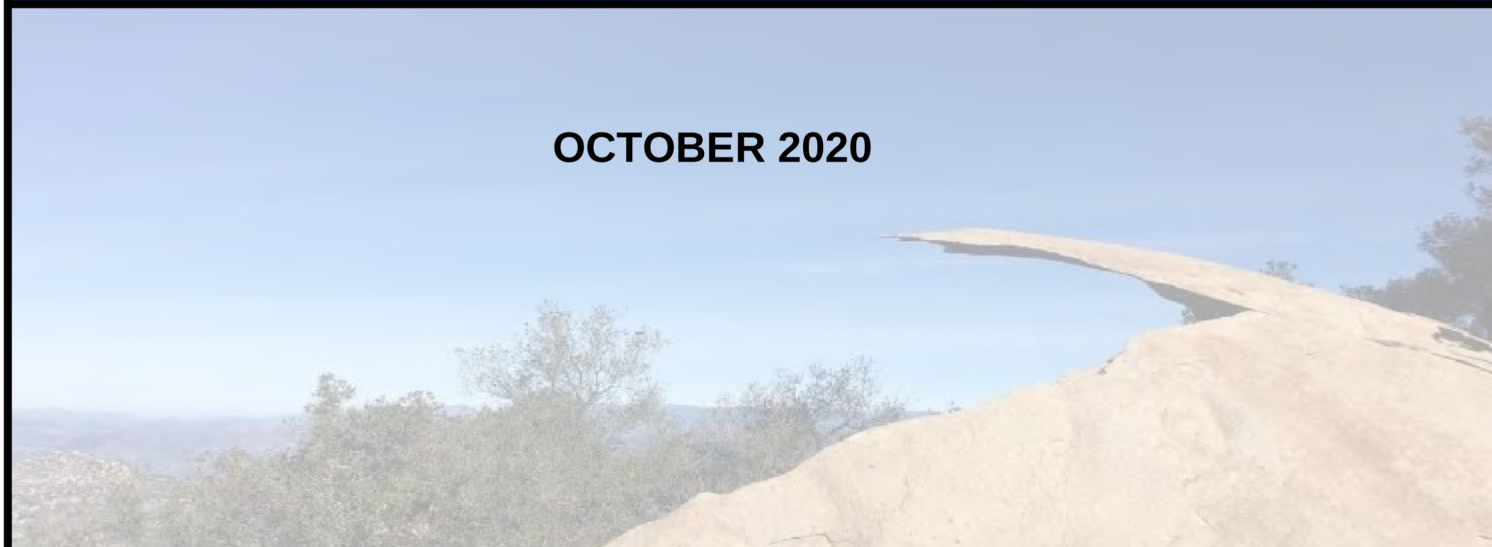
2020 PLAN FOR ATTAINING THE NATIONAL AMBIENT AIR QUALITY STANDARDS FOR OZONE IN SAN DIEGO COUNTY

OCTOBER 2020



APCD
AIR POLLUTION CONTROL DISTRICT
COUNTY OF SAN DIEGO

This is the plan to achieve the National Ambient Air Quality Standards for ozone in San Diego County.

Through a combination of regulatory and incentive-based approaches, clean air is within reach.

2020 PLAN FOR ATTAINING THE NATIONAL AMBIENT AIR QUALITY STANDARDS FOR OZONE IN SAN DIEGO COUNTY

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ATTACHMENTS

Source: https://www.forbes.com/sites/robinraven/2019/07/15/where-to-stay-in-san-diego/#231ecf767cf3

EXECUTIVE SUMMARY

This Ozone Attainment Plan for San Diego County (Attainment Plan) demonstrates how the region will further reduce air pollutant emissions in order to attain the current National Ambient Air Quality Standards (NAAQS) for ozone by specified dates. If approved by the San Diego County Air Pollution Control District (District) Board, this Attainment Plan will be submitted to the California Air Resources Board (CARB) for their approval, and then submittal to the U.S. Environmental Protection Agency (EPA) as a revision to the California State Implementation Plan (SIP) for attaining the ozone standards.

In 2008 and 2015, the EPA promulgated the ozone standards addressed in this Attainment Plan. In 2008, the EPA set the limit for ozone concentrations in the outdoor air at 75 parts per billion (ppb) on an eight-hour average basis. The San Diego region is currently classified by the EPA as a Serious Nonattainment Area for the 2008 ozone standard, with an attainment deadline of July 20, 2021. In 2015, the EPA issued an additional, more health-protective ozone standard of 70 ppb while retaining the 2008 standard. The region is classified as a Moderate Nonattainment Area for the 2015 ozone standard, with an attainment deadline of August 3, 2024.

The District continuously measures ozone levels at seven locations throughout the region to track the region's progress in attaining the ozone standards. Maximum ozone levels have dropped by 21% since year 2000 and large portions of the region meet both federal ozone standards, yet there are a few areas of the County that do not. Furthermore, in 2019, the region experienced record-low levels of ozone-forming emissions and had the fewest number of exceedances of the ozone standards since air quality monitoring began here in the 1950s. These regionwide air quality improvements are the result of increasingly stringent air pollution regulations where local businesses have reduced their emissions substantially, consumer products we all use now emit less ozone-forming compounds, newer motor vehicles are lower emitting (some even emitting zero emissions), and the District mobile source emissions programs (grants for clean equipment and rule enforcement); all helping to create substantially cleaner air for everyone. Nevertheless, in order to attain the federal ozone standards, the region still requires further reductions of air pollutants, especially from mobile sources as they contribute 65% of all ozone-forming pollutants emitted in San Diego County in 2020.

Air quality management is a shared responsibility amongst the EPA, CARB, and the District, with each managing different programs. The EPA primarily oversees mobile air pollutant emissions (on-road vehicles) and major stationary sources (and for which authority is delegated to the District). CARB regulates consumer products (e.g. small engines, garden equipment, aerosol paints, personal care products), motor vehicle fuels, mobile sources (e.g. motor vehicles, off-road equipment), and greenhouse gases. The District regulates stationary sources of air pollutants. The combined efforts of these agencies over many decades have resulted in the cleanest air ever in San Diego County, yet further improvements are required in order to attain the National Ambient Air Quality Standards for ozone.

Although air quality in this region has improved substantially, and is projected to continue occurring, scientific air quality modeling performed by CARB concludes that a longer timeframe is necessary to attain each ozone standard. The longer timeframes will allow necessary time to realize full implementation of the stationary and mobile source regulations contained in this Attainment Plan. This will result in the region being reclassified from a Serious Nonattainment

Area to a Severe Nonattainment Area for both ozone standards, despite air quality continuing to improve. The Severe classifications will result in new attainment year deadlines of 2026 and 2032. Upon submittal of this Attainment Plan to the EPA, CARB will request that San Diego County be reclassified as a Severe Nonattainment Area for both ozone standards as authorized by the federal Clean Air Act (CAA). As such, this Attainment Plan complies with the Severe Nonattainment Area classification planning requirements and includes demonstrations for attainment of the 75 ppb and 70 ppb ozone standards by 2026 and 2032, respectively. The plan includes, but is not limited to:

A. Regionwide inventories of ozone-forming emissions;
B. A Reasonably Further Progress (RFP) demonstration showing emissions reductions during the years leading to the attainment dates;
C. An assessment of Reasonably Available Control Technology (RACT) and Reasonably Available Control Measures (RACM);
D. Contingency measures in the event the emissions controls fall short of achieving the needed reductions;
E. Other plan elements as required by the federal CAA.

This Attainment Plan satisfies requirements for both ozone standards, and consists of the following components:

- **Introduction and Overview** (Section 1)
  Introductory information common to the 2008 and 2015 National Ambient Air Quality Standards (NAAQS), including background information on ozone formation, health effects of ozone exposure, the NAAQS designation process, the emissions reductions achieved, and the effects of transported air pollution on San Diego County.
- **General Attainment Plan Requirements** (Section 2)
  The Attainment Plan requirements shared by the 2008 and 2015 ozone NAAQS. The information presented in this section fulfills the requirements for both standards. Included are emissions inventories, emissions budgets for general conformity, a summary of State and local emission control measures, New Source Review (NSR) permitting requirements, and certification that the District has a local rule in place to require sources to report emission data as required by the Clean Air Act.
- **Planning requirements applicable to the 2008 ozone NAAQS** (Section 3)
  The planning requirements applicable only to the 2008 ozone NAAQS, including: specified attainment and milestone years, on-road motor vehicle emissions budgets for transportation conformity, a Vehicle Miles Traveled offset demonstration, Reasonably Available Control Measures (RACM), Reasonable Further Progress (RFP), an Attainment Demonstration, and contingency measures in the event of a failure to meet a milestone or to attain by the predicted attainment date.
- **Planning requirements applicable to the 2015 ozone NAAQS** (Section 4)
  The planning requirements applicable only to the 2015 ozone NAAQS, including: specified attainment and milestone years, on-road motor vehicle emissions budgets for transportation conformity, a Vehicle Miles Traveled offset demonstration, Reasonably Available Control Measures (RACM), Reasonable Further Progress (RFP), an Attainment Demonstration, and contingency measures in the event of a failure to meet a milestone or to attain by the predicted attainment date.


Source: https://www.landandfarm.com/property/619_Acres_in_San_Diego_County-3324905/

1.0 INTRODUCTION AND OVERVIEW

SECTION 1 HIGHLIGHTS

- Ground-level ozone is a harmful air pollutant.
- Air pollution control in San Diego County is a shared responsibility among the District, California Air Resources Board (CARB), and the U.S. Environmental Protection Agency (EPA).
- Significant emission reductions have occurred due to the air pollution control program, despite considerable regional growth.
- Transported pollution from the South Coast air basin and Mexico increases ozone levels in San Diego County under certain weather conditions.
- Attainment of the 2008 ozone standard by the current deadline of July 20, 2021, is not feasible. Nor is attainment of the 2015 ozone standard by the current deadline of August 3, 2024.
- Upon submittal of this Attainment Plan to the EPA, CARB will request that San Diego County be reclassified as a Severe nonattainment area for both standards.
- The District has prepared an Attainment Plan for both ozone standards, to optimize resources and meet all necessary CAA requirements for each standard.

1.1 BACKGROUND

Pursuant to the federal Clean Air Act (CAA),[1] the U.S. Environmental Protection Agency (EPA) has established the National Ambient Air Quality Standards (NAAQS) for six common, yet harmful, outdoor air pollutants in order to protect public health and the environment. Each area of the nation with air pollution levels exceeding a federal ambient air standard must be designated by the EPA as a “Nonattainment Area” for that standard and must submit a “State Implementation Plan” (SIP) outlining the combination of local, State, and federal actions and emission control regulations necessary to bring the area into attainment as expeditiously as practicable. Further, the EPA classifies ozone nonattainment areas as Marginal, Moderate, Serious, Severe, or Extreme, depending on the severity and persistence of the ozone problem. Areas with greater air pollution levels place people at a greater risk of harm, and subsequently must adopt ever more stringent (tougher) air pollution control measures. These generally include enhanced rules designed to limit emissions of air pollutants. Areas with the highest air pollution levels are given added time to attain the NAAQS because their challenges are greater, often requiring technology-forcing innovations to further reduce air pollutant emissions.

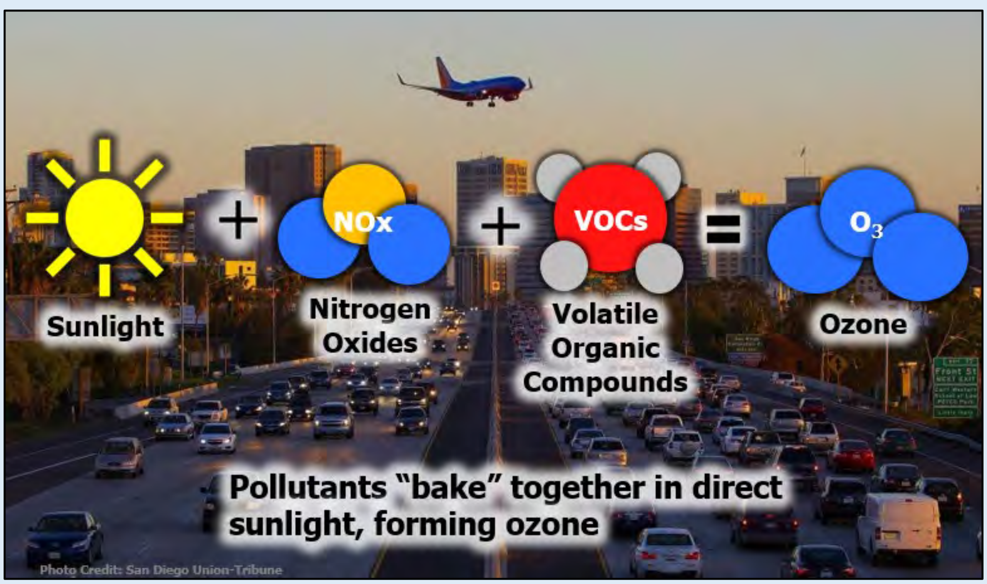
San Diego County is currently designated as a Serious Nonattainment Area for the 2008 ozone NAAQS (75 ppb), and a Moderate Nonattainment Area for the 2015 ozone NAAQS (70 ppb). Accordingly, the San Diego County Air Pollution Control District (District) must prepare and submit to the EPA, via CARB, two ozone SIPs identifying control measures and associated emissions reductions necessary to demonstrate attainment of the 75 ppb standard by July 20, 2021 (2020 attainment year)[2] and attainment of the 70 ppb standard by August 3, 2024 (2023 attainment year). This Attainment Plan addresses all requirements for both ozone standards.

Air quality management in California is a shared responsibility among federal, State, and local agencies. At the national level, the EPA regulates emissions from off-road equipment and inter-state sources such as ships, trains, aircraft, and out-of-state vehicles. In California, CARB regulates emissions from on-road motor vehicles, off-road vehicles and equipment, fuels, and consumer products.[3] The District regulates emissions from stationary sources of air pollutants such as factories, power plants, gasoline stations, and other businesses and industrial operations.[4] Additionally, the District regulates products such as coatings, industrial solvents, and residential water heaters and furnaces. As a result of these collective efforts, the mobile and stationary sources in San Diego County are among the cleanest in the nation; yet, further emissions reductions are necessary in order to attain the 2008 and 2015 ozone NAAQS and protect public health throughout the region.

1.2 OZONE

Ozone is a reactive and corrosive gas composed of three oxygen atoms, that is found in two layers of the atmosphere. It occurs naturally in the stratosphere where it absorbs harmful ultraviolet (UV) radiation that is emitted by the sun, thusly partially shielding the public from its effects such as extreme sunburn and skin cancer.

Ozone also exists in the troposphere. For the most part, this “ground-level” ozone is not naturally occurring (yet plants and wildfires do emit ozone forming compounds), but rather is the result of human activities that create air pollutants that react to form ozone. Ground-level ozone is not emitted directly into the air but is formed by chemical reactions driven by heat and sunlight (UV radiation) that turn two common air pollutants into ozone: oxides of nitrogen (NOx) and volatile organic compounds (VOC). NOx is emitted by combustion processes such as motor vehicle engines, planes, ships, trains, and industrial processes that burn fuel. VOCs include paint thinner vapors, barbecue lighter fluid, gasoline vapors, fumes from paints and cleaners, and even propane gas.



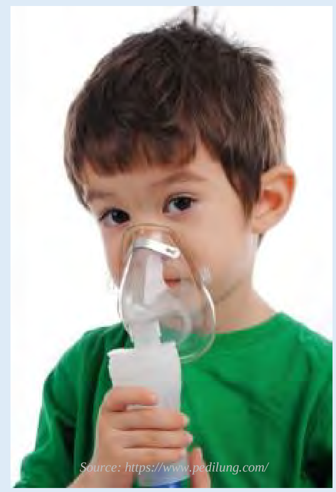
How is ground-level ozone formed?

Ozone concentrations are usually high during the spring and summer months because abundant sunshine and warm air temperature promotes ozone formation. This is especially true when warm, stagnant weather occurs and causes a buildup of reactive air pollutants in the atmosphere. Additionally, warm weather is often associated with stable atmospheric conditions and an inversion layer[5] in the lower atmosphere, which reduce the dispersion of ozone.

Because of the harmful impacts on human health and the environment, ground-level ozone is regulated by the federal Clean Air Act, and as such is the subject of this Attainment Plan.

1.2.1 Health and Welfare Effects

Research has shown that exposure to unhealthful levels of ozone can cause lung and airway inflammation, significant decreases in lung function and capacity, and other respiratory symptoms such as coughing and pain when taking a deep breath. As with any health issues, some people are more sensitive to ozone than others and the severity of health effects can vary widely among individuals. Children, older adults, people with pre-existing disease and anyone working, exercising, or playing outdoors are at a greater risk of adverse health impacts from ozone exposure. Ozone also impacts the agricultural and forest industries, slowing plant growth, reducing crop yields, and increasing susceptibility to disease, pests, and harsh weather.



Ground-level ozone and other air pollutants can trigger asthma flare-ups

1.2.2 National Ambient Ozone Air Quality Standards

The NAAQS establish the outdoor air pollutant concentrations that, when attained, are deemed protective of public health and the environment. The EPA periodically reviews and may revise the NAAQS based on the latest medical and scientific evidence regarding air pollutant impacts. Consequently, this is why there are two ozone standards (2008 and 2015 ozone NAAQS), with the more recent standard being more health protective.

The NAAQS include both "primary" and "secondary" standards for each pollutant. Primary standards are set at a level to protect public health, including the health of vulnerable populations (such as children, asthmatics and the elderly) with an adequate margin of safety. Secondary standards are set at a level to protect the public welfare including agriculture, ecology, buildings and materials.

The EPA has repeatedly tightened the NAAQS for ozone over the past 40 years. The primary and secondary ozone standards were as high as 120 ppb in 1979 before being lowered to 84 ppb in 1997. Then, the primary and secondary standards were reduced to 75 ppb in 2008 and to 70 ppb in 2015. The 1979 and 1997 ozone standards have been revoked by the EPA for areas that attained these standards, including San Diego County. The 2008 ozone standards have been retained by the EPA and remain in effect along with the 2015 ozone standards.

1.2.2.1 2008 Ozone NAAQS

On March 27, 2008, the EPA published a final rule lowering the federal ozone NAAQS standards from 84 ppb to a more health-protective 75 ppb, effective May 27, 2008.[6] The 2008 ozone NAAQS is attained when the "three year average" of the "annual fourth highest daily maximum" eight-hour average ozone concentration—called the "design value"—is no greater than 75.9 ppb at each EPA-approved ozone air quality monitor in the region.

On May 21, 2012, the EPA published a final ozone rule detailing the designations and classification scheme for nonattainment areas, effective July 20, 2012.[7] Effective April 6, 2015,[8] the EPA published a final rule detailing the implementation requirements for the standard. This final implementation rule addresses a range of nonattainment area SIP requirements for the 2008 ozone NAAQS, including attainment demonstrations, Reasonable Further Progress (RFP), Reasonably Available Control Technology (RACT), Reasonably Available Control Measures (RACM), New Source Review (NSR), emissions inventories, and the timing of required SIP submissions and compliance with emission control measures in the SIP. These requirements are addressed in this Attainment Plan.

Upon the effective date of the implementation rule for the more stringent 2015 ozone NAAQS on February 4, 2019,[9] EPA did not revoke the 2008 ozone NAAQS. Instead, areas such as San Diego County that were classified as nonattainment for the 2008 NAAQS at the time EPA issued its implementation rule for the 2015 ozone NAAQS will remain subject to the 2008 standard until those regions attain that standard and then develop an EPA-approved maintenance plan demonstrating how compliance with that standard will be maintained.

