and future year forecasts for manmade sources of ozone precursors;
- Demonstration that control measures meet reasonably available control measures (RACM) level;
- Plan provisions that require reasonable further progress (RFP);
- Provisions for sufficient contingency measures for RFP and attainment;
- Transportation conformity emission budgets to ensure transportation projects are consistent with the SIP; and
- Demonstration that sufficient transportation control strategies and transportation control measures (TCM) have been adopted and implemented to offset any growth in emissions due solely to growth in vehicle miles travelled (VMT).

A. Emission Inventory

Ozone SIPs must contain base year inventories of NOx and ROG, as well as future year forecasts. An emission inventory consists of a systematic listing of sources of air pollutants with an estimate of the amount of pollutant emissions from each source category over a period of time.

ARB and District staff worked jointly to prepare an updated summer average emission inventory for the 2016 Ozone SIP. The inventory includes a category-by-category review and update using the most recent information available on emissions-generating activities and anticipated population and economic growth in the region. Additional information on the emission inventory methodologies and resulting base and future year emissions can be found in Appendix B of the 2016 Ozone SIP. Information on the emissions reporting programs is provided in Chapter 3 of the 2016 Ozone SIP.

New Source Review rules require new and modified stationary sources that increase emissions in amounts exceeding specified thresholds to provide emission reduction offsets to mitigate the emissions growth. Emission reduction offsets represent either on-site emission reductions or use of banked emission reduction credits (ERCs). ERCs are voluntary, surplus emission reductions, which are registered, or banked, with the District for future use as offsets.

Per U.S. EPA policy, ERCs banked before the plan's emission inventory base year (2012 for this plan) must be explicitly treated as emissions in the air. As shown in Table 6, projected ERC use is equal or less than the plan's estimated total growth in emissions for each pollutant. Further detail on ERCs is provided in Appendix L of the 2016 Ozone SIP.

Table 6. Expected ERC Use

Pollutant	Expected ERC Use (tpd)	Growth (tpd)
NOx	5.27	5.28
ROG	12.66	23.57

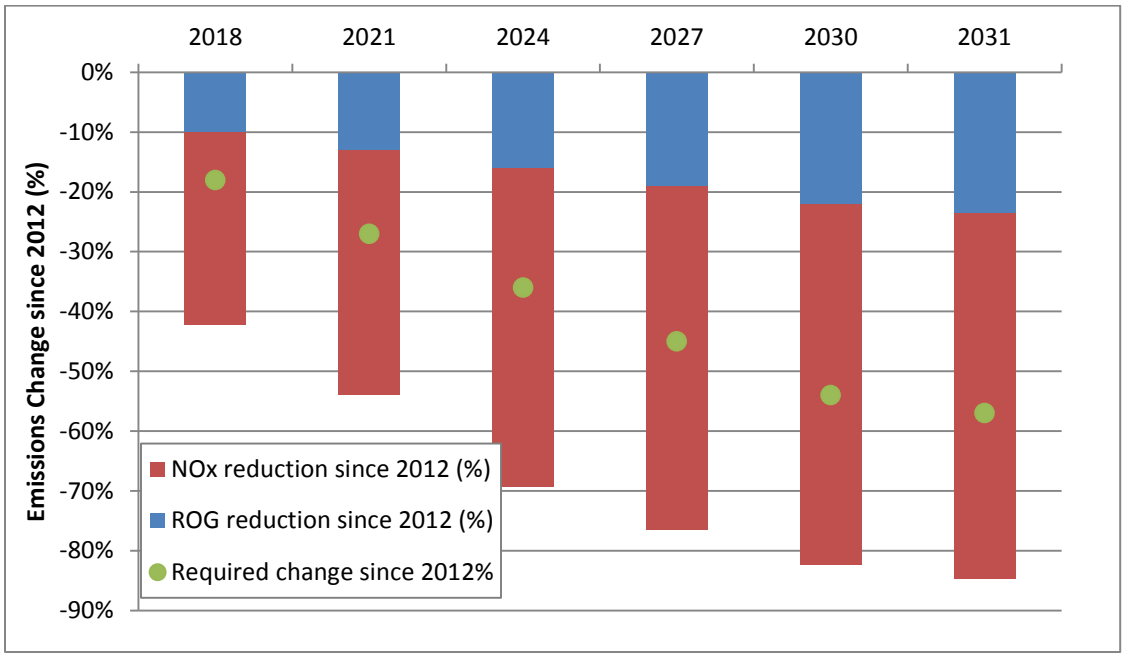
B. Reasonably Available Control Measures Demonstration

As specified in the Act, the SIP shall provide for the implementation of RACM as expeditiously as practicable to provide for attainment of the ozone standard. RACM must also include emission reductions from existing sources that may be obtained through the adoption, at a minimum, of reasonably available control technology (RACT). The U.S. EPA has interpreted RACM as those emission control measures that are technologically and economically feasible and when considered in aggregate, would advance the attainment date by at least one year. The 2016 Ozone SIP contains a RACM demonstration for State, District, and metropolitan transportation agencies that demonstrate no new measures were identified that would advance attainment. These analyses are further described in Chapter 6 of the 2016 Ozone SIP. The District submitted the required RACT SIP to U.S. EPA in 2014. Appendix C of the 2016 Ozone SIP presents the District's further rule evaluation.