1.2.2.2 2015 Ozone NAAQS

Effective December 28, 2015, the EPA established an additional, more health-protective standard of 70 ppb.[10] The 2015 ozone NAAQS is attained when the region's design value is no greater than 70.9 ppb at each EPA-approved ozone air quality monitor in the region. Effective February 4, 2019, the EPA finalized a rule detailing the implementation requirements for the standard, as well as a classification scheme for nonattainment areas.[11] This final rule addresses a range of nonattainment area and SIP requirements for the 2015 ozone NAAQS, including similar implementation requirements for the 2008 ozone NAAQS. These requirements are addressed herein.

1.2.3 <u>Ozone Designation and Classification Status</u>

1.2.3.1 2008 Ozone NAAQS

The San Diego region's air quality designations for each NAAQS (attainment, nonattainment, or unclassifiable) are established by federal regulation.[12] The region was initially designated a Marginal Nonattainment Area for the 2008 ozone NAAQS, effective July 20, 2012. Marginal nonattainment areas were required to attain the 2008 ozone NAAQS by July 20, 2015.

Despite substantial air quality progress, the region did not meet the July 20, 2015, attainment deadline. Consequently, on June 3, 2016, the EPA reclassified San Diego County from a Marginal to a Moderate Nonattainment Area.[13] Accordingly, the District was required to submit a SIP that fulfilled Moderate Nonattainment Area requirements, including providing a demonstration of attainment of the 2008 ozone standard by July 20, 2018. The District adopted the required SIP on December 14, 2016.[14] CARB approved the SIP on March 23, 2017, and it was submitted to the EPA on April 12, 2017.[15]

The reason for the region's failure to meet the two previous attainment deadlines is illustrated in Figure 1-1, where the San Diego region experienced uncharacteristically warm temperatures from 2014 through 2017, as shown in yellow highlight. This resulted in the formation of elevated ozone levels in the ambient air, causing the region to fail to attain the 2008 ozone standard by both the July 20, 2015, deadline as a Marginal area, and the July 20, 2018, deadline as a Moderate area. Again, even though substantial emissions reductions have occurred, the warm stagnant weather conditions drove up ozone levels in the air in recent years.

As a result of the above factors, on September 23, 2019, the EPA reclassified San Diego County as a Serious Nonattainment Area,[16] requiring a revised SIP to be submitted by August 3, 2020, along with a demonstration of attainment by July 20, 2021 (2020 attainment year).

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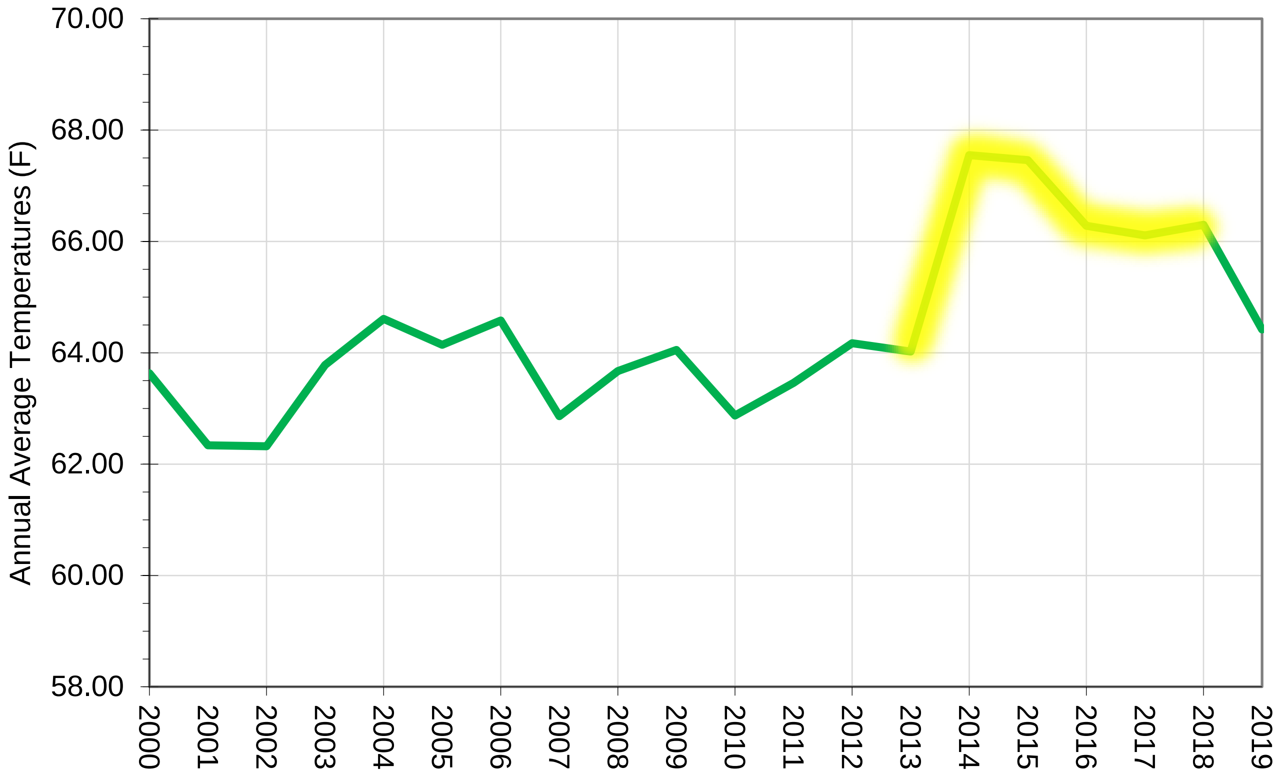
FIGURE 1-1
Annual Average Temperatures at San Diego International Airport, 2000-2019



The photochemical air quality modeling conducted by CARB for this Attainment Plan determined that attainment by July 2020 (which is the Serious Nonattainment Area attainment year deadline) is not feasible. Additional time is required to realize full implementation of the stationary and mobile source regulations contained in this Attainment Plan. Section 181(b)(3) of the CAA permits the State to request a higher classification ("bump-up") to extend the time to achieve the emission reductions necessary for attainment while implementing more stringent permitting requirements on stationary sources. Accordingly, upon submittal of this Attainment Plan to the EPA, CARB will request a Severe classification for San Diego County for the 2008 ozone NAAQS. Accordingly, the Attainment Plan herein addresses Severe nonattainment area requirements, including more restrictive permitting requirements on stationary sources and a demonstration of attainment by July 20, 2027 (2026 attainment year).

1.2.3.2 2015 Ozone NAAQS

The San Diego region is currently designated a Moderate nonattainment area for the 2015 ozone NAAQS, effective August 3, 2018,[17] requiring attainment of the standard no later than August 3, 2024 (2023 attainment year), submission of an updated RACT SIP by August 3, 2020,[18] and submission of a new Attainment Plan meeting Moderate nonattainment requirements no later than August 3, 2021.

However, photochemical air quality modeling conducted by CARB for this Attainment Plan determined that attainment by 2023 (i.e. the Moderate Nonattainment Area attainment deadline) is not feasible. Additional time is required to realize full implementation of the stationary and mobile source regulations contained in this Attainment Plan. Additionally, attainment of the less stringent 2008 ozone NAAQS is projected for 2026. Consequently, attainment of the more stringent 2015 ozone NAAQS in 2023, prior to attaining the less stringent 2008 ozone NAAQS in 2026, is infeasible.

As noted previously, Section 181(b)(3) of the CAA permits the State to request a higher classification (“bump-up”) to extend the time to achieve the emission reductions necessary for attainment. Accordingly, upon submittal of this Attainment Plan to the EPA, CARB will request a Severe classification for San Diego County for the 2015 ozone NAAQS. Therefore, this Attainment Plan herein addresses Severe nonattainment area requirements, including more restrictive permitting requirements on stationary sources and a demonstration of attainment by August 3, 2033 (2032 attainment year).

1.3 AIR QUALITY IMPROVEMENT

As illustrated in Figure 1-2, the region has experienced substantial growth in gross regional product, population, vehicle miles traveled, and energy consumption between 1990- and 2018. Concurrently, emission levels declined, and air quality continued to improve. Total regionwide NOx and VOC emissions were reduced by over 60% and 50%, respectively, during the 2000-2018 time period (see Section 2.1.4 for more information on the emissions trend).[19] These improvements are the result of a combination of regulatory and incentive-based approaches at local, State, and federal government levels. Ongoing implementation of these strategies will continue reducing total ozone precursor emissions as new lower-emitting sources replace older, higher-emitting sources at the end of their useful lives.

To gauge the region’s progress, measurements of ambient air quality (including ozone levels) are continuously collected at seven sites throughout the region pursuant to federal requirements.[20] The resulting data indicate that San Diego County has achieved a 36% reduction (improvement) in the ozone design value between 1990 and 2019.[21]

Figures 1-2 and 1-3 illustrate the long-term decline (improvement) in ozone pollution levels and exceedance days. Notwithstanding the historical trend of declining ozone levels, it is not uncommon to observe ozone upticks in some years due to year-to-year changes in weather conditions that impact ozone formation (such as daily temperatures, relative humidity, and wind speed) rather than to emissions, which have steadily decreased year after year as shown in Figure 1-2.

FIGURE 1-2
Emissions, Air Quality, and Growth Trends in San Diego County, Percent Change Since 1990

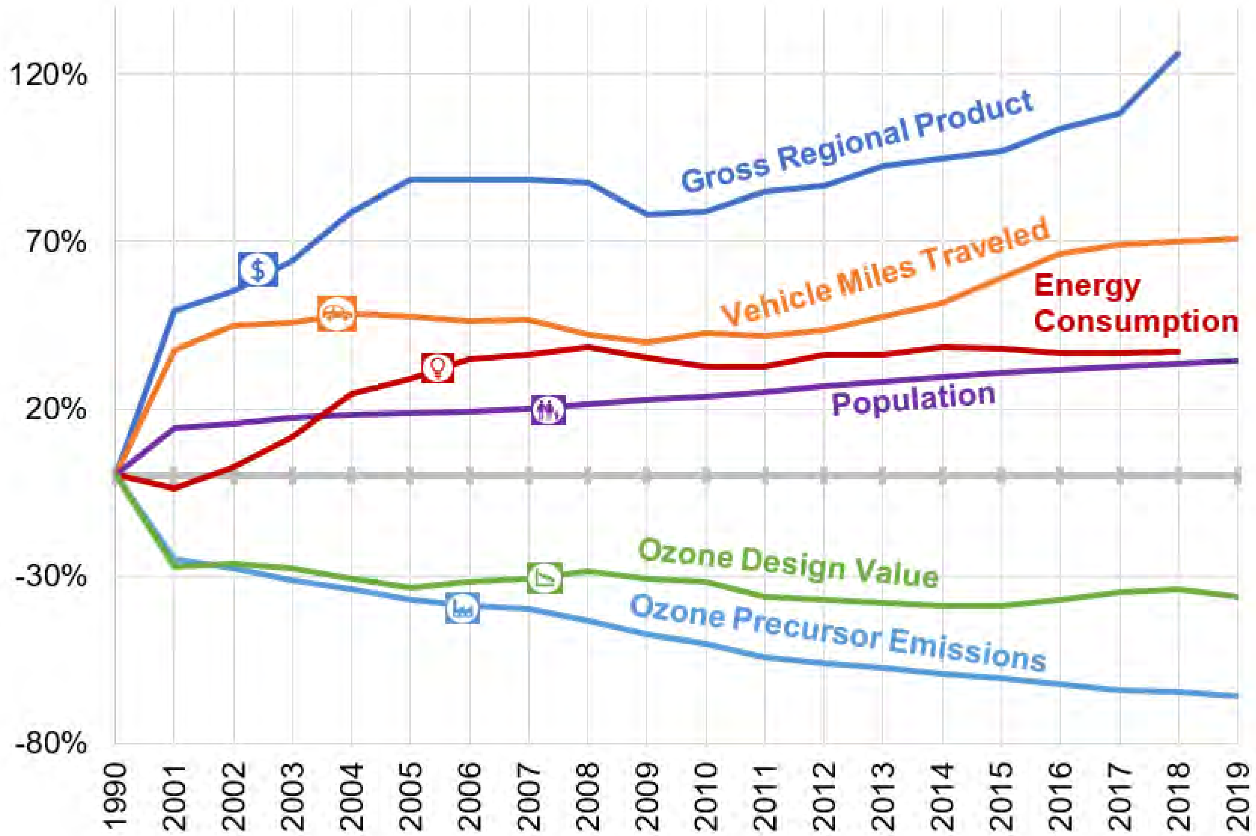


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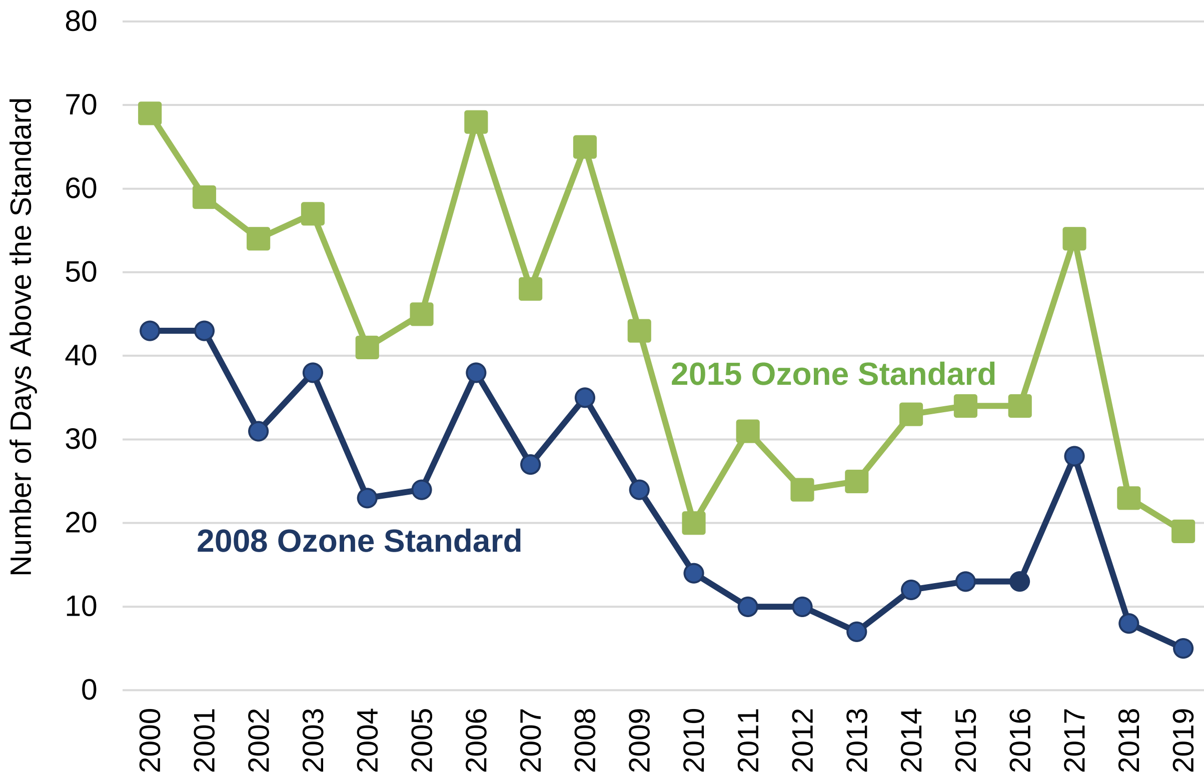
FIGURE 1-3
Improvement in San Diego County Air Quality, San Diego Air Basin



1.3.1 Transported Pollution

Reducing local emissions generated in the San Diego region is the cornerstone of this Attainment Plan. However, San Diego County is situated between Mexico which lacks stringent air quality controls, as well as being downwind of the South Coast air basin,[22] which is an Extreme nonattainment area for ozone. Consequently, air pollution from both regions significantly contribute to ozone levels in the San Diego region under certain weather conditions. This impact is acknowledged in State documentation[23] and regulation.[24] Importantly, the South Coast Air Quality Management District (SCAQMD) has implemented effective emissions control programs, resulting in a trend of emission reductions and air quality improvements in the South Coast region. Though the region is designated as an Extreme Nonattainment Area for the 2008 and 2015 ozone NAAQS, SCAQMD predicts continued ozone reductions through at least 2031 as shown in their SIP for the 2008 ozone NAAQS.[25] In turn, air pollution transported to San Diego County is expected to decrease as a result of their actions.

1.4 TRIBAL NATIONS

As sovereign entities, tribal nations have authority over their own territories. Such areas are generally exempt from local/State regulations and none of the region's tribal areas are subject to District regulations. Tribal nations located in the San Diego region have authority over any air quality planning they choose to perform for their portions of the nonattainment area. In other words, the attainment status of tribal areas and jurisdictional County limits are distinct from one another. Nonetheless, with one exception, tribal lands within the boundaries of San Diego County are designated nonattainment as part of the federal nonattainment area and as such have the same classification level as the entire nonattainment area for both ozone standards. The exception noted above is a tribal nation (Pechanga Reservation) with tribal land that straddles SCAQMD and San Diego County boundaries.[26]

Thus, with the exception for the Pechanga Reservation, CARB's pending request to reclassify San Diego County as a Severe Nonattainment Area for both ozone standards may, at the EPA's discretion, apply to tribal lands in the federal nonattainment area as well. To ensure tribes are included and consulted in the decision-making process, tribal representatives were notified of the availability of this Attainment Plan and were invited to participate in the public review process. Additionally, the District conducted outreach to SANDAG's Interagency Technical Working Group on Tribal Transportation Issues which includes one representative from each federally recognized tribal government in San Diego County. Additional opportunities to review and comment will take place at the State and federal levels when the Attainment Plan is considered for approval by CARB and the EPA.

Source: https://blog.sandiego.org/2013/03/wildflowers-east-county/

2.0 GENERAL ATTAINMENT PLAN REQUIREMENTS

SECTION 2 HIGHLIGHTS

- The District must adhere to planning and emission control requirements to comply with the CAA for each ozone standard.
- In compliance with these requirements, an emission inventory is included to apply to all relevant baseline, milestone, and attainment years for each ozone standard.
- The District also satisfies these requirements by having local emission statement rule, New Source Review (NSR) program, and a stringent suite of emission control measures in place that apply to each ozone standard.
- Projected emissions at local military facilities and the San Diego International Airport have been included in the region's emission inventory to demonstrate general conformity. The emissions can be accommodated without causing additional ozone exceedances.
- Ozone precursor emissions in San Diego County are projected to continue decreasing through 2040.

Section 2 addresses Clean Air Act requirements for which the District's demonstrations of compliance apply to both the 2008 and 2015 ozone standards. Sections 3 and 4 address Clean Air Act requirements for which compliance is demonstrated separately for each ozone standard.

The specific planning and emissions control requirements to implement the 2008 and 2015 ozone NAAQS were published by the EPA on April 6, 2015, and February 4, 2019, respectively.[27,28] These requirements are based on the provisions of Subpart 2 (Title I, Part D) of the CAA. Subpart 2 requirements have long been implemented in San Diego County pursuant to the region's previous nonattainment status for the former 1979 and 1997 ozone NAAQS.

Subpart 2 general attainment plan requirements consist of the following:

- **Emissions Inventories** (Section 2.1) (CAA Section (§) 182(a)(1)). This is a comprehensive estimation of emissions from all sources of air pollution in San Diego County, organized by emission source category. This Attainment Plan includes updated inventories of ozone precursor emissions (VOC and NOx) for the 2017 base year for each of the ozone NAAQS (i.e. the year from which future-year inventories are projected and emission reduction progress is measured).[29] For the 2008 ozone NAAQS, the base year is 2017, with a predicted attainment year of 2026. For the 2015 ozone NAAQS, the base year is also 2017, with an attainment year of 2032. All years are representative of a typical seasonal day. Section 2.1.3 identifies Emissions Budgets for general conformity (i.e. ensuring federal actions are consistent with this Attainment Plan). Transportation conformity (i.e. on-road motor vehicle emissions budgets) for each ozone NAAQS are addressed separately in Sections 3.1.2 and 4.1.2 respectively.

- **Emissions Statement Rule Certification** (Section 2.2) (CAA §182(a)(3)(B)). This demonstrates that the District's existing emissions statement reporting Rule 19.3

(Emission Information) is sufficient for the purposes of the 2008 and 2015 ozone NAAQS for major sources.

- **New Source Review** (NSR) (Section 2.3) (CAA §182(a)(2)). This is required to control and reduce emissions from new and modified sources. This Attainment Plan meets this requirement through the District's NSR rules, which were updated in April 2016 and June 2019.[30] The 2019 rule revision incorporated the emissions applicability thresholds and offset ratios for all possible ozone nonattainment classifications.

- **Emission Control Measures** (Section 2.4). This summary identifies a comprehensive set of stationary and mobile source rules and regulations necessary to attain the 2008 and 2015 ozone NAAQS as expeditiously as practicable.

2.1 EMISSIONS INVENTORIES

2.1.1 Inventory Development Process

Emission inventories, projections, and trends in this Attainment Plan are based on the latest ozone precursor emissions data compiled and maintained by CARB.[31] Supporting data were jointly developed by CARB, the District, and the San Diego Association of Governments (SANDAG), which each play a role in collecting and reviewing the data necessary to generate comprehensive emission inventories. The supporting data include socio-economic projections, industrial and travel activities, emission factors, and emission speciation profiles.

First, CARB compiles annual statewide emission inventories in its emission-related information database, the California Emission Inventory Development and Reporting System (CEIDARS). Emissions data for past and future years are generated using the CARB California Emission Projection Analysis Model (CEPAM) to track progress in meeting emission reduction goals and mandates. CEPAM utilizes the most current growth and emissions control data available (and agreed upon by the stakeholder agencies) to provide comprehensive projections of anthropogenic (human activity related) emissions for each year from 2011 to 2040.[32, 33]

Next, local air districts are responsible for compiling emissions data for all stationary sources and many areawide sources. For mobile sources, CEPAM integrates emission estimates from the CARB EMFAC2017 and OFFROAD models. SCAG and SANDAG incorporate data regarding highway and transit projects from their respective Travel Demand Models for estimating and projecting vehicle miles traveled (VMT) and speed. The CARB on-road emissions inventory (EMFAC2017) relies on these VMT and speed estimates. To complete the inventory, estimates of biogenic (naturally occurring) emissions are developed by CARB using the Biogenic Emissions Inventory Geographic Information System (BEIGIS) model.

Additional information regarding the development of the emissions inventories has been provided by CARB, and can be found within Attachment A, Page A-25.

2.1.2 Inventories for Base and Attainment Years

Detailed inventories of VOC and NOx emissions are presented in Attachment A for the 2017 base year, the 2026 attainment year for the 2008 ozone NAAQS, and the 2032 attainment year for the 2015 ozone NAAQS. Further information is included in Sections 3.1.1 and 4.1.1 for each ozone NAAQS. Additional information regarding the development of the emissions inventories has been provided by CARB and can be found within Attachment A, Page A-25.

2.1.3 Emissions Budgets

2.1.3.1 Military Emissions

The federal general conformity regulation[34] and corresponding District Rule 1501 (Conformity of General Federal Actions),[35] require federal agencies proposing major actions to make a determination that the actions will conform to the SIP. A method for demonstrating conformity is forecasting and accounting for reasonably anticipated emissions from future actions by federal agencies in the SIP.[36]

The Department of the Navy (DoN) and United States Marine Corps (USMC) developed updated projections of future emissions from anticipated military actions in San Diego County through 2037.[37] Further information can be found within Attachment B, which includes preliminary schedules for implementation of the planned military projects through 2037.

For the purposes of analyzing the potential impact of these projects on regionwide attainment of the 2008 and 2015 ozone NAAQS, total emissions from full implementation of these projects were conservatively assumed to occur in 2018. CARB incorporated this growth increment into the 2019 CARB CEPAM emissions inventory (Version 1.00) in June 2019; therefore, a total growth projection of 8.34 tons per day of NOx and 1.08 tons per day of VOC emissions has been incorporated into this Attainment Plan and air quality modeling conducted by CARB. The modeling analysis indicates that military project-related emissions are not expected to cause additional ozone violations.[38]

2.1.3.2 San Diego International Airport Emissions

As discussed in Section 2.1.3.1, a method for demonstrating federal general conformity and compliance with Rule 1501 is the forecasting of, and accounting for, reasonably anticipated emissions from future actions by federal agencies in the applicable SIP (either the attainment plan or the maintenance plan). Accordingly, the San Diego County Regional Airport Authority (Authority) developed an emissions inventory of criteria pollutant emissions at the San Diego International Airport (SDIA)[39] for inclusion in this Attainment Plan. The inventory is included for reference in Attachment C.

The Authority quantified actual emissions from 2012 for aviation and non-aviation sources on SDIA property,[40] including:

- Aircraft (airborne and ground modes)
- Ground support equipment (GSE)
- Roadways and parking garages
- Construction (current and future)[41]
- Stationary sources

The Authority estimated future emissions from these sources based on actions anticipated to occur by 2040.[42] Some source categories identified in the SDIA inventory not already accounted for in the regionwide emissions inventory (Attachment A) include Auxiliary Power Units (APU), new jet fuel storage tanks, and large future construction projects planned between 2020 and 2037.[43] To analyze the construction projects' potential impact on ozone attainment for both ozone standards, full build-out at SDIA was conservatively assumed to have occurred prior to 2026.[44] Updated emissions as reported in Attachment C are accounted for in CARB's emission inventory.[45] Consequently, the forecasted emissions growth from SDIA (at build-out) totaled 1.756 tons per day of NOx, and 0.141 tons per day of VOC. The modeling analysis indicates that these emissions are not expected to cause additional ozone exceedances.[46,47]

ource: SDCRAA, 2019.

Updated Project Site Map of Terminal 1 Replacement

2.1.3.3 Pre-Baseline Banked Emission Credits

The District's federally mandated NSR Rules require new and modified major stationary sources that increase emissions in amounts exceeding specified thresholds to provide emission reduction offsets to mitigate their emissions growth. Offsets represent either on-site emission reductions, or the use of banked emission reduction credits (ERCs), which are voluntary, surplus emission reductions previously achieved and registered with the District for future use as offsets. As a result of offset requirements, there should be no net emission increases from proposed new or modified major stationary sources; in other words, emission increases that would otherwise be added to the inventory are offset by reductions of other emissions in the inventory. Notably, the "no net effect on the inventory" result from offsetting new or modified major sources holds true only if the emissions that were reduced to provide offsets remain in the inventory.

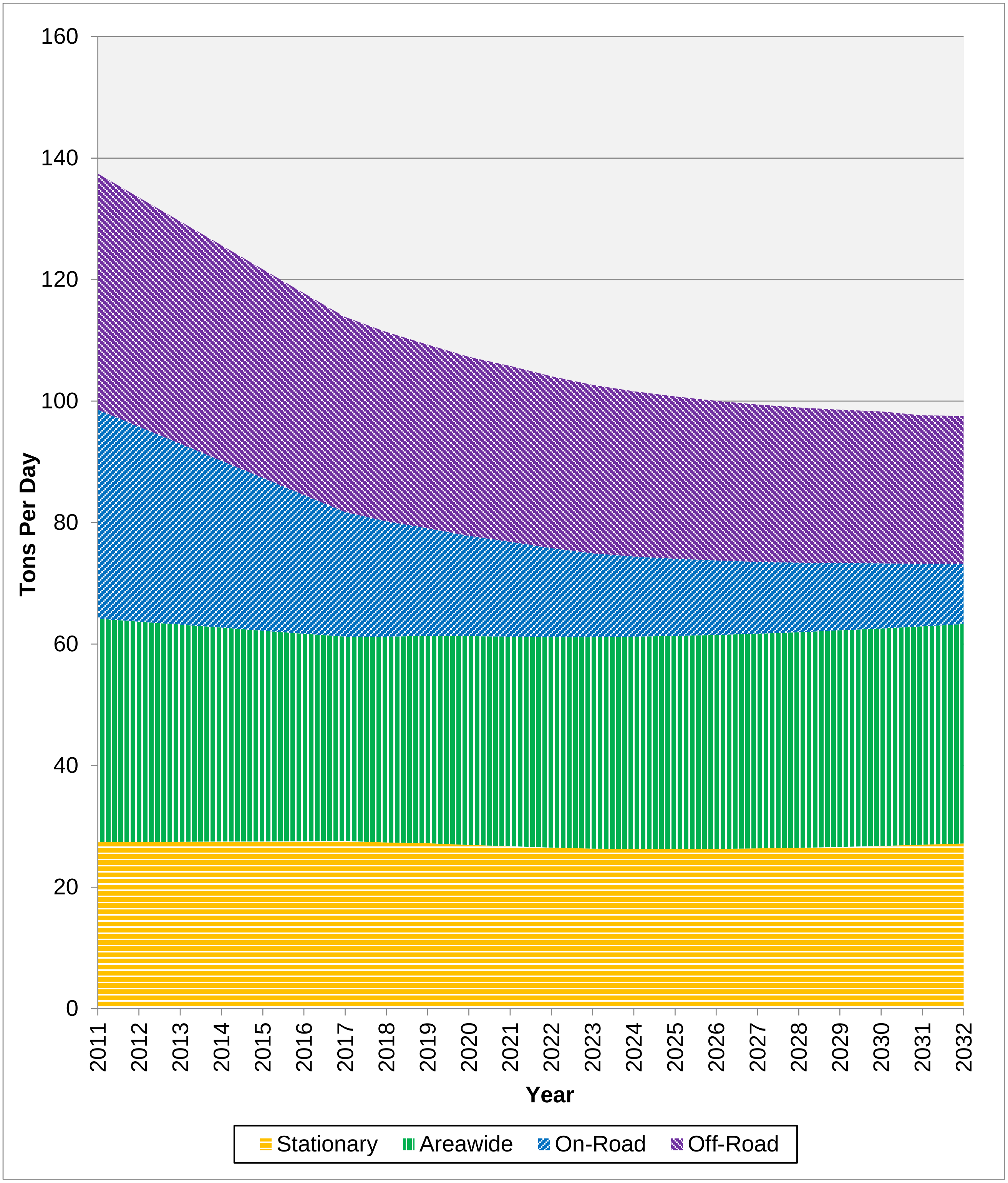
To ensure future new or modified major sources have no net effect on the emissions inventories used for demonstrating attainment of the 2008 and 2015 ozone NAAQS, the banked ERCs derived from pre-2017 emission reductions—which otherwise would not be included as emissions in the 2017 baseline and subsequent inventories—are included as a line item adjustment to the 2019 CARB CEPAM (Version 1.00) inventory and in the RFP Demonstration to account for pre-base year inventory ERCs pursuant to federal requirements.[48] This ensures ERCs are accounted for as potential future growth and not as permanent emission reductions. This is based on the conservative assumption that all pre-baseline year ERCs will be used to offset emission increases from permitted facilities, therefore the entire balance is included in forecast inventories as potential growth. Total available ERC balances as of May 3, 2018 were 0.71 tons of VOC per day and 0.56 tons of NOx per day. Attachment F presents the pre-baseline ERCs in the District's credit bank that were added to the inventories for each ozone NAAQS.

2.1.4 <u>Long-Term Emission Trends</u>

The historical and projected trends in San Diego County for VOC and NOx emissions are illustrated in Figures 2-1 and 2-2, respectively. Only currently adopted emission control regulations are reflected in future year projections. The resulting data are disaggregated for on-road, off-road, areawide, and stationary source emissions.

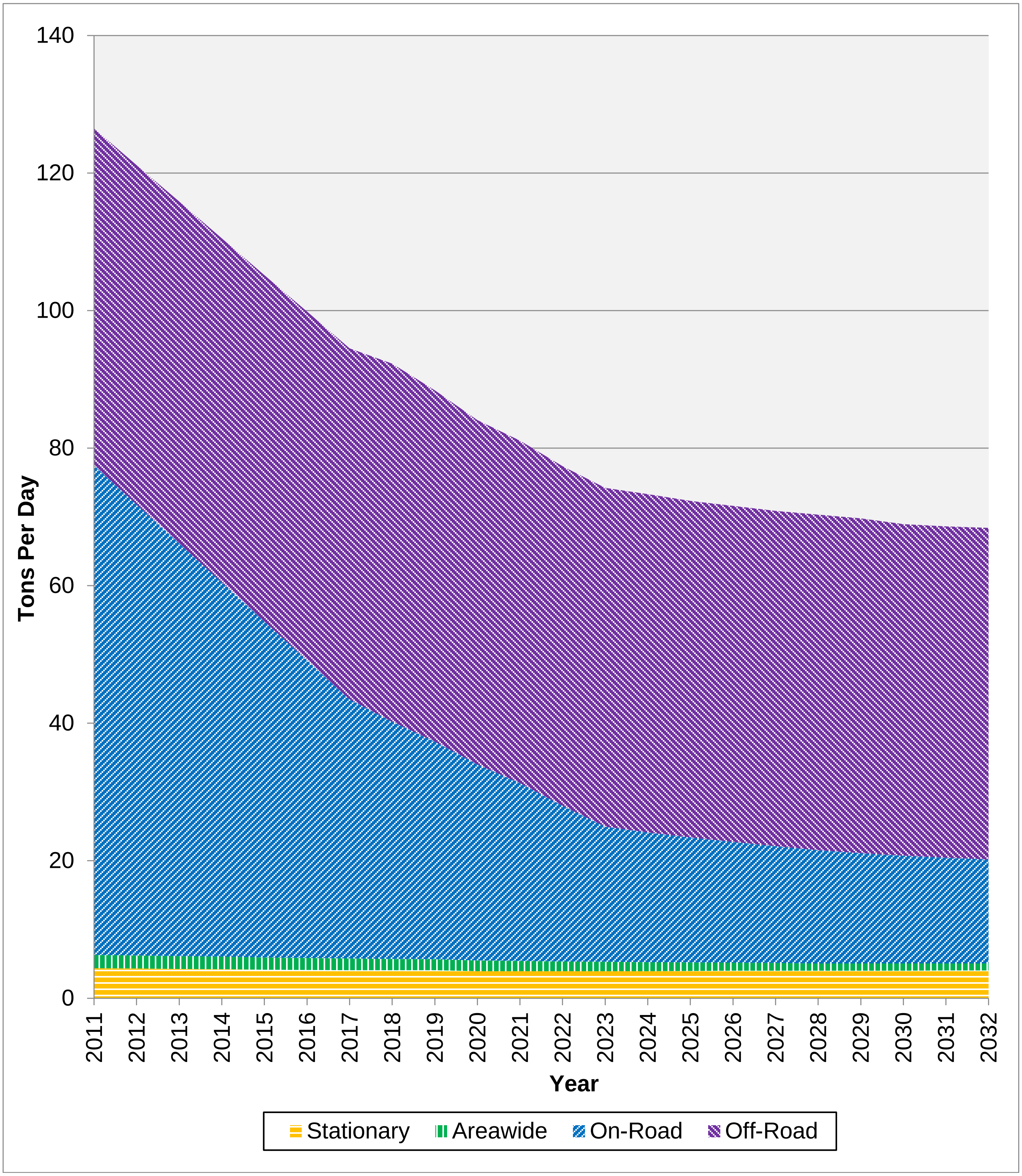
As new lower-emitting motor vehicles gradually replace used, higher-emitting vehicles (per State tailpipe regulations), the share of VOC and NOx emissions from motor vehicles is projected to drop. Stationary source control measures continue to hold stationary source emissions relatively constant despite economic growth. Nevertheless, although not reflected in the figures, future ongoing implementation of the RACT requirements of federal law and the "all feasible control measures" requirement of State law is anticipated to provide further reductions in emissions as additional cost-effective control technologies become available.

FIGURE 2-1
VOC Emissions Trend in San Diego County



Source: 2019 CARB CEPAM emissions inventory, Version 1.00.

FIGURE 2-2
NOx Emissions Trend in San Diego County



Source: 2019 CARB CEPAM emissions inventory, Version 1.00.

2.2 EMISSIONS STATEMENT RULE CERTIFICATION

CAA §182(a)(3)(B) requires all ozone nonattainment areas to have in place a program that requires emissions statements from stationary sources of NOx and VOC emissions. Specifically, CAA §182(a)(3)(B)(i) requires air agencies to submit to the EPA a SIP revision requiring the owner or operator of each stationary source to report and certify the accuracy of their reported NOx and VOC emissions, beginning in 1993 and annually thereafter.

CAA §182(a)(3)(B)(ii) allows air agencies to waive the requirements under subsection (i) for stationary sources emitting less than 25 tons per year of VOC or NOx if the State provides an inventory of emissions from such class or category of sources, based on the use of the emission factors established by the EPA or other methods acceptable to the EPA as part of the inventories required under CAA §182(a)(1) (i.e. the base year emissions inventory) and CAA §182(a)(3)(A) (i.e. the periodic emissions inventory).[49] The inventories being submitted in Attachment A include all such sources using emission factors acceptable to the EPA as required.

The implementation rules for the 2008[50] and 2015[51] eight-hour ozone standards acknowledge that if an area has a previously approved emission statement rule in force for the former 1997 eight-hour ozone NAAQS or the 1979 one-hour ozone NAAQS, then the existing rule is likely sufficient for meeting the emission statement requirement for the 2008 and 2015 ozone NAAQS. If the existing rule does not meet CAA §182(a)(3)(B) requirements, a revised or new rule would be required as part of the current ozone SIP. Otherwise, air districts may provide a written statement to the EPA certifying a determination has been made that the existing rule is adequate in lieu of submitting a new or revised rule.

District Rule 19.3 (Emission Information), satisfies CAA §182(a)(3)(B) emissions statement requirements for San Diego County. Rule 19.3 was initially adopted on April 6, 1993, and was last amended on May 15, 1996. The nonattainment area for San Diego County has not been significantly modified since that time. The EPA approved Rule 19.3 into the SIP on May 8, 2000.[52] To ensure its current adequacy, Rule 19.3 was evaluated for compliance with the CAA requirements and subsequent EPA guidance and associated memoranda.[53] Based on the rationale in Table 2-1 below, the District determined that existing Rule 19.3 is adequate to meet the CAA §182(a)(3)(B) emissions statement requirements for the 2008 and 2015 ozone NAAQS.