C. Reasonable Further Progress

The purpose of the RFP demonstration is to ensure that a nonattainment makes steady progress towards attainment. Per the Implementation Rule, the Valley must demonstrate an average 18 percent reduction in ROG or NOx or in combination for the first six years of the attainment planning period, and an average of three percent per year reduction in emission every three years thereafter until the attainment date. The RFP demonstration in Chapter 6 of the District 2016 Ozone SIP shows that ROG and NOx emission reductions are more than sufficient to meet the required RFP in every milestone year. Figure 6 shows the percent reductions in ROG and NOx emissions, along with the required percent reduction targets since 2012. The emission reductions exceed those required for RFP, as the incremental reductions needed for attainment in an extreme ozone nonattainment area are much larger than the minimum requirements for progress required under the Act.

Figure 6. ROG and NOx Emission Reductions Relative to RFP Targets(1)



(1) Graph from data in Table 6-3 *San Joaquin Valley 2008 8-Hour Ozone NAAQS Reasonable Further Progress* in the 2016 Ozone SIP.

D. Contingency Measures

Contingency measures provide additional emission reductions in the event a nonattainment area fails to achieve RFP targets or attain the ozone standard by its attainment date. These reductions are additional, since they are reductions not accounted for in the RFP or the attainment demonstration. U.S. EPA has interpreted this requirement to represent one year's worth of RFP, amounting to three percent of reductions from measures that are already in place or that would take effect without further rulemaking action.

The RFP demonstration in the 2016 Ozone SIP shows the San Joaquin Valley meets RFP milestone year contingency requirements. The three percent contingency was secured by the first milestone year (2018) and carried through to the attainment year (2031).

To meet the three percent emission reduction for attainment contingency (4 tpd NOx), the 2016 Ozone Plan relies in part on additional reductions occurring between 2031 and 2032 from the continued implementation of the mobile source control program, including the turnover in the mobile source fleet (2.4 tpd). To provide for the remaining reductions, the District's plan makes a small commitment under the 182(e)(5) advanced technology provisions of the Act for extreme nonattainment areas. However, subject to approval by the Board, the reductions identified for the San Joaquin Valley in the State SIP Strategy are sufficient to eliminate the need to include a 182(e)(5) commitment to satisfy the Act's contingency requirements.

E. Transportation Conformity Budgets

Under section 176(c) of the Act, transportation plans, programs, and projects that receive federal funding or approval must be fully consistent with the SIP before being approved by a Metropolitan Planning Organizations (MPO). U.S. EPA's transportation conformity rule[6] details requirements for establishing motor vehicle emission budgets (budgets) in SIPs for the purpose of ensuring the conformity of transportation plans and programs with the SIP.

The 2016 Ozone SIP establishes county-level on-road motor vehicle emission budgets for each RFP milestone year, as well as for the attainment year. Emission budgets for NOx and VOC were calculated using EMFAC2014 and reflect summer average emissions. The emission budgets established in the 2016 Ozone SIP fulfill the requirements of the Act and U.S. EPA regulations to ensure that transportation projects will not interfere with progress and attainment of the annual PM2.5 standard. Additional detail on the on-road motor vehicle emission budgets can be found in Appendix D of the 2016 Ozone SIP.

F. VMT Offset Demonstration

The Act requires areas classified as severe or extreme nonattainment of the ozone standard to submit a VMT offset demonstration. The San Joaquin Valley Air Basin is currently designated as extreme and is therefore subject to this requirement. For areas classified as extreme, Section 182(d)(1)(A) of the Act requires that SIPs include a demonstration that "identifies specific enforceable transportation control strategies and transportation control measures to offset any growth in vehicle miles travelled or number of vehicle trips in such area...."

[6] Federal transportation conformity regulations are found in 40 CFR Part 51, subpart T – Conformity to State or Federal Implementation Plans of Transportation Plans, Programs, and Projects Developed, Funded or Approved Under Title 23 U.S.C. of the Federal Transit Laws. Part 93, subpart A of this chapter was revised by the EPA in the August 15, 1997 Federal Register.