(CONTINUED ON NEXT PAGE)

Table 2-1
Emission Statement Certification, CAA Requirements

CAA Requirements	District Demonstration of Compliance
"Within 2 years after November 15, 1990, the State shall submit a revision to the State implementation plan to require that the owner or operator of each stationary source of oxides of nitrogen or volatile organic compounds provide the State with a statement, in such form as the Administrator may prescribe (or accept an equivalent alternative developed by the State), for classes or categories of sources, showing the actual emissions of oxides of nitrogen and volatile organic compounds from that source." *(CAA §182(a)(3)(B)(i))*	Rule 19.3 was adopted by the District on April 6, 1993. The rule was amended May 15, 1996 and approved into the SIP effective May 8, 2000 (65 FR 12472). In its Technical Support Document for the SIP approval, the EPA confirmed Rule 19.3's data collection process was already consistent with all aspects of CAA Section 182 and were appropriate for approval in the SIP at that time.[54] Notwithstanding this prior approval, Rule 19.3 will be proposed for amendment by June 2021 to ensure the rule is fully consistent with *CAA §182(a)(3)(B)(i))* that emission statements be submitted to show actual emissions of NOx and VOC from the source, or include sufficient data to allow the District to estimate actual emissions of NOx and VOC. Amended Rule 19.3, if adopted) will be re-submitted to the EPA for inclusion into the SIP <u>Rule Text</u> *"(3) Any person owning or operating any stationary source of emissions subject to this rule which emits 25 tons per year or greater of volatile organic compounds or oxides of nitrogen shall, in accordance with the 1990 Federal Clean Air Act Amendments, Title I, Section 182 (a)(3)(B), submit Emissions Statement Forms to the District for the 1992 calendar year and for each calendar year thereafter."*
"Submittal of the first statement was required to be submitted within three years after November 15, 1990. Submittal of subsequent statements is required at least every year thereafter." *(CAA §182(a)(3)(B)(i))*	Rule 19.3 requires any person operating stationary sources of emissions subject to the rule which emit 25 tons of VOC or NOx per year, to report data via an Emissions Statement form to the District on an annual basis. <u>Rule Text</u> *"(c)(3) Any person owning or operating any stationary source of emissions subject to this rule which emits 25 tons per year or greater of volatile organic compounds or oxides of nitrogen shall, in accordance with the 1990 Federal Clean Air Act Amendments, Title I, Section 182 (a)(3)(B), submit Emissions Statement Forms to the District for the 1992 calendar year and for each calendar year thereafter."*

CAA Requirements	District Demonstration of Compliance
"Statements shall contain a certification that the information contained in the statement is accurate to the best knowledge of the individual certifying the statement." *(CAA §182(a)(3)(B)(i))*	Each statement received by the District contains a certification that the information contained in the statement is accurate to the best knowledge of the completer. <u>Rule Text</u> *"(ii) Provide with the completed form a signed statement by the person, or a responsible official, certifying that the information contained in the form is accurate to the best knowledge of that person or official."*
"The State (or District) may elect to waive the application of clause (i) to any class or category of stationary sources which emit less than 25 tons per year of VOC or NOx if the State provides an inventory of emissions from such class or category of source, based on the use of the emission factors established by the Administrator or other methods acceptable to the Administrator." *(CAA §182(a)(3)(B)(ii))*	The District electronically reports emissions of sources less than 25 tons per year of VOC or NOx to the EPA (through CARB) via the California Emission Inventory Development and Reporting System (CEIDARS) using CARB and EPA approved methodologies. Data has been submitted on an annual basis since 1993. These emissions are encompassed within the District's SIP emissions inventory (Attachment A), as well as 2019 CEPAM v1.00. <u>Rule Text</u> *Rule 19.3(c)(4): "Effective January 1, 1994, any person owning or operating any stationary source subject to this rule which emits 5 or more tons per year but less than 25 tons per year of VOC or NOx, and any person who sells or supplies any material the use of which may cause the emission of air pollutants, may be required to submit an Emissions Statement Form and/or Emissions Inventory Report Form, as deemed appropriate by the Air Pollution Control Officer."*

2.3 NEW SOURCE REVIEW (NSR)

NSR rules are required by CAA §182(c)(10) for new or modified stationary sources of VOC or NOx emissions. For purposes of implementing both the 2008 and 2015 ozone NAAQS, NSR rules must have applicability thresholds and offset ratios at least as stringent as mandated in the CAA for the nonattainment area's classification for both standards.[55] The EPA's reclassification of San Diego County to Serious Nonattainment for the 2008 ozone NAAQS required establishing major source emissions applicability thresholds at 50 tons per year for both VOC and NOx and an emissions offset ratio of at least 1.2-to-1. This Attainment Plan meets this requirement through the District's NSR rules 20.1-20.4, which were last updated on June 26, 2019, in order to incorporate the major-source emissions applicability thresholds and emissions offset ratios for all possible ozone nonattainment classifications (i.e. Marginal, Moderate, Serious, Severe, or Extreme). Appropriate revisions were also made to incorporate the updated Interprecursor Trading (IPT) requirements mandated by the 2015 ozone NAAQS.[56,57]

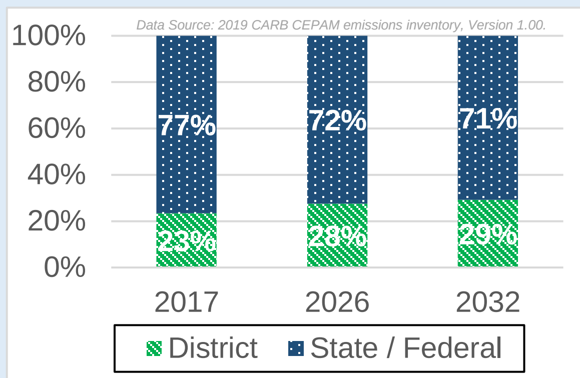
The District's revised NSR rules were submitted to the EPA through CARB in July 2019 for approval and inclusion in the SIP. The emissions thresholds for a Severe Nonattainment Area will apply automatically upon the EPA's formal reclassification of San Diego County (as published in the Federal Register) as a Severe Nonattainment Area. Accordingly, the District certifies that its existing NSR rules are sufficient for the purposes of the 2008 and 2015 ozone NAAQS and fulfill the requirements of a Severe Nonattainment Area.

2.4 EMISSION CONTROL MEASURES

Ozone levels in San Diego County have declined substantially as a result of decades of implementing comprehensive air pollution strategies for both mobile and stationary sources of emissions. As the benefits of existing local, State, and federal regulations come into play, there will be further reductions of ozone precursor emissions. These improvements are the primary basis for this Attainment Plan.

2.4.1 State and Federal Emissions Control Programs

CARB is responsible for numerous emission control regulations including those addressing consumer products and mobile sources (except where federal law preempts CARB's authority – see Section 2.4.1.2).[58] CARB also develops fuel specifications, adopts statewide control measures for air toxics, establishes gasoline vapor recovery standards, and certifies vapor recovery systems. CARB has regulated mobile sources since the 1960's and consumer products since the early 1990's. Notably, CARB continually strives to further reduce the emissions of air pollutants, with the goal of improving air quality and reducing public health risk.



Emissions Responsibility by Agency in San Diego County

Other state agencies, such as the Department of Pesticide Regulation (DPR) and the Bureau of Automotive Repair (BAR), also regulate emissions through their respective roles. DPR is responsible for control of agricultural, commercial and structural pesticides and the BAR runs the state's Smog Check programs to identify and repair higher polluting vehicles.

At the national level, the EPA is authorized to control emissions from mobile sources, including some that are exclusively under federal jurisdiction. Examples include interstate trucks, some farm and construction equipment, locomotives, aircraft, and marine vessels based in the United States. International organizations also develop standards for aircraft and marine vessels that operate outside the country. Federal agencies have the lead role in representing the U.S. in the development of international emissions standards.

Attachments D and E list the suite of CARB-implemented regulations in place since 1985. These regulations helped the region attain the former 1979 one-hour and 1997 eight-hour ozone NAAQS and they support current efforts to attain the 2008 and 2015 ozone NAAQS. Once the benefit of these regulations is realized, ozone precursor emissions are projected to decrease by more than 37 tons per day between the 2017 baseline year and 2026, which is the forecasted attainment year for the 2008 ozone NAAQS. Similarly, emissions are projected to decrease by more than 45 tons per day between the 2017 baseline year and 2032, which is the forecasted attainment year for the 2015 ozone NAAQS. This equates to countywide emissions reductions of VOC by 29% and NOx by 35%, as shown in Table 2-2.

TABLE 2-2
San Diego County Emission Reductions from
Existing State and Federal Control Programs (tons per day)

Source Category	VOC Reductions	NOx Reductions	VOC Reductions	NOx Reductions
	2008 Ozone NAAQS 2017-2026		2015 Ozone NAAQS 2017-2032	
Consumer Products	-1.0	0.0	-1.7	0.0
On-road Motor Vehicles	8.2	20.1	10.5	22.5
Commercial Boats	0.0	0.7	0.0	1.1
Recreational Boats	4.7	0.4	6.7	0.5
Residential/ Industrial/ Construction Equipment	0.6	2.9	0.2	3.5
Farm Equipment	0.1	0.7	0.2	1.1
Gasoline Cans	0.3	0.0	0.8	0.0
Pesticides	0.0	0.0	0.0	0.0
TOTAL	**12.9**	**24.8**	**16.7**	**28.7**
PERCENT REDUCTION	**29%**		**35%**	

Negative numbers represent an emission increase in the selected category, stemming from population growth.
Source: 2019 CARB CEPAM emissions inventory, Version 1.00.

2.4.1.1 Future State Measures

CARB continues to plan for the implementation of additional state measures as necessary to attain the 2008 and 2015 ozone NAAQS throughout California. CARB developed a 2017 State SIP Strategy[59] as well as a 2018 SIP Update[60] that contain additional measures that, when fully implemented, will provide substantial emission reductions beyond what the current regulations provide, resulting in improvements in air quality in the San Diego region. Additionally, CARB is developing an updated Mobile Source Strategy in 2020.[61] These measures may be implemented statewide or specifically targeted for regions with the greatest need for emissions reductions, such as the South Coast air basin. Emission reductions achieved in the South Coast region will also benefit its downwind neighbor, San Diego County, which is often impacted by air pollution transported from the South Coast area.

Zero-emission vehicles, like the ones above, will be vital for the region to attain national ozone standards

Further, in March 2018, CARB outlined nine additional actions identified in Table 2-3, to further reduce community health impacts and emissions from freight facilities.[62] Existing CARB regulations and incentive programs have measurably reduced freight-related emissions, yet additional reductions are necessary to protect local communities and help achieve air quality goals. Upon their adoption, the proposed concepts/measures will likely result in quantifiable emission reductions. This said, these measures will go beyond what is included in the current State Implementation Plan.[63]

CARB notes in subsequent documentation that some of the proposed measures in Table 2-3 may focus on certain geographical areas urgently in need of emissions reductions. These areas would likely include the South Coast air basin, where its ports and railyards contribute significant amounts of air pollution. The measures targeted for the South Coast air basin should also improve air quality and facilitate attainment of the 2008 and 2015 ozone NAAQS in San Diego County.

(CONTINUED ON NEXT PAGE)

TABLE 2-3
CARB Actions to Further Reduce Emissions from Freight Sources and Facilities

Action	Timeframe for CARB Board To Consider (tentative)	Timeframe for Implementation (tentative)
Drayage Truck Regulation to transition to zero-emission regulation	2022	2026-2028+
Commercial Harbor Craft Regulation amendments	2020	2023+
Cargo Handling Equipment Regulation to transition to zero-emission	2022	2026+
Evaluation and potential development of regulation to reduce idling emissions from all rail yard sources, and emissions from other stationary locomotive operations	2020	2023+
Evaluation and potential development of regulation to reduce emissions from locomotives not pre-empted under the Clean Air Act	2022	2025+
Development of Freight Handbook (warehouses and distribution centers)	2020+	2020+
Development of Freight Handbook (seaports, rail yards, etc.)	2021+	2021+

Source: "Update on Concepts to Minimize the Community Health Impacts from Large Freight Facilities – Advance Materials (Revised)," CARB. March 14, 2018.

2.4.1.2 Impact of the EPA's Withdrawal of California's Clean Air Act Preemption Waiver

As noted above, CARB has had regulatory authority to control mobile source emissions dating back to the 1960's. This authority was delegated by the EPA via Clean Air Act Section 209, in which the EPA grants California a waiver of preemption to adopt mobile source emission standards, provided they are "at least as protective of public health and welfare as applicable federal standards."[64] California's standards have historically been more stringent than federal standards, in recognition of the unique and significant air quality issues in many areas of the state. The EPA has approved a waiver for California several times since the promulgation of the Clean Air Act. It was last approved by the EPA on January 9, 2013,[65] for California's Advanced Clean Car (ACC) regulations. The ACC program is comprised of the Low Emission Vehicle (LEV) program, the Zero-Emission Vehicle mandate, and Greenhouse Gas standards applicable to model years 2021-2025. These programs are critical to continuing NOx emissions reductions throughout California, including San Diego County, through 2025.

Under its authority, the EPA proposed the "Safer Affordable Fuel-Efficient (SAFE) Vehicles Rule for Model Years 2021-2026 Passenger Cars and Light Trucks" (SAFE Vehicles Rule) on August 24, 2018. The EPA claimed the proposed rule will increase vehicle affordability, reduce regulatory burdens by freezing standards at 2020 levels, and set nationwide motor vehicle emission standards. In final rulemaking, the EPA bifurcated each individual action to be adopted independently of one another.

As such, on November 26, 2019,[66] the EPA formally withdrew the 2013 waiver of the CAA preemption granted for California's ACC program for greenhouse gases, as allowed by CAA Section 209(b)(1)(B). The action specifically applies to greenhouse gas emissions and not criteria pollutants, though the full impact of the action remains an unanswered question. The second action (modifying vehicle fuel economy standards), was finalized effective June 29, 2020[67] However, at the time of its proposal, additional NOx emissions in San Diego County were not anticipated to result in substantial ozone pollutant emission increases.[68]

EPA's action to withdraw the waiver, as well as the modification of vehicle fuel economy standards, is now being contested by California and over 20 other states. At the time of this Attainment Plan's preparation, the waiver withdrawal rule has been held in abeyance until further notice or action by the courts. As such, California's waiver and its ACC and ZEV programs remain valid elements of California's SIP and San Diego County's overall emission reduction control strategy. Consequently, this Attainment Plan's emissions inventory, as well as other subsequent analyses and modeling, incorporate future emission reductions anticipated by California's ACC and ZEV program. This said, should the waiver withdrawal be upheld by the courts in the future, the District and/or CARB commits to revising/resubmitting specific elements of this Attainment Plan as needed, to fully satisfy any modified federal requirements.

2.4.2 <u>Local Control Measures</u>

A comprehensive listing of existing District rules to control and reduce ozone-forming emissions is included under separate cover in the *"2020 Reasonably Available Control Technology Demonstration for the National Ambient Air Quality Standards for Ozone in San Diego County."* These rules apply to many stationary and areawide sources that include, but are not limited to factories, power plants, chemical plants, landfills, gas stations, dry cleaners, coating operations, stationary engines, boilers, and furnaces. These rules are implemented mostly through District permits that are specific to each facility or operation. Facility inspections are conducted by District staff to verify ongoing compliance.

Source: https://www.sdlodge.com/attractions/la-jolla-cove

3.0 2008 EIGHT HOUR OZONE NAAQS ATTAINMENT PLAN REQUIREMENTS

SECTION 3 HIGHLIGHTS

- Due to different federal requirements, an Attainment Plan including elements applicable specifically to the 2008 ozone standard has been prepared.
- A RACT Demonstration (under separate cover) has been prepared to confirm that all relevant local stationary source rules meet federal requirements as a Severe Nonattainment Area, and align with comparable rules found in California.
- Other required elements completed include motor vehicle emission budgets for transportation conformity, VMT growth offset analysis, RACM and RFP demonstrations, commitments to adopt a Section 185 penalty fee program, an attainment demonstration, photochemical modeling, and a weight of evidence analysis.
- Photochemical modeling and a supplementary analysis predict San Diego County will attain the 2008 ozone standard by July 20, 2027, to adhere to the CAA.
- Contingency measures will be adopted and implemented should the region fail to meet federal attainment deadlines.

3.1 ATTAINMENT PLAN REQUIREMENTS

The EPA's implementation rule for the 2008 ozone standard identifies the required elements of an Attainment Plan for a Severe Nonattainment Area, which includes:

- **Reasonably Available Control Technology** (RACT) Demonstration (CAA §182(b)(2) and verifying the implementation of RACT on all major sources of VOC or NOx and on each VOC source category for which the EPA has issued a Control Techniques Guideline (CTG) document.[69,70] In Severe Nonattainment Areas, a major source is a stationary source that emits or has the potential to emit at least 25 tons of VOC or NOx per year. The District's RACT Demonstration can be found under separate cover in the *"2020 Reasonably Available Control Technology Demonstration for the National Ambient Air Quality Standards for Ozone in San Diego County."*

- **Emissions Inventories** for the 2017 base year for the attainment analysis, the predicted attainment year of 2026, and relevant RFP milestone years of 2017, 2020, 2023, and 2026 (see Section 3.1.1) (CAA Section (§) 182(a)(1)). For RFP purposes, the baseline year is required to be 2011.[71] All years are representative of a typical summer seasonal day.

- **Transportation Conformity Emission Budgets** which ensure transportation plans, programs, and projects are consistent with the SIP prior to approval by SANDAG, the region's metropolitan planning organization (Section 3.1.2) (CAA §176(c)). This Attainment Plan establishes new budgets for future RFP milestones and attainment years (2020, 2023, and 2026) associated with the 2008 ozone NAAQS.

- **Vehicle Miles Travelled (VMT) Offset Demonstration** (Section 3.1.3 and Attachment N) (CAA §182(d)(1)(a)), that shows the adoption of transportation control strategies and transportation control measures in San Diego County offset any growth in VMT or numbers of vehicle trips.

- **Reasonably Available Control Measures** (RACM) **Demonstration** (Section 3.2.1 and Attachments G, H, I, and J) (CAA §172(c)), verifying that all potential RACM the District or CARB could potentially adopt, including those for stationary, mobile, transportation-related, and consumer products, would not provide the additional emissions reductions necessary to advance the predicted attainment year for the 2008 ozone NAAQS from 2026 to 2025.

- **Reasonable Further Progress** (RFP) **Demonstration** (Section 3.2.2) (CAA §182(b)(1)), showing forecasted emissions reductions at milestone and attainment years of 2017, 2020, 2023, and 2026, relative to the 2011 base year, pursuant to the EPA's implementation rule for nonattainment areas classified as Moderate or above.[72]

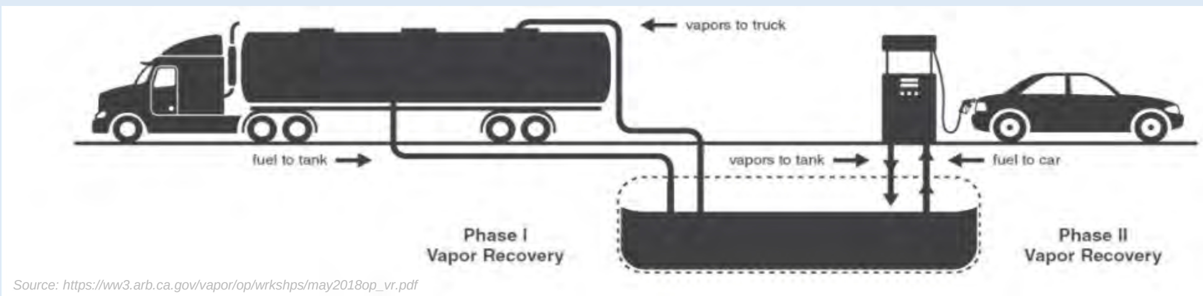
- **Commitment to develop a CAA Section 185 Fee Rule** (Section 3.2.3) applicable to major stationary sources and which will be implemented only if the region fails to attain the 2008 ozone NAAQS as a Severe Nonattainment Area by the predicted 2026 attainment year. The CAA does not require a rule to have been adopted or in place at the time of the submittal of this Attainment Plan.

- **Attainment Demonstration** (Section 3.3 and Attachments K, L, and M) (CAA §182(c)(2)(A)), comprised of photochemical air quality simulation modeling and other approved analytical techniques collectively called the "Weight of Evidence". Together, these analyses demonstrate the ability of the Emission Control Measures in Section 2.4 to provide for attainment of the 2008 ozone NAAQS as expeditiously as practicable. Ozone nonattainment areas are required to model attainment in the ozone season prior to their specific attainment date.[73,74] For San Diego County, the demonstrated attainment year is 2026. This date encompasses the first full ozone season prior to the July 20, 2027, attainment deadline for a Severe Nonattainment Area.

- **Contingency Measures** (Section 3.4 and Attachment O) (CAA §179(c)(9) and CAA §182(c)(9)), which must be implemented only if the EPA makes a formal finding that San Diego County failed to satisfy a regulatory requirement to meet an RFP milestone and/or attainment deadline, thusly necessitating implementation of the contingency measures and ensuring emissions reductions progress. If enacted, contingency measures are designed to provide additional emissions reductions beyond those relied upon in the Attainment Demonstration.

- **Additional CAA Subpart 2 Requirements** as listed below have been met via the implementation of various programs in San Diego County pursuant to the region's former status as a Serious Nonattainment Area for the prior 1979 one-hour ozone NAAQS[75] and former 1997 eight-hour ozone NAAQS. These programs continue to be implemented in the region and are required to continue because of anti-backsliding provisions in the federal CAA. The District carefully reviewed these programs and determined that no changes were needed to satisfy federal planning requirements. As such, the District certifies that the following approved programs (with SIP approval references as applicable) remain adequate and meet all federal CAA requirements set forth in the 2008 ozone standard implementation rule:

- o Enhanced vehicle inspection and maintenance program (CAA §182(c)(3));[76]
- o Stage II gasoline vapor recovery (CAA §182(b)(3));[77]
- o Clean Fuels for Fleets (CAA §182(c)(4));[78]
- o Source emission statement regulations (CAA §182(a)(3)(B));[79]
- o Enhanced ambient monitoring (Photochemical Assessment Monitoring Stations (PAMS) (CAA §182(c)(1));[80]
- o Periodic emissions inventory (CAA §182(a)(2); and
- o Reformulated gasoline (CAA §211(k));



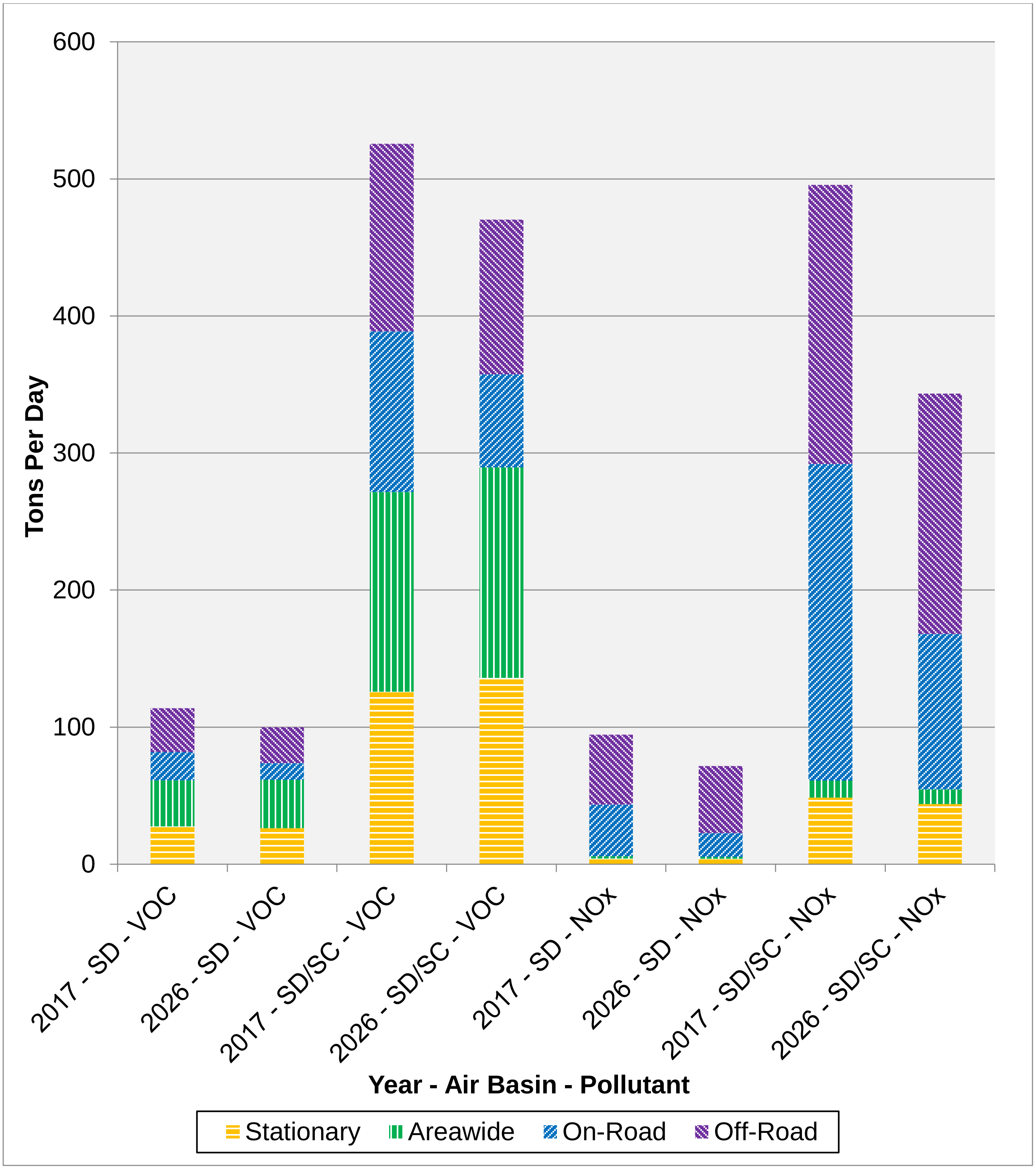
California and the District have been leaders in implementing low-emission gasoline vapor recovery systems

3.1.1 Inventories for Base Year, Attainment Year, and RFP Milestone Years

Pursuant to the CAA, the District is submitting all required emissions inventories to the EPA for the purposes of this Attainment Plan, as found in Attachment A.

Since San Diego County's air quality is often affected by VOC and NOx atmospherically transported into this region from the South Coast air basin (see Section 1.3.1), both an inventory of San Diego County-only emissions (Attachment A, Table A-1) [81] and a combined inventory of the San Diego County and the South Coast Air District emissions are presented (Attachment A, Table A-2). The latter inventory represents the South Coast-San Diego County transport couplet. Figure 3-1 depicts the base year and attainment years in both the San Diego County-only and South Coast-San Diego County couplet. Additionally, an emission inventory used for the purposes of determining RFP and contingency measure emission reductions is also presented in Attachment A, Table A-3.[82]

FIGURE 3-1
Ozone Precursor Emissions in San Diego County and South Coast Air District, 2017-2026



SD = San Diego Air Basin; SC = South Coast Air District
Source: 2019 CARB CEPAM emissions inventory, Version 1.00.

3.1.2 On-Road Motor Vehicle Emission Budgets for Transportation Conformity

Section 176(c) of the CAA requires transportation planning agencies to demonstrate that their transportation plans, funding programs, and projects are consistent with ("conform to") the SIP. Transportation planning agencies also have to demonstrate conformity through a comparison of vehicle emissions listed in their transportation plans to the emissions budgets used in the SIP. An emissions budget is the level of emissions from on-road motor vehicles that provides for RFP and attainment of the NAAQS for ozone.

The budgets in Table 3-1 have been developed in collaborative consultation with SANDAG, the District, CARB, and the EPA, and are consistent with the attainment and progress demonstrations in this Attainment Plan.[83] These budgets were developed using EMFAC2017 with VMT and speed distributions modeled by SANDAG.[84] The California Air Resources Board (CARB) staff released a revised emission rate model (EMFAC2017) that updates the emission rates and planning assumptions used in calculating conformity budgets.[85] The recently approved Safer Affordable Fuel-Efficient (SAFE) Vehicles Rule Part One: *One National Program,* effective November 26, 2019, has impacted some of the underlying assumptions in the EMFAC2017 model. Hence, the emissions output from the EMFAC2017 model were adjusted to account for the emissions impact of the SAFE rule.

TABLE 3-1
On-Road Motor Vehicle Emission Budgets in San Diego County, 2008 Ozone NAAQS (tons per day)

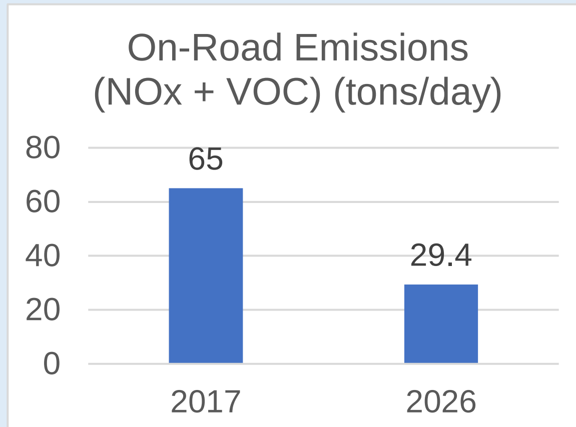
	2017 (Reference)		2020 (RFP)		2023 (RFP)		2026+ (Attainment)	
	VOC	NOx	VOC	NOx	VOC	NOx	VOC	NOx
Baseline Emissions	-	-	16.25	28.01	13.51	19.24	12.02	17.20
SAFE Rule Adjustment	-	-	0.00	0.00	0.01	0.00	0.02	0.01
Total	-	-	16.25	28.01	13.52	19.24	12.04	17.21
Emissions Budget (rounded)	**23**	**42**	**16.3**	**28.1**	**13.6**	**19.3**	**12.1**	**17.3**

Note: Emission budgets reflect an average “summer day.”

Conformity to the SIP means that proposed transportation activities must not (1) cause or contribute to any new violation of any NAAQS, (2) worsen the severity of any existing violation, or (3) delay timely attainment of any NAAQS or any interim milestones. The SIP includes an analysis assessing the region’s total emissions inventory from all sources necessary to demonstrate reasonable further progress (RFP), attainment, or maintenance of the NAAQS. The portion of the total emissions inventory from on-road highway and transit vehicles, which provides for RFP and attainment of the NAAQS in these analyses becomes the “motor vehicle emissions budget.” Motor vehicle emissions budgets are the mechanism for ensuring that transportation planning activities conform to the SIP. Budgets are set for each criteria pollutant or its precursors, for which the area does not attain the NAAQS and are set for each RFP milestone year and the attainment year.

SANDAG prepares a long-range Regional Transportation Plan (RTP) at least every four years and a short-range funding program known as the Regional Transportation Improvement Program (RTIP) every two years. Before adopting the RTP/RTIP, SANDAG prepares a regional emissions analysis using the proposed plan and program and compares those emissions to the emission budgets in the SIP. SANDAG may determine RTP/RTIP conforms if the emissions from the proposed actions are less than or equal to the emissions budgets in the SIP. The conformity determination also signifies that SANDAG has met other transportation conformity requirements such as undertaking interagency consultation.

The federal transportation conformity regulation[86] requires this Attainment Plan to specify on-road motor vehicle emission budgets for all applicable RFP milestone years (2017, 2020 and 2023), as well as the predicted attainment year of 2026.[87] In 2017, the EPA determined the motor vehicle emission budgets for 2017 were adequate for transportation conformity purposes for the 2008 ozone NAAQS.[88] This budget has not been revised and the milestone year has now passed. The previously approved 2017 budgets are reflected in Table 3-1 only for reference. The emissions budget for 2026 (the predicted attainment year) will also apply to all subsequent transportation conformity analysis years for the 2008 ozone NAAQS, as required by the regulation.



By 2026, on-road motor vehicle emissions in San Diego County are projected to decrease over 54% compared to 2017 levels

3.1.3 Vehicles Miles Traveled (VMT) Offset Demonstration

Section 182(d)(1)(A) of the CAA requires Severe or worse Nonattainment Areas to submit VMT offset demonstrations validating that the region has adopted sufficient transportation control measures to offset any growth in vehicle emissions in the Attainment Plan period. Demonstrations must validate that VMT emissions in the 2026 attainment year (assuming predicted growth in VMT and imposition of any new transportation control measures)[89] are equal to or less than the modeled emissions in the 2026 attainment year (assuming no growth in VMT and that no new transportation measures were added). The VMT offset demonstration included in Attachment N satisfies this requirement by validating that the full motor vehicle control program emissions in the 2026 attainment year are lower than the emissions from the motor vehicle control program frozen at 2017 levels. Consequently, the identified transportation control strategies and transportation control measures are deemed sufficient to offset the growth in emissions due to growth in VMT, thusly satisfying the CAA VMT offset requirements.

3.2 CAA SUBPART 2 (TITLE I, PART D) PLAN REQUIREMENTS[90]

3.2.1 Reasonably Available Control Measures (RACM) Demonstration

3.2.1.1 RACM Requirements

The CAA requires a demonstration that all Reasonably Available Control Measures are being implemented as expeditiously as practicable.[91] Specifically, the air district must consider a wide range of potential additional measures beyond those already being implemented to further control emissions from stationary sources, transportation, and other mobile sources. A potential additional measure is considered "reasonably available" and must be implemented if it would, either alone or in combination with other feasible measures, advance the predicted attainment year by one year (i.e. from 2026 to 2025). In other words, the reasonably available measures would need to reduce emissions to 2026 levels by 2025. Based on the analysis performed for this Attainment Plan, the District finds that there are no potential additional measures that can alone or collectively reduce emissions to 2026 levels by 2025.

As mentioned in Section 1.3.1, air pollutants transported from the South Coast region (as well as Mexico on occasion) contributes to higher ozone levels in San Diego County under certain weather conditions. This impact is accounted for in the photochemical air quality modeling conducted by CARB for this Attainment Plan. Accordingly, this RACM analysis accounts for projected emissions from the San Diego County-South Coast transport couplet (see Attachment A, Table A-2). Table 3-2 identifies the increment of emissions reductions needed in 2025 for San Diego County to reach attainment under all weather conditions. Specifically, San Diego County would need additional reductions of 2.8 tons per day of VOC and 3.4 tons per day of NOx (6.2 tons combined) in 2025 to advance the attainment year from 2026 to 2025 in San Diego County.

TABLE 3-2
Emissions Reductions Needed to Advance Attainment By One Year, 2008 Ozone NAAQS (tons per day)

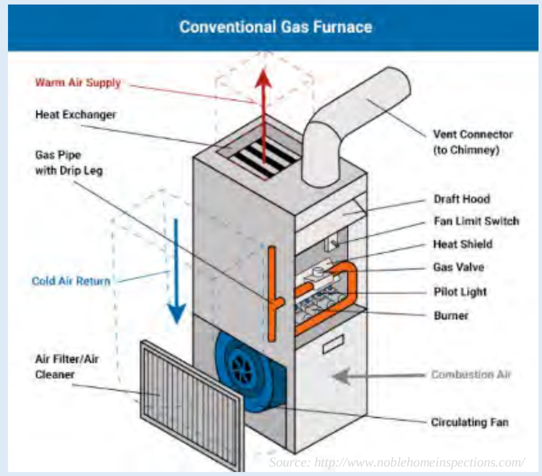
Emissions Totals	Emissions (tpd)
2026 VOC Emissions Inventory *(Attachment A, Table A-2)*	471.0
2025 VOC Emissions Inventory *(Attachment A, Table A-2)*	473.8
VOC Emissions Reductions Needed in 2025 to Demonstrate Attainment	**2.8**
2026 NOx Emissions Inventory *(Attachment A, Table A-2)*	344.0
2025 NOx Emissions Inventory *(Attachment A, Table A-2)*	347.4
NOx Emissions Reductions Needed in 2025 to Demonstrate Attainment	**3.4**

Source: 2019 CARB CEPAM emissions inventory, Version 1.00.
Includes ERC Balance and SAFE Vehicle Rule Part One Adjustments

3.2.1.2 Identifying Potential RACM for Stationary Sources

Identifying potential additional control measures for consideration as RACM is challenging in San Diego County because, pursuant to State law, the District is already required to adopt a combination of all feasible control measures and, under federal law, RACT. Notably, the District has continued to implement all feasible control measures for emissions from stationary sources, and has submitted rules into the SIP as necessary to meet RACT requirements.

Additionally, State law requires Best Available Retrofit Control Technology (BARCT), which generally is more stringent than RACT. Accordingly, the District has already adopted BARCT for stationary sources. As such, the District's existing BARCT rules cannot be considered as potential RACM. This is because these rules have already been implemented and would not provide additional new emissions reductions that could advance the attainment year. In order to identify potential RACM, the District has relied upon an ongoing control measure evaluation process to adopt all feasible measures as required by State law. Specifically, the District is required to consider, for each emission source category, whether adopting the requirements of the most stringent of the adopted rules in the state would be feasible for local sources and thusly advance attainment by one year.



Further reducing NOx emissions from natural gas-fired fan-type central furnaces is a potential RACM measure (Measure G.10)

The District's review of other air districts' rules revealed source categories that are subject to more stringent requirements than the current District rules (Attachment G, Table G-1), yet those were primarily in Extreme nonattainment areas. The District identified 17 stationary source measures that could achieve additional emission reductions, yet the analyses presented in Attachment G and Table G-1 show that if all 17 stationary source measures were adopted as prohibitory rules in 2020, an additional 0.41 tons of VOC reductions per day and 0.40 tons of NOx reductions per day could be expected upon full implementation.

Thusly, the cumulative 0.81 tons per day of VOC/NOx emission reductions potentially resulting from the adoption of all 17 stationary source measures would not on their own achieve the requisite level of VOC/NOx emission reductions needed to advance the attainment year to 2025, where a total of 6.2 tons per day of emissions reductions is necessary (see Table 3-2).[92] A detailed analysis of each of the stationary source control measures identified as potential RACM is presented in Attachment G.

3.2.1.3 Identifying Potential RACM for Transportation Sources

Potential RACM also includes Transportation Control Measures (TCMs), which are strategies to reduce motor vehicle trips, vehicle miles traveled, or vehicle idling and the associated air pollutant emissions. Attachment H, Table H-1, lists the 16 TCMs identified in CAA §108(f) and their implementation status in San Diego County. A discussion of each TCM further describing the status of implementation is found in Attachment H.

The "Mid-Coast Trolley Extension" is an example of TCM #1 (Improve Public transit) being implemented in San Diego County

As indicated, 13 of the 16 TCMs have been implemented. These include transit and traffic flow improvements, ridesharing, high occupancy vehicle (HOV) lanes, pedestrian-only streets, and limits on extended vehicle idling. The agencies responsible for developing and implementing these TCMs include SANDAG and other State and local transportation agencies.

Five of the implemented TCMs — TCMs 1, 3, 5, 8, and 10 — were included in the 1982 SIP Revision for San Diego County.[93] Descriptions in this document of any ongoing implementation beyond the 1982 SIP commitments do not constitute submittal of additional implementation commitments into the SIP. Such submittals would be required only if the TCMs meet the RACM qualifications of advancing the region's attainment year, as specified in Section 3.2.1.1. TCMs that have already been implemented cannot provide additional emissions reductions in 2025 sufficient to advance the attainment year from 2026 to 2025. Therefore, they cannot be considered RACM.