The 2016 Ozone SIP includes a VMT offset demonstration with analysis provided by ARB. This demonstration was prepared pursuant to the requirements of the Act and is consistent with August 2012 U.S. EPA guidance entitled "Implementing Act Section 182(d)(1)(A): Transportation Control Measures and Transportation Control Strategies to Offset Growth in Emissions Due to Growth in Vehicle Miles Traveled." The 2016 Ozone SIP demonstrates that the VMT offset demonstration is satisfied for the San Joaquin Valley and is described further in Appendix D of SIP.

G. Other Requirements

As described in the 2016 Ozone Plan, the Valley already meets the following Act requirements, since they were addressed as part of previously adopted ozone SIPs.

New Source Review: District Rule 4001 (New Source Performance Standards) satisfies the Act's requirements for the preconstruction review and permitting of new or modified major stationary sources. In addition, Rule 2201 (New and Modified Stationary Source Review Rule) sets the emission offsets requirements.

Clean Fuels and Advanced Technologies for Boilers: District Rules 4305, 4306 and 4352 address NOx emission limits for boilers in this category. U.S. EPA approved these rules as part of the SIP for the previous 8-hour ozone Plan[7] that they comply with the Act requirement for clean fuels and technologies for boilers.

H. Bakersfield Area Monitor

An adequate monitoring network is important for assessing pollutant exposure across a region. As part of meeting Infrastructure SIP requirements defined in the Act, states must demonstrate that the monitoring network meets all federal monitoring regulations. On April 1, 2016, U.S. EPA partially disapproved elements of the California Infrastructure SIP related to ozone monitoring requirements in the Bakersfield Metropolitan Statistical Area (MSA) [8]. ARB operated an ozone monitor at the Arvin Bear Mountain monitoring site for twenty years. At the time of operation, this site recorded the highest ozone concentrations in the Bakersfield MSA. However, in 2009 the Arvin Edison Water District notified ARB that it would not renew ARB's lease for the Arvin Bear Mountain site. Although ARB immediately established a replacement site at the Arvin Di Giorgio elementary school, U.S. EPA had not yet approved the relocation at the time of their disapproval of the Infrastructure SIP. The relocation of the Bear Mountain monitoring site to the Di Giorgio monitoring site was subsequently approved by U.S. EPA on May 2, 2016. A copy of the approval letter is included in Appendix C**.** Documentation of the approval of Arvin Di Giorgio as the replacement site included in this SIP submission addresses U.S. EPA's partial disapproval of the California Infrastructure SIP.

[7] 76 FR 57846 https://www.gpo.gov/fdsys/pkg/FR-2011-09-16/pdf/2011-23656.pdf
[8] 81 FR 18766 http://www.gpo.gov/fdsys/pkg/FR-2016-04-01/pdf/2016-07323.pdf

VI. ENVIRONMENTAL IMPACTS

The District found that the 2016 Ozone Plan will not result in any potentially significant adverse effects on the environment and is exempt from the provisions of the California Environmental Quality Act (CEQA) under the provisions of sections 15061 (b)(3) (the general rule that CEQA only applies to projects which have the potential for causing a significant effect on the environment) and 15308 (actions taken by a regulatory agency for protection of the environment) of the CEQA Guidelines.

ARB has determined that its review and approval of the 2016 Ozone Plan submitted by the District for inclusion in the California State Implementation Plan (SIP) is a ministerial activity by ARB for purposes of CEQA (14 CCR § 15268). A "ministerial" decision is one that involves fixed standards or objective measurements, and the agency has no discretion to shape the activity in response to environmental concerns. (14 CCR § 15369; *San Diego Navy Broadway Complex Coalition v. City of San Diego* (2010) 185 Cal.App.4th 924, 934.)

ARB's review of the 2016 Ozone Plan is limited to determining if it meets all the requirements of the Act. ARB is prohibited from approving it or changing it unless ARB finds that it does not comply with the Act (Health and Safety Code § 41650 and 41652). Since ARB lacks authority to not approve the plan, or modify it, in response to environmental concerns raised through the CEQA process, ARB's action on the plan is ministerial for purposes of CEQA.

VII. STAFF RECOMMENDATION

ARB staff recommends that the Board:

1. Adopt the San Joaquin Valley 2016 Ozone SIP, including emission inventory, attainment demonstration, RACM demonstration, RFP demonstration, contingency measures, transportation conformity budgets, and VMT offset demonstration, as a revision to the California SIP.

2. Submit ARB's request in the staff report identifying the Arvin-Di Giorgio ozone monitoring site as the maximum ozone concentration monitor in the Bakersfield MSA as an addition to the California SIP to address U.S. EPA's partial disapproval of the California Infrastructure SIP.

3. Direct the Executive Officer to submit the San Joaquin Valley 2016 Ozone SIP and the ARB staff report to U.S.EPA for approval.