Attachment H and Table H-1 also address the three TCMs that have not been implemented and the reasons for non-implementation. These measures address trip-reduction ordinances, peak-period vehicle restrictions, and vehicle emissions in extremely cold environments, none of which are applicable in San Diego County by operation of State law and due to favorable meteorological conditions.

3.2.1.4 Emission Reduction Potential of Transportation Control Measures

Trip Reduction Ordinances alone (TCM 4) have been estimated to reduce on-road vehicle emissions by less than two percent.[94] That analysis also estimated that the implementation of all other TCMs combined would be less effective than Trip Reduction Ordinances alone (that is, they would not provide combined emission reductions exceeding two percent). As a result, the maximum emissions reduction potential of implementing all unimplemented TCMs (TCMs 4, 7, and 12) is assumed to be two percent of on-road vehicle emissions in San Diego County.

Projected on-road motor vehicle emissions in San Diego County in 2026 are 12.2 tons of VOC per day and 17.5 tons of NOx per day (see Table A-1 in Attachment A). Therefore, the maximum emissions reduction potential of implementing all unimplemented TCMs (assuming a two percent reduction in on-road emissions) is an estimated 0.2 tons per day reduction of VOC emissions and 0.4 tons per day reduction of NOx emissions. The cumulative VOC and NOx emission reductions available from the adoption of all unimplemented TCMs in 2020 is 0.6 tons per day, and would not on their own achieve the requisite level of VOC/NOx emission reductions needed to advance the attainment year to 2025 where a reduction of 6.2 tons per day would be required (see Table 3-2). A detailed analysis of TCMs as potential RACM is presented in Attachment H.

3.2.1.5 Identifying Potential RACM for Mobile Sources and Consumer Products

Most California regions, including San Diego County, face challenges in reducing emissions from mobile sources, which are the primary source of air pollution in the region. Over half of the total daily ozone-precursor emissions in San Diego County are attributable to mobile sources. To address the severity of these air quality challenges, CARB has implemented the most stringent mobile source emissions control programs in the nation.

CARB has regulatory authority over most mobile sources in California, including: light,[95] medium, and heavy-duty on-road vehicles, off-road equipment, motorcycles, recreational boats, cargo handling equipment, and commercial harbor craft. It also regulates the fuels used in mobile equipment. CARB's measures encompass a comprehensive approach to reducing mobile source emissions by establishing stringent motor vehicle and engine emissions standards, deadlines for adopting new technology, clean fuel specifications, and incentive programs to encourage early retirement (scrapping) of highly polluting vehicles and equipment in favor of lower-emitting equipment. The District relies on these State measures to attain the ozone standards in a timely manner.

Given the severity of California's air quality challenges, CARB has implemented the most stringent mobile source emissions control program in the nation. CARB's comprehensive strategy to reduce emissions from mobile sources includes stringent emissions standards for new vehicles, in-use programs to reduce emissions from existing vehicle and equipment fleets, cleaner fuels that minimize emissions, and incentive programs to accelerate the penetration of the cleanest vehicles beyond that achieved by regulations alone. A detailed analysis reviewing possible RACM for mobile sources and consumer products in the San Diego region was completed by CARB in 2020 (see Attachment I). CARB's analysis concluded that there are no reasonably California mobile source and consumer products regulatory control measures excluded from use in this Attainment Plan; therefore, there are no emissions reductions associated with unused regulatory control measures that, on their own, could advance San Diego County's attainment of the 2008 ozone NAAQS by one year from 2026 to 2025 (i.e. 6.2 tons per day, as determined in Table 3-2).

3.2.1.6 RACM Cumulative Analysis

The combination of potential additional Reasonably Available Control Measures for stationary sources (Attachment G), TCMs (Attachment H), and mobile sources (Attachment I), if adopted and implemented in 2020, could provide no more than 1.4 tons of VOC and NOx reductions per day in total (see Attachment J). This falls short of the 6.2 tons per day of VOC and NOx reductions that would be needed to advance attainment from 2026 to 2025, as illustrated in Table 3-2.

Therefore, none of the potential additional control measures are considered reasonably available and do not require adoption for the purposes of this 2008 ozone NAAQS RACM analysis and corresponding Attainment Plan.

3.2.2 Reasonable Further Progress (RFP)

CAA §172(c)(2) and §182(b)(1) require attainment plans to provide for ongoing reasonable further progress (RFP) in reducing emissions between the base year and attainment year. RFP is defined in CAA §171(1) as "…such annual incremental reductions in emissions of the relevant air pollutant as are required…for the purpose of ensuring attainment of the applicable NAAQS by the applicable date." This requirement to demonstrate steady progress in emissions reductions between the baseline year (2011) and attainment year (2026) ensures that areas will not delay implementation of control programs until immediately before the attainment deadline.

There are either one or two separate RFP requirements for nonattainment areas depending upon their classification. The first is a one-time requirement for a 15 percent reduction in VOC emissions over the first six years of the planning period for nonattainment areas classified as Moderate or above (CAA §182(b)(1)) (see Section 3.2.2.1). The second, which is for ozone nonattainment areas classified as Serious or worse, is a required three percent per year reduction of ozone precursor emissions, averaged over the first six years of the planning period, and for each subsequent three-year period thereafter until attainment occurs (CAA §182(c)(2)(B)) (see Section 3.2.2.3).

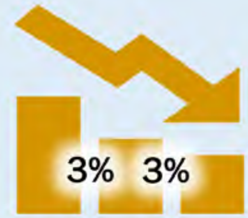
3.2.2.1 Fifteen Percent VOC-only Rate of Progress Requirements

The March 2015 EPA implementation rule for the 2008 ozone NAAQS,[96] established requirements for RFP that depend on the area's classification and whether the area has an approved 15 percent VOC-only rate of progress demonstration for a previous ozone standard that covers all of the current ozone nonattainment area. In 1997, the EPA approved a 15 percent rate of progress plan for San Diego County for the one-hour ozone standard covering the entire nonattainment area for the 2008 ozone standard.[97] This 15 percent VOC-only rate of progress requirement has been met for San Diego County.

3.2.2.2 RFP Requirements

Per the implementation rule under CAA §182(c)(2)(B), San Diego County must demonstrate an 18 percent reduction in ozone precursor emissions for the first six years of the attainment planning period of 2011 to 2017, beginning on January 1 of the year following the RFP base year (i.e. January 1, 2012, or the 2011 ozone season).[98] The six-year period concluded on January 1, 2018 (i.e. 2017 ozone season). An additional requirement is that areas classified Serious or worse must demonstrate average emissions reductions of three percent per year after the six-year period, which is averaged over each subsequent three-year period until the attainment year. As a result of this requirement, the years 2020, 2023, and 2026 have been included in the RFP analysis. Both VOC and NOx emissions reductions are needed to meet the RFP reduction targets. The San Diego County RFP Demonstration is achieved by forecasted emissions reductions occurring as a result of existing emissions control regulations as shown in the planning inventory (Attachment A, Table A-3). Due to the EPA's previous approval of the region's 15% VOC rate-of-progress demonstration[99] in 1997,[100] NOx substitution is used on a percentage basis to cover any shortfall in VOC reductions.

Although the 2016 San Diego County Moderate SIP used a 2012 RFP baseline year as allowed by the 2008 ozone NAAQS implementation rule, in 2018, the courts determined that the appropriate baseline year for RFP for the 2008 ozone NAAQS is 2011. As such, the San Diego County RFP Demonstration for the 2008 ozone NAAQS now uses a 2011 baseline year.



To demonstrate Reasonable Further Progress (RFP), San Diego County must effectively demonstrate at least a 3% annual reduction in ozone precursor emissions between 2011-2026 for the 2008 ozone NAAQS.

3.2.2.3 RFP Demonstration

The RFP Demonstration is provided in Table 3-3, which was developed in accordance with all applicable EPA guidance. The RFP Demonstration is achieved by forecasted emissions reductions resulting from existing air pollution control regulations. These are shown in the planning inventory in Attachment A, Table A-3, and demonstrates that San Diego County meets the RFP targets in the milestone years of 2017, 2020, 2023, and 2026 for the 2008 ozone NAAQS based on the ongoing implementation of existing local, State, and federal regulations to control and reduce ozone-forming emissions.

(CONTINUED ON NEXT PAGE)

TABLE 3-3
RFP Demonstration, 2008 Ozone NAAQS

Line	Year	2011	2017	2020	2023	2026
A	Baseline VOC Emissions (tons/day)[101]	136.6	112.9	107.0	102.4	99.7
B	Change in VOC since 2011 (tons/day)		23.7	29.6	34.2	36.9
C	Change in VOC since 2011, %		17.4%	21.7%	25.1%	27.0%
D	Required % change since 2011		18%	27%	36%	45%
E	Shortfall (-)/ Surplus (+) in VOC, %		-0.6%	-5.3%	-10.9%	-18.0%
Line	**Year**	**2011**	**2017**	**2020**	**2023**	**2026**
F	Baseline NOx Emissions (tons/day)[102]	110.7	77.0	67.1	56.8	53.6
G	Change in NOx since 2011 (tons/day)		33.7	43.6	53.9	57.1
H	Change in NOx since 2011, %		30.5%	39.3%	48.7%	51.6%
I	NOx reductions since 2011 used for VOC substitution in this milestone year, %		0.6%	5.3%	10.9%	18.0%
J	NOx reductions since 2011 surplus after meeting VOC substitution needs in this milestone year, %		29.8%	34.0%	37.8%	33.6%
K	RFP shortfall (-), % (if any)		0.0%	0.0%	0.0%	0.0%
L	**RFP Met?**		**YES**	**YES**	**YES**	**YES**

Source: CARB. February 2020. Emission data obtained from 2019 CARB CEPAM emissions inventory (Version 1.00), San Diego Air Basin, Summer Day.

CAA §172(c)(9) also requires attainment plans to provide for contingency measures in case the EPA makes a formal finding that a nonattainment area failed to satisfy an RFP milestone or attainment requirement, thus necessitating implementation of the contingency measure(s).[103] The contingency measure requirement is intended to ensure emissions reductions progress continues. The EPA has interpreted this requirement to represent one year's worth of emission reduction progress for VOC or NOx, amounting to a three percent reduction of either pollutant based on an RFP baseline year, from measures that can take effect without further rulemaking action. This requirement is addressed in Section 3.4 and Attachment O of this Attainment Plan.

3.2.2.4 Milestone Compliance Demonstration Background

CAA Section 182(g)(2) requires Serious and worse Nonattainment Areas to submit RFP progress reports known as Milestone Compliance Demonstrations (MCDs) within 90 days after the date on which an applicable RFP milestone occurs. This demonstration ensures the region achieves the incremental emissions reductions projected in RFP demonstrations that ultimately help the region attain the NAAQS by the specified attainment date. The demonstration must be completed every three years through the region's attainment year. CARB determines whether San Diego County has achieved the necessary VOC and/or NOx emission reductions during the applicable milestone period. Actual emissions reductions must equal or exceed the reductions proposed in the District's RFP Demonstration (Section 3.2.2.3), which is a minimum of three percent per year.

San Diego County was officially reclassified as a Serious Nonattainment Area for the 2008 ozone NAAQS effective September 23, 2019.[104] Reclassification to a Serious Nonattainment Area for the 2008 ozone NAAQS necessitates the submittal of MCDs until the region attains the applicable NAAQS.[105] The next RFP milestone date is January 1, 2021, and as a result, the District will be required to submit a MCD by April 1, 2021 (see Section 3.2.2.5). Upon submittal of each subsequent MCD, the EPA will, within 90 days, make the determination as to whether the demonstration is adequate. Failure of the District to submit an adequate demonstration by the CAA deadlines could potentially result in several actions which include, but are not limited to: 1) Reclassifying the region to a worse nonattainment level such as "Extreme", or 2) Implementing a requirement to put in place additional emission control measures to cover the shortfall in emissions reductions.

The federal deadline for the District to submit an MCD to the EPA for the 2008 ozone NAAQS is April 1, 2021

3.2.2.5 Future Milestone Compliance Demonstrations

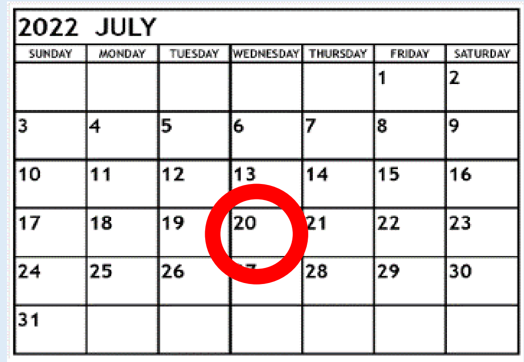
As noted in Section 3.2.2.4, CAA Section 182(g)(2) requires Serious and worse Nonattainment Areas to submit Milestone Compliance Demonstrations within 90 days after the date on which an applicable RFP milestone and/or attainment occurs. Future MCDs for the 2008 ozone NAAQS must be submitted to the EPA within 90 days of the dates listed below. The District commits to submitting the MCDs for the purposes of the 2008 ozone NAAQS as required:

- April 1, 2021 (January 1, 2021 + 90 days), through the 2020 ozone season;
- March 31, 2024 (January 1, 2024 + 90 days), through the 2023 ozone season;
- April 1, 2027 (January 1, 2027 + 90 days), through the 2026 ozone season.[106]

3.2.3 <u>Section 185 Fee Rule</u>

Although not expected, should the region miss the 2026 attainment deadline as a Severe Nonattainment Area for the 2008 ozone NAAQS, then CAA Section 185 requires each major stationary source of VOC and NOx emissions (those with emissions of 25 tons or more annually) in the region to pay an annual fee to the District for their emissions above a "baseline amount" until the region is redesignated to attainment of the NAAQS.

Pursuant to the reclassification of the region to a Severe Nonattainment Area, the District is required to submit a rule to implement CAA Section 185. The rule, which is required of Severe or worse Nonattainment Areas, must be adopted and submitted to the EPA as a federally enforceable SIP revision within ten years of the region's initial nonattainment designation for the NAAQS. [107] The rule only takes effect if the 2026 attainment year deadline is not met.



Federal deadline for the District (through CARB) to submit a Section 185 Fee Rule to the EPA is July 20, 2022

The region's initial nonattainment designation for the 2008 ozone NAAQS became effective July 20, 2012. Consequently, a local rule satisfying CAA Section 185 for the 2008 ozone NAAQS must be submitted to the EPA (through CARB) by July 20, 2022. The District commits to meeting this deadline. The program will outline all required procedures for assessment and collection of such fees should they be required.

The local adoption of a CAA Section 185 rule by July 20, 2022, would not invoke the collection of fees at that time. Rather, the actual collection of fees would begin only if the region were to miss the 2026 attainment-year deadline for the 2008 ozone NAAQS.

For reference, CAA Section 185(b) outlines a standard computation method to calculate a source's fees, if required. The 1990 CAA Amendments set the fee at $5,000 per ton of VOC and NOx emitted by the source during the calendar year that are in excess of 80% of a facility's "baseline emissions."[108] The CAA also requires the fees to be adjusted annually for inflation based on the Consumer Price Index (CPI). The CPI-adjusted rate cross-references the methodology found in CAA Section 502(b)(3)(B)(v), which determines the presumptive minimum fee per Part 70 for Title V operating permits. Using Part 70 adjusted fees, the latest CPI-adjusted rate effective for calendar year 2018 for Section 185 fees is set at $10,050.67 per ton of VOC and NOx emissions.[109]

3.2.3.1 Possible Alternative Section 185 Fee Program

EPA guidance (January 2010) on CAA Section 185 implementation allows for alternative approaches to satisfy the fee requirements if a NAAQS standard has been revoked and such alternatives are at least as stringent as standard CAA Section 185 fee programs.[110] For example, the South Coast AQMD and the San Joaquin Valley APCD have adopted and submitted stationary source fee rules to the EPA in compliance with CAA Section 185 requirements. However, those same air districts have supplemented their rules by also adopting and submitting alternative "fee-equivalent" CAA Section 185 programs applicable to mobile sources. These alternative programs are intended to provide a more equitable distribution of responsibility for emission reductions.

The District will gather input from stakeholders and review and assess all available methods to determine the appropriate approach for complying with CAA Section 185 in San Diego County. The District commits to submitting a corresponding rule to the EPA (through CARB) by July 20, 2022, fully satisfying CAA Section 185 requirements for the 2008 ozone NAAQS.

3.3 ATTAINMENT DEMONSTRATION

3.3.1 Background

Pursuant to CAA and EPA requirements,[111] the Attainment Demonstration summarizes the results of photochemical air quality modeling and supplemental Weight of Evidence analyses prepared by CARB. The Attainment Demonstration verifies that the Emission Control Measures discussed in this Attainment Plan will reduce ozone precursor emissions sufficiently to provide for attainment of the 2008 ozone NAAQS by July 20, 2027 (i.e. 2026 attainment year).

EPA Guidance establishes comprehensive procedures for demonstrating attainment of the NAAQS. These procedures include but are not limited to a Modeled Attainment Test,[112] and a Weight of Evidence Demonstration (see Section 3.3.5).

3.3.2 Modeled Attainment Test and Photochemical Modeling

CAA Section 182(c)(2)(A) requires that Serious and worse Nonattainment Areas, such as San Diego County, use a photochemical grid model to demonstrate attainment by specified dates. Ozone formation in the atmosphere is a complex photochemical process, and sophisticated photochemical air quality simulation modeling is used to help predict the amount of precursor emissions reductions needed for attainment of the 2008 ozone NAAQS. The air quality model mathematically simulates each of the physical and chemical processes that govern air pollution in the lower atmosphere. A few of the processes include, but are not limited to:

- Air pollutant releases into the air;
- Air pollutant transport and diffusion by the wind;
- Air pollutant creation and destruction in the air through chemical reactions;
- Deposition of pollutants onto the ground

Attachments K and L, as summarized in Table 3-4, describe the photochemical modeling and analysis performed by CARB:

TABLE 3-4
CARB Photochemical Modeling Technical Documents

Attachment	Technical Document Title	Description
K	Modeling Protocol and Attainment Demonstration for the 2020 San Diego County Ozone SIP	The modeling protocol includes details and procedures for conducting the photochemical modeling that forms the basis of the attainment demonstration for the SIP. The modeling attainment demonstration document provides details of the modeling results for the 2008 ozone NAAQS in San Diego County, which forms the scientific basis for the attainment demonstration.
L	Modeling Emissions Inventory for the Ozone State Implementation Plan in San Diego County	This document describes how the base and future year gridded photochemical modeling emissions inventory are prepared.

The area analyzed by a photochemical air pollution model is termed the modeling "region" or "domain." It is a geographical area divided into a three-dimensional array of grid cells. The model calculates air pollutant concentrations in each grid cell for each hour of the modeling period. Photochemical modeling must be performed for each air monitoring site within the nonattainment area. In San Diego County, only the Alpine monitoring site violates the 2008 ozone NAAQS. The Alpine site is in the inland foothills at an elevation of approximately 2,000 feet. Other monitoring sites in San Diego County have occasionally recorded exceedances of the 2008 ozone NAAQS on certain days. However, these sites either did not record four or more annual exceedances of the standard or were not the highest recorded ozone level in the region on such exceedance days, and as such do not violate the standard.

Further information regarding air quality modeling, including photochemical grid models of the type used for this Attainment Plan, can be found on EPA's website:

3.3.3 Summary of Results and Model-Predicted Attainment Year Design Value

As discussed in Table 3-6 and in Attachments K and L, the photochemical model predicts a 2026 design value in San Diego County of 74 ppb, which indicate ozone attainment in that year. To further substantiate the predicted 2026 attainment year, this Attainment Demonstration incorporates a supplementary Weight of Evidence Demonstration (Section 3.3.5 and Attachment M). This includes analyses of the monitored air quality, predicted emissions trends, and meteorology for the region. It concludes that attainment of the 2008 ozone NAAQS in 2026 is possible and serves as rationale supporting 2026 as San Diego County's attainment year for the 2008 ozone NAAQS. Combined with the Modeled Attainment Test, the results confirm that the existing emission control measures are adequate to continue reducing ozone concentrations to the level of the 2008 ozone NAAQS by July 20, 2027 (2026 attainment year).

TABLE 3-5
Calculation of Model-Predicted 2026 Design Values at San Diego County Monitoring Sites, 2008 Ozone NAAQS

Station Name	Station Number	2017 Baseline Design Value (ppb)	2026 Design Value (ppb)
Alpine	06-073-1006	84	74
Chula Vista	06-073-0001	62	61
Camp Pendleton	06-073-1008	70	65
Otay Mesa – Donovan	06-073-1014	70	65
San Diego – Kearny Villa Rd.	06-073-1016	70	68

3.3.4 Target Carrying Capacity

The Target Carrying Capacity represents the maximum levels of NOx and VOC emissions that the region's atmosphere can "carry" while still providing for attainment of the 2008 ozone NAAQS. This value was established through photochemical modeling that reflects the benefits of existing emissions control measures (State and local, adopted through December 2018), as incorporated in the emissions inventory found in Attachment A, Table A-1 for the predicted 2026 attainment year. The target carrying capacity established through photochemical modeling is 100.8 tons per day of VOC and 72.2 tons per day of NOx.

3.3.5 Weight of Evidence Demonstration

EPA modeling guidance[113] recommends that nonattainment areas supplement their photochemical modeling results with a Weight of Evidence assessment to address the uncertainties inherent to photochemical modeling assessments.[114] The Weight of Evidence analysis includes air quality and emissions trends along with meteorological analyses to provide a better understanding of the overall air quality problem. It also provides insights about the mix of emissions reductions and the measures needed for attainment. Results of the analysis are considered in concert with the results of the Modeled Attainment Test. Together, these support the conclusions that: 1) Existing emissions control measures, if implemented in a timely manner, are sufficient to attain the 2008 ozone NAAQS by July 20, 2027 (2026 attainment year), and 2) An earlier attainment year is not feasible. The complete Weight of Evidence Demonstration prepared by CARB for both the 2008 and 2015 ozone NAAQS, is found in Attachment M.

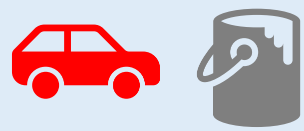
The Weight of Evidence in this Attainment Plan confirms that local emissions and transport of ozone and ozone precursors from the South Coast air basin (and Mexico on occasion) contribute to elevated ozone levels in San Diego County. Unfavorable meteorological conditions in late spring through early fall typically contribute to exceedances along the inland/foothills in the region, as temperatures rise and air stagnates. Nonetheless, despite these challenges, numerous analyses presented in the Weight of Evidence confirm that emission controls are working as designed, and as a result have and will continue to lower ozone design values through the attainment year, and result in fewer exceedance days.

3.3.6 Summary

In summary, photochemical modeling performed by CARB as part of this Attainment Plan demonstrates that attainment of the 2008 ozone NAAQS is predicted by 2026. This conclusion is consistent with the additional analyses presented in the Weight of Evidence Demonstration, where observed ozone levels, meteorology, and precursor emissions are used as a basis for this conclusion. This analysis complements the SIP-required Modeled Attainment Test by providing additional support for the Attainment Demonstration, where ozone concentrations, air pollutant emissions, and exceedance days are all predicted to decrease.

3.4 CONTINGENCY MEASURES

CAA Sections 172(c)(9) and 182 (c)(9) require ozone Nonattainment Areas to include contingency measures (i.e. additional air pollution controls) in SIPs that will go into effect without further regulatory action on the part of the District, State or the EPA if attainment is not achieved as predicted. Further, EPA guidance recommends that SIPs contain trigger mechanisms for such contingency measures, such as a schedule for implementation if the area fails to satisfy an RFP milestone or attainment deadline.[115]



Future emission reductions from existing regulations, District measure(s), and CARB measure(s) comprise the suite of local contingency measures in San Diego County

The CAA did not establish a specific amount of emission reductions that must be achieved through the implementation of contingency measures. However, where the EPA has approved other air district's SIPs and in implementation rules, the EPA has recommended that contingency measures should provide emissions reductions equating to approximately one year's worth of RFP, or three percent of the VOC or NOx baseline emissions inventory.[116]

Contingency measures in San Diego County have historically relied solely upon mobile source control programs at the state level, which will be implemented regardless of contingency measure requirements and result in an on-going emissions reduction trend. This said, recent litigation concluded that regions cannot rely solely on already implemented measures.[117] For that reason, the District has proposed to include an additional contingency measure in this Attainment Plan to withdraw the small container exemption provision found in District Rule 67.0.1 (Architectural Coatings). This measure will be enacted (without further Board action) only if the EPA makes a formal finding that San Diego County failed to meet an RFP milestone or attainment deadline, or to submit an MCD, thus necessitating implementation of the contingency measure. Coupled with ongoing emissions reductions from mobile sources, the contingency measure included in this Attainment Plan will provide emissions reductions equivalent to one year's worth of RFP for VOC or NOx should they be necessary. This measure will provide additional emission reductions beyond those relied upon in the Attainment Demonstration. A discussion of the District's contingency measure and CARB's mobile source reductions for this Attainment Plan is included in Attachment O.

4.0 2015 EIGHT HOUR OZONE NAAQS ATTAINMENT PLAN REQUIREMENTS

SECTION 4 HIGHLIGHTS

- Due to different federal requirements, an Attainment Plan including elements applicable specifically to the 2015 ozone standard has been prepared.
- A RACT Demonstration (under separate cover) has been prepared to confirm that all relevant local stationary source rules meet federal requirements as a Severe Nonattainment Area and align with comparable rules found in California.
- Other required elements completed include motor vehicle emission budgets for transportation conformity, VMT growth offset analysis, RACM and RFP demonstrations, milestone compliance demonstrations, commitments to adopt a Section 185 penalty fee program, an attainment demonstration, photochemical modeling, and a weight of evidence analysis.
- Photochemical modeling and a supplementary analysis predict San Diego County will attain the 2015 ozone standard by August 3, 2033, to adhere to the CAA.
- Contingency measures will be adopted and implemented should the region fail to meet federal attainment deadlines.

4.1 ATTAINMENT PLAN REQUIREMENTS

The EPA's implementation rule for the 2015 ozone standard identifies the required elements of an Attainment Plan for a Severe Nonattainment Area, which include:

- **Reasonably Available Control Technology** (RACT) Demonstration (CAA §182(b)(2) and verifying the implementation of RACT on all major sources of VOC or NOx and on each VOC source category for which the EPA has issued a Control Techniques Guideline (CTG) document.[118,119] In Severe Nonattainment Areas, a major source is a stationary source that emits or has the potential to emit at least 25 tons of VOC or NOx per year. The District's RACT Demonstration can be found under separate cover in the *"2020 Reasonably Available Control Technology Demonstration for the National Ambient Air Quality Standards for Ozone in San Diego County."*

- **Emissions Inventories** for the 2017 base year for all analyses, the predicted attainment year of 2032, and relevant RFP milestone years of 2023, 2026, and 2029 (see Section 4.1.1) (CAA Section (§) 182(a)(1)). All years are representative of a typical summer seasonal day.

- **Transportation Conformity Emission Budgets** which ensure transportation plans, programs, and projects are consistent with the SIP prior to approval by SANDAG, the region's metropolitan planning organization (Section 4.1.2) (CAA §176(c)). This Attainment Plan establishes on-road motor vehicle budgets for future RFP milestone and attainment years (2023, 2026, 2029, and 2032) associated with the 2015 ozone NAAQS.

- **Vehicle Miles Travelled (VMT) Offset Demonstration** (Section 4.1.3 and Attachment N) (CAA §182(d)(1)(a)), that shows the adoption of transportation control strategies and transportation control measures in San Diego County offset any growth in VMT or numbers of vehicle trips.

- **Reasonably Available Control Measures** (RACM) **Demonstration** (Section 4.2.1 and Attachments G, H, I, and J) (CAA §172(c)), verifying that all potential RACM the District or CARB could potentially adopt, including those for stationary sources, mobile sources, transportation-related, and consumer products, would not provide the additional emissions reductions necessary to advance the predicted attainment year for the 2015 ozone NAAQS from 2032 to 2031.

- **Reasonable Further Progress** (RFP) **Demonstration** (Section 4.2.2) (CAA §182(b)(1)), showing forecasted emissions reductions at milestone and attainment years of 2023, 2026, 2029, and 2032, relative to the 2017 base year, pursuant to the EPA's implementation rule for nonattainment areas classified as Moderate or above.[120]

- **Commitment to develop a CAA Section 185 Penalty Fee Rule** (Section 4.2.3) applicable to major stationary sources and which will be implemented only if the region fails to attain the 2015 ozone NAAQS as a Severe Nonattainment Area by the predicted 2032 attainment year. The CAA does not require a rule to have been adopted or be in place at the time of the submittal of this Attainment Plan.

- **Attainment Demonstration** (Section 4.3 and Attachments K, L, and M) (CAA §182(c)(2)(A)), comprised of photochemical air quality simulation modeling and other approved analytical techniques collectively called the "Weight of Evidence". Together, these analyses demonstrate the ability of the Emission Control Measures in Section 2.4 to provide for attainment of the 2015 ozone NAAQS as expeditiously as practicable. Ozone nonattainment areas are required to model attainment in the ozone season[121] prior to their specific attainment date.[122] For San Diego County, the demonstrated attainment year is 2032. This date encompasses the first full ozone season prior to the August 3, 2033, attainment deadline as a Severe Nonattainment Area.

- **Contingency Measures** (Section 4.4 and Attachment O) (CAA §179(c)(9) and CAA §182(c)(9)), which must be implemented only if the EPA makes a formal finding that San Diego County failed to satisfy a regulatory requirement to meet an RFP milestone and/or attainment deadline, thusly necessitating implementation of the contingency measures and ensuring emissions reductions progress. If enacted, the contingency measures are designed to provide additional emissions reductions beyond those relied upon in the Attainment Demonstration.

- **Additional CAA Subpart 2 Requirements** as listed below have been met via the implementation of various programs in San Diego County, pursuant to the region's former status as a Serious Nonattainment Area for the prior 1979 one-hour ozone NAAQS,[123] and former 1997 eight-hour ozone NAAQS. These programs continue to be implemented in the region and are required to continue because of anti-backsliding provisions in the federal CAA. The District carefully reviewed these programs and determined that no changes were needed to satisfy federal planning requirements. As such, the District certifies that the following approved programs (with SIP approval references as applicable) remain adequate and meet all federal CAA requirements set forth in the 2015 ozone standard implementation rule:

The District has an extensive ambient air quality monitoring network located throughout San Diego County

- Enhanced vehicle inspection and maintenance program (CAA §182(c)(3));[124]
- Stage II gasoline vapor recovery (CAA §182(b)(3));[125]
- Clean Fuels for Fleets (CAA §182(c)(4));[126]
- Source emission statement regulations (CAA §182(a)(3)(B));[127]
- Enhanced ambient monitoring (Photochemical Assessment Monitoring Stations (PAMS) (CAA §182(c)(1));[128]
- Periodic emissions inventory (CAA §182(a)(2); and
- Reformulated gasoline (CAA §211(k));

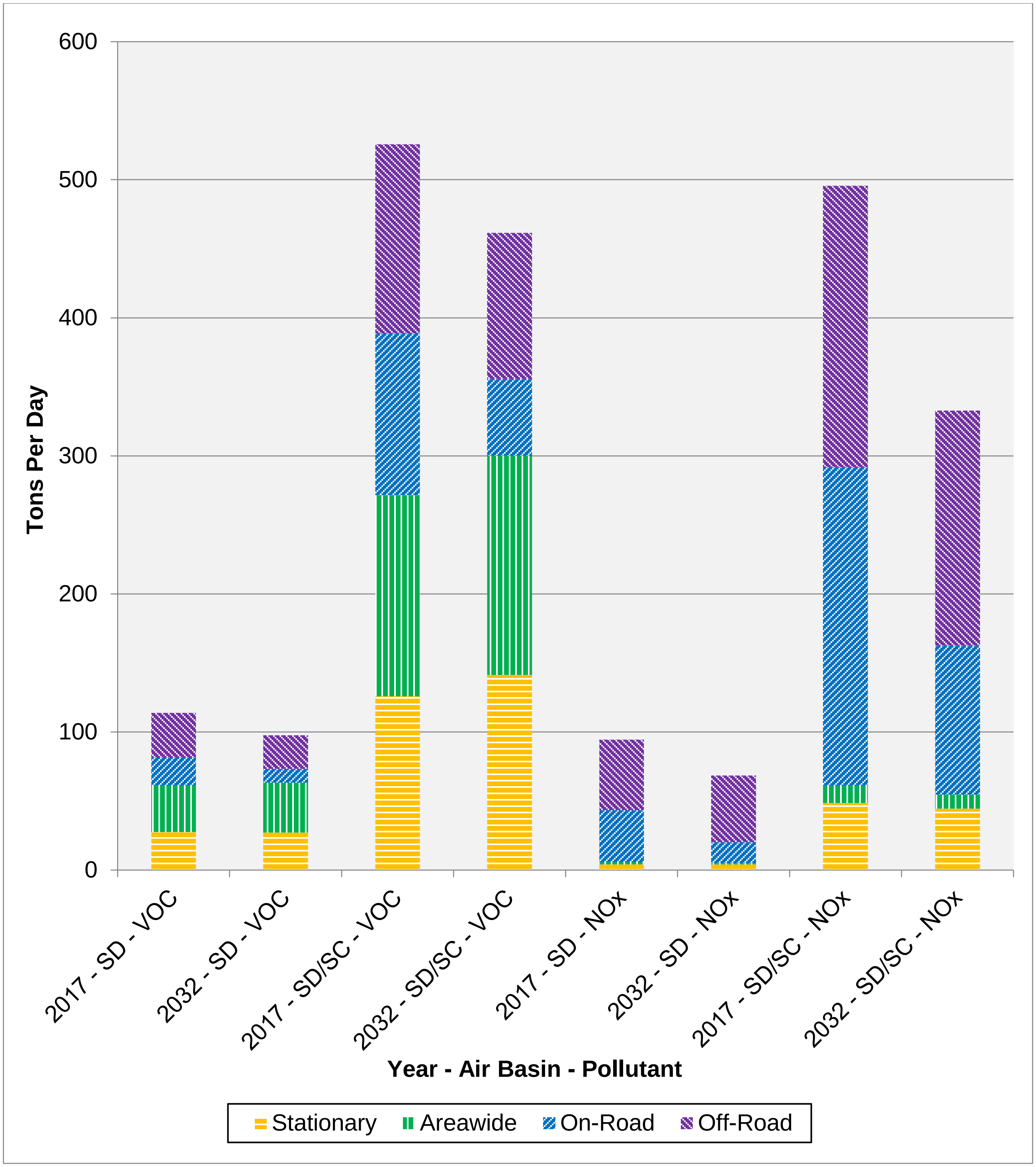
4.1.1 Inventories for Base Year, Attainment Year, and RFP Milestone Years

Pursuant to the CAA, the District is submitting all required emissions inventories to the EPA for the purposes of this Attainment Plan, as found in Attachment A.

Since San Diego County's air quality is often affected by VOC and NOx atmospherically transported into this region from the South Coast air basin (see Section 1.3.1), both an inventory of San Diego County-only emissions (Attachment A, Table A-1) and a combined inventory of the San Diego County and the South Coast Air District emissions are presented (Attachment A, Table A-2). The latter inventory represents the South Coast-San Diego County transport couplet. Figure 4-1 depicts the base year and attainment years in both the San Diego County-only and South Coast-San Diego County couplet. Additionally, an emission inventory used for the purposes of determining RFP and contingency measure emission reductions is also presented in Attachment A, Table A-3.

(CONTINUED ON NEXT PAGE)

FIGURE 4-1
Ozone Precursor Emissions in San Diego County and South Coast Air District, 2017-2032



SD = San Diego Air Basin; SC = South Coast Air District
Source: 2019 CARB CEPAM emissions inventory, Version 1.00.

4.1.2 On-Road Motor Vehicle Emission Budgets for Transportation Conformity

Section 176(c) of the CAA requires transportation planning agencies to demonstrate that their transportation plans, funding programs, and projects are consistent with ("conform to") the SIP. Transportation planning agencies also have to demonstrate conformity through a comparison of vehicle emissions listed in their transportation plans to the emissions budgets used in the SIP. An emissions budget is the level of emissions from on-road motor vehicles that provides for RFP and attainment of the NAAQS for ozone.

The budgets in Table 4-1 have been developed in collaborative consultation with SANDAG, the District, CARB, and the EPA, and are consistent with the attainment and progress demonstrations in this Attainment Plan.[129] These budgets were developed using EMFAC2017 with VMT and speed distributions modeled by SANDAG.[130] The California Air Resources Board (CARB) staff released a revised emission rate model (EMFAC2017) that updates the emission rates and planning assumptions used in calculating conformity budgets.[131] The recently approved Safer Affordable Fuel-Efficient (SAFE) Vehicles Rule Part One: *One National Program*, effective November 26, 2019, has impacted some of the underlying assumptions in the EMFAC2017 model. Hence, the emissions output from the EMFAC2017 model were adjusted to account for the emissions impact of the SAFE rule.

TABLE 4-1
On-Road Motor Vehicle Emission Budgets in San Diego County, 2015 Ozone NAAQS (tons per day)

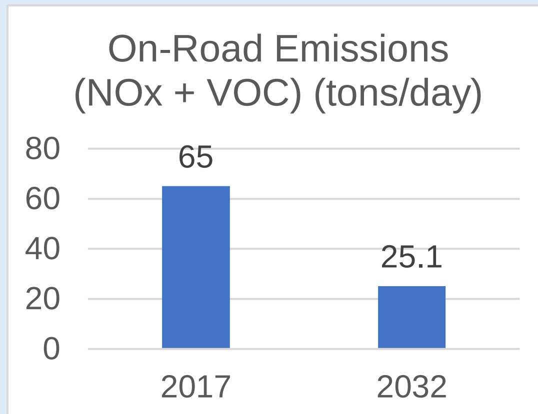
	2017 (Reference)		2023 (RFP)		2026 (RFP)		2029 (RFP)		2032+ (Attainment)	
	VOC	NOx	VOC	NOx	VOC	NOx	VOC	NOx	VOC	NOx
Baseline Emissions	-	-	13.51	19.24	12.02	17.20	10.93	15.83	9.93	15.07
SAFE Rule Adjustment	-	-	0.01	0.00	0.02	0.01	0.03	0.02	0.04	0.02
Total	-	-	13.52	19.24	12.04	17.21	10.96	15.85	9.97	15.09
Emissions Budget	**23**	**42**	**13.6**	**19.3**	**12.1**	**17.3**	**11.0**	**15.9**	**10.0**	**15.1**

Note: Emission budgets reflect a “summer day.”

Conformity to the SIP means that proposed transportation activities must not (1) cause or contribute to any new violation of any NAAQS, (2) worsen the severity of any existing violation, or (3) delay timely attainment of any NAAQS or any interim milestones. The SIP includes an analysis assessing the region’s total emissions inventory from all sources necessary to demonstrate reasonable further progress (RFP), attainment, or maintenance of the NAAQS. The portion of the total emissions inventory from on-road highway and transit vehicles, which provides for RFP and attainment of the NAAQS in these analyses becomes the “motor vehicle emissions budget.” Motor vehicle emissions budgets are the mechanism for ensuring that transportation planning activities conform to the SIP. Budgets are set for each criteria pollutant or its precursors, for which the area does not attain the NAAQS and are set for each RFP milestone year and the attainment year.

SANDAG prepares a long-range Regional Transportation Plan (RTP) at least every four years and a short-range funding program known as the Regional Transportation Improvement Program (RTIP) every two years. Before adopting the RTP/RTIP, SANDAG prepares a regional emissions analysis using the proposed plan and program and compares those emissions to the emission budgets in the SIP. SANDAG may determine RTP/RTIP conforms if the emissions from the proposed actions are less than or equal to the emissions budgets in the SIP. The conformity determination also signifies that SANDAG has met other transportation conformity requirements such as undertaking interagency consultation.

The federal transportation conformity regulation[132] requires this Attainment Plan to specify on-road motor vehicle emission budgets for all applicable RFP milestone years (2023, 2026, and 2029), as well as the predicted attainment year of 2032.[133] In 2017, the EPA determined the motor vehicle emission budgets for 2017 were adequate for transportation conformity purposes for the 2008 ozone NAAQS.[134] This budget has not been revised and the milestone year has now passed. The previously approved 2017 budgets are reflected in Table 4-1 only for reference. The emissions budget for 2032 (the predicted attainment year) will also apply to all subsequent transportation conformity analysis years for the 2015 ozone NAAQS, as required by the regulation.



By 2032, on-road motor vehicle emissions in San Diego County are projected to decrease over 61% compared to 2017 levels

4.1.3 Vehicles Miles Traveled (VMT) Offset Demonstration

Section 182(d)(1)(A) in the CAA requires Severe or worse Nonattainment Areas to submit VMT offset demonstrations validating that the region has adopted sufficient transportation control measures to offset any growth in vehicle emissions in the Attainment Plan period. Demonstrations must show that VMT emissions in the 2032 attainment year (assuming predicted growth in VMT and imposition of new transportation control measures)[135] are equal to or less than the modeled emissions in the 2032 attainment year (assuming no growth in VMT and that no new transportation measures were added). The VMT offset demonstration included in Attachment N meets this requirement by showing that the full motor vehicle control program emissions in the 2032 attainment year are lower than the emissions from the motor vehicle control program frozen at 2017 levels. Consequently, the identified transportation control strategies and TCMs are deemed sufficient to offset the growth in emissions due to growth in VMT, thusly satisfying the VMT Offset requirements.

4.2 CAA SUBPART 2 (TITLE I, PART D) PLAN REQUIREMENTS[136]

4.2.1 Reasonably Available Control Measures (RACM) Demonstration

4.2.1.1 RACM Requirements

The CAA requires a demonstration that all Reasonably Available Control Measures are being implemented as expeditiously as practicable.[137] Specifically, the air district must consider a wide range of potential additional measures beyond those already being implemented to further control emissions from stationary sources, transportation, and other mobile sources. A potential additional measure is considered "reasonably available" and must be implemented if it would, either alone or in combination with other feasible measures, advance the predicted attainment year by one year (i.e., from 2032 to 2031). In other words, the reasonably available measures would need to reduce emissions to 2032 levels by 2031. Based on the analysis performed for this Attainment Plan, the District finds that there are no potential additional measures that can alone or collectively reduce emissions to 2032 levels by 2031.

For a more thorough analysis for the 2015 ozone NAAQS, this RACM analysis accounts for projected emissions from only San Diego County (see Attachment A, Table A-1). Table 4-2 identifies the increment of emissions reductions needed in 2031 for San Diego County to reach attainment. San Diego County would need an additional 0.1 tons per day of VOC reductions and an additional 5.9 tons per day of NOx reductions in 2031 to advance the attainment year from 2032 to 2031 in San Diego County. For the purposes of this analysis, the District assumes that such VOC reductions are possible by 2031; thus, the RACM analysis focuses on necessary NOx reductions to determine if attainment could be advanced by one year.

TABLE 4-2
Emissions Reductions Required to Advance Attainment By One Year, 2015 Ozone NAAQS (tons per day)

Emissions Totals	Emissions (tpd)
2032 VOC Emissions Inventory *(Attachment A, Table A-1)*	98.3
2031 VOC Emissions Inventory *(Attachment A, Table A-1)*	98.4
VOC Emissions Reductions Needed in 2031 to Demonstrate Attainment	**0.1**
2032 NOx Emissions Inventory *(Attachment A, Table A-1)*	69.0
CARB 2032 NOx Emissions Reduction Commitment *(Section 4.3.5)*	- 4.0
District 2032 NOx Emissions Reduction Commitment *(Sections 4.3.4 & L.3.9)*	- 1.7
2032 NOx Emissions Inventory *(Adjusted for RACM)*	63.3
2031 NOx Emissions Inventory *(Attachment A, Table A-1)*	69.2
NOx Emissions Reductions Needed in 2031 to Demonstrate Attainment	**5.9**

Source: 2019 CARB CEPAM emissions inventory, Version 1.00.
Includes ERC Balance and SAFE Vehicle Rule Part One Adjustments.

4.2.1.2 Identifying Potential RACM for Stationary Sources

Identifying potential additional control measures for consideration as RACM is challenging in San Diego County because, pursuant to State law, the District is already required to adopt a combination of all feasible control measures and, under federal law, RACT. Notably, the District has continued to implement all feasible control measures for emissions from stationary sources, and has submitted rules into the SIP as necessary to meet RACT requirements.

Additionally, State law requires Best Available Retrofit Control Technology (BARCT), which generally is more stringent than RACT. Accordingly, the District has already adopted BARCT for stationary sources. As such, the District's existing BARCT rules cannot be considered as potential RACM. This is because these rules have already been implemented and would not provide additional new emissions reductions that could advance the attainment year. In order to identify potential RACM, the District has relied upon an ongoing control measure evaluation process to adopt all feasible measures as required by State law. Specifically, the District is required to consider, for each emission source category, whether adopting the requirements of the most stringent of the adopted rules in the state would be feasible for local sources and thusly advance attainment by one year.

The District's review of other air districts' rules revealed source categories that are subject to more stringent requirements than the current District rules (Attachment G, Table G-1), yet those are primarily in Extreme nonattainment areas. The District identified 17 stationary source measures that could achieve additional emission reductions, yet the analyses presented in Attachment G and Table G-1 show that if all 17 stationary measures were adopted as prohibitory rules in 2020, an additional 0.41 tons of VOC reductions per day and 0.40 tons of NOx reductions per day could be expected upon implementation.

Reducing VOC emissions from metalworking fluids and direct-contact lubricants is a potential RACM measure

Thusly, the 0.81 tons per day of VOC/NOx emission reductions potentially resulting from the adoption of all 17 stationary source measures would not on their own achieve the requisite level of NOx emission reductions needed to advance the attainment year to 2031, where a total of 5.9 tons per day of NOx emissions reductions is necessary (see Table 4-2). A detailed analysis of each of the stationary source control measures identified as potential RACM is presented in Attachment G.

4.2.1.3 Identifying Potential RACM for Transportation Sources

Potential RACM also includes Transportation Control Measures (TCMs), which are strategies to reduce motor vehicle trips, vehicle miles traveled, or vehicle idling and the associated air pollutant emissions. Attachment H, Table H-1 lists the 16 TCMs identified in CAA §108(f) and their implementation status in San Diego County. A discussion of each TCM further describing the status of implementation is found in Attachment H.

As indicated, 13 of the 16 TCMs have been implemented. These include transit and traffic flow improvements, ridesharing, high occupancy vehicle (HOV) lanes, pedestrian-only streets, and limits on extended vehicle idling. The agencies responsible for developing and implementing these TCMs include SANDAG and other State and local transportation agencies.

Five of the implemented TCMs — TCMs 1, 3, 5, 8, and 10 — were included in the 1982 SIP Revision for San Diego County.[138] Descriptions in this document of any ongoing implementation beyond the 1982 SIP commitments do not constitute submittal of additional implementation commitments into the SIP. Such submittals would be required <u>only</u> if the TCMs meet the RACM qualifications of advancing the region's attainment year, as specified in Section 4.2.1.1. TCMs that have already been implemented cannot provide additional emissions reductions in 2031 sufficient to advance the attainment year from 2032 to 2031. Therefore, they cannot be considered RACM.

Attachment H and Table H-1 also address the three TCMs that have not been implemented and the reasons for non-implementation. These measures address trip-reduction ordinances, peak-period vehicle restrictions, and vehicle emissions in extremely cold environments, none of which are applicable to San Diego County by operation of State law and due to favorable meteorological conditions.

San Diego's iCommute program supports various shared-ride initiatives (TCM #8), including the "Walk, Ride, and Roll to School" program to encourage active transportation amongst K-12 students.

4.2.1.4 Emission Reduction Potential of Transportation Control Measures

Trip Reduction Ordinances alone (TCM 4) have been estimated to reduce on-road vehicle emissions by less than two percent.[139] That analysis also estimated that the implementation of all other TCMs combined would be less effective than Trip Reduction Ordinances alone (that is, they would not provide combined emission reductions exceeding two percent). As a result, the maximum emissions reduction potential of implementing all unimplemented TCMs (TCMs 4, 7, and 12) is assumed to be two percent of on-road vehicle emissions.

Projected on-road motor vehicle emissions in San Diego County in 2032 are 9.9 tons of VOC per day and 15.1 tons of NOx per day (see Table A-1 in Attachment A). Therefore, the maximum emission reduction potential of implementing all unimplemented TCMs (assuming a two percent reduction in on-road emissions) is an estimated 0.2 tons per day reduction of VOC emissions and 0.3 tons per day reduction of NOx emissions. The cumulative VOC and NOx emission reductions available from the possible adoption of all TCMs in 2020 is 0.5 tons per day, and would not on their own achieve the requisite level of NOx emission reductions needed to advance the attainment year to 2031 where a NOx reduction of 5.9 tons per day would be required (see Table 4-2). A detailed analysis of TCMs as potential RACM is presented in Attachment H.

4.2.1.5 Identifying Potential RACM for Mobile Sources and Consumer Products

Most California regions, including San Diego County face challenges in reducing emissions from mobile sources, which are the primary source of air pollution in the region. Over half of the total daily ozone-precursor emissions in San Diego County are attributable to mobile sources. To address the severity of these air quality challenges, CARB has implemented the most stringent mobile source emissions control programs in the nation.

CARB has regulatory authority over most mobile sources in California, including: light,[140] medium, and heavy-duty on-road vehicles, off-road equipment, motorcycles, recreational boats, cargo handling equipment, and commercial harbor craft. It also regulates the fuels used in mobile equipment. CARB’s measures encompass a comprehensive approach to reducing mobile source emissions by establishing stringent motor vehicle and engine emissions standards, deadlines for adopting new technology, clean fuel specifications, and incentive programs to encourage early retirement (scrapping) of highly polluting vehicles and equipment in favor of lower-emitting equipment. The District relies on these State measures to attain the ozone standards in a timely manner.

Given the severity of California’s air quality challenges, CARB has implemented the most stringent mobile source emissions control program in the nation. CARB’s comprehensive strategy to reduce emissions from mobile sources includes stringent emissions standards, for new vehicles, in-use programs to reduce emissions from existing vehicle and equipment fleets, cleaner fuels that minimize emissions, and incentive programs to accelerate the penetration of the cleanest vehicles beyond that achieved by regulations alone. A detailed analysis reviewing possible RACM for mobile sources and consumer products in the San Diego region was completed by CARB in 2020 (see Attachment I). CARB’s analysis concluded that there are no reasonably California mobile source and consumer products regulatory control measures excluded from use in this Attainment Plan; therefore, there are no emissions reductions associated with unused regulatory control measures that, on their own, could advance San Diego County’s attainment of the 2015 ozone NAAQS by one year from 2032 to 2031 (i.e. 5.9 tons of NOx per day, as determined in Table 4-2).

4.2.1.6 Identifying Potential RACM for the Top Ten Non-Mobile Sources of VOC and NOx in San Diego County Emissions Inventory

Because the 2015 ozone NAAQS is more stringent and has a later attainment deadline compared to the 2008 ozone NAAQS, a more thorough RACM analysis compared to the District's emissions inventory is necessary to provide a comprehensive assessment of possible emission reductions that could advance the attainment year from 2032 to 2031. Consequently, the District has assessed the top ten non-mobile sources of VOC and NOx in San Diego County's emissions inventory (Attachment A, Table A-1) and determined their percentage share of San Diego's County's total VOC or NOx emissions, as found in Tables 4-3 and 4-4.

Table 4-3
Top Ten Categories of VOC Emissions in 2032 (Non-Mobile)

Rank	Source Category	EIC Number(s)	VOC Emissions in 2017 (tpd)	VOC Emissions in 2032 (tpd)	% of Total VOC Emissions in SD County in 2032 (tpd)	Applicable Regulations	RACM Reductions Possible?
1	Consumer Products	510-500-XXXX-XXXX (15 categories) 510-506-XXXX-XXXX (168 categories)	17.661	19.369	19.85%	CARB Consumer Products Regulation	No; Amendment proposed in Late 2020
2	Architectural Coatings	520-520-XXXX-XXXX (56 categories) 520-522-XXXX-XXXX (3 categories)	9.025	9.979	10.23%	APCD Rule 67.0.1	No; Amendment proposed in Late 2020
3	Printing Inks and Solvents	240-995-8000-0000 240-240-8000-0000 240-262-8400-0000 240-264-8400-0000 240-266-8400-0000 240-268-8400-0000	4.49	6.026	6.18%	APCD Rule 67.19	No; As stringent as SCAQMD Rule 1141.1. RACT.
4	Coatings and Related Process Solvents (Various)	230-995-9000-0000 230-236-9000-0000 230-240-8300-0000	3.048	2.666	3.76%	APCD Rule "67" Series and Rule 66.1	**Yes;** RACM Measures G.4, G.5, & G.6
5	Adhesives and Sealants	250-292-8202-0000 250-292-8250-0000	2.613	2.908	2.98%	APCD Rule 67.21	**Yes;** RACM Measure G.8

Rank	Source Category	EIC Number(s)	VOC Emissions in 2017 (tpd)	VOC Emissions in 2032 (tpd)	% of Total VOC Emissions in SD County in 2032 (tpd)	Applicable Regulations	RACM Reductions Possible?
6	Commercial Cooking (Charbroiling & Deep Frying)	690-680-6000-0000 690-682-6000-0000	2.192	2.422	2.48%	None	**Yes;** RACM Measure G.15
7	Asphalt Production/ Paving	430-424-7006-0000 540-560-0400-0000 540-562-0400-0000 540-564-0400-0000 540-566-0400-0000 540-590-0400-0000	2.398	2.347	2.41%	APCD Rule 67.7	No; As stringent as SJVAPCD Rule 4641. RACT.
8	Vehicle Refueling	330-378-1100-0000 330-380-1100-0000 330-381-1100-0000	5.382	1.662	1.70%	CARB Enhanced Vapor Recovery APCD Rules 61.4 / 61.4.1	No; State program is cleanest in nation. RACT.
9	Landfills	120-122-0242-0000	1.369	1.512	1.55%	EPA Subpart WWW and XXX APCD Rules 59 / 59.1	No; As stringent as federal regulation. Almost all emissions are fugitive.
10	Metal Parts/ Metal Furniture Coatings	230-226-9000-0000 230-230-9000-0000 230-230-9020-0000	1.127	1.441	1.48%	APCD Rule 67.3	**Yes;** RACM Measure G.3

VOC Category #1: Consumer Products

Consumer products are defined as chemically formulated products used by household and institutional consumers. The category will comprise 19% of the total emissions inventory for VOC in 2032. For thirty years, CARB has taken actions pertaining to the regulation of consumer products. Three regulations have set VOC limits for over 100 consumer product categories. These regulations have been amended frequently, and progressively stringent VOC limits and reactivity limits have been established. The program's most recent rulemaking occurred in 2018, and another update is planned in late 2020. Consequently, upon adoption of the proposed amendments in 2020 by CARB, there are no RACM available that would enable further emissions reductions in this source category (See Section 4.2.1.5).

VOC Category #2: Architectural Coatings

Architectural coatings include a variety of residential, commercial and industrial paints, primers, sealers and other coatings which, when applied, emit VOCs. The category will comprise 10% of the total emissions inventory for VOC in 2032. The District regulates architectural coatings through District Rule 67.0.1 (Architectural Coatings). Rule 67.0.1 currently incorporates VOC limits from CARB's 2007 Suggested Control Measure (SCM). However, an amendment to Rule 67.0.1 is planned for consideration by the end of 2020 to incorporate more stringent limits found in CARB's 2019 and 2020 Suggested Control Measures, as well as to incorporate other attainment plan provisions. As such, upon adoption of the proposed amendment by the District, there are no RACM available that would enable further emissions reductions in this source category.

VOC Category #3: Printing Inks and Solvents

District Rule 67.19 (Coatings and Printing Inks Manufacturing Operations) regulates VOC emissions from coatings and printing inks manufacturing operations at one large facility located in San Diego County. The category will comprise 6% of the total emissions inventory for VOC in 2032. The limits found within Rule 67.19 are as stringent as the comparable rule found at South Coast AQMD (Rule 1141.1 – Coatings and Ink Manufacturing), which typically has the more stringent emission controls in the nation. Rule 67.19 was determined to represent RACT for both ozone standards in the companion 2020 RACT Demonstration. Because Rule 67.19 is as stringent as the comparable South Coast AQMD rule, and because the category represents RACT, there are no RACM available that would enable further emissions reductions in this source category.

VOC Category #4: Coatings and Related Process Solvents (Various)

In general, the emissions for this category are comprised of miscellaneous sources of VOC emissions from coatings and solvent operations that are not found within the emission inventory elsewhere. These could include VOC coating operations emissions from the manufacturer of plastic parts, electronic equipment, and miscellaneous aircraft, to name a few. Notably, though, it does not include specific coating categories such as marine coatings or metal product coatings, which have their own specific category in the inventory. The category will comprise 3% of the total emissions inventory for VOC in 2032. The emissions from this category are regulated in San Diego County by various District rules (Rule 66.1 and other rules in the Rule 67-series). Most of the applicable rules that cover this category are already as stringent as possible, as evidenced in the companion 2020 RACT Demonstration for both ozone standards. Nonetheless, three District coating rules were found to potentially have RACM available (Measures G.4, G.5, and G.6) that could enable further emissions reductions in their respective source categories if they were found feasible, cost-effective, and adopted. As

Emissions from adhesives have been regulated in San Diego County since the late 1990's.

a result, the District has included these RACM measures in the RACM analysis found in Attachment G.

VOC Category #5: Adhesives and Sealants

District Rule 67.21 (Adhesive Materials Application Operations) regulates VOC emissions from the use of adhesives and sealants. The category will comprise 2% of the total emissions inventory for VOC in 2032. Rule 67.21 was found by the EPA to represent RACT in March 2020. The same determination was made by the District as part of the companion 2020 RACT Demonstration for both ozone standards. Additionally, VOC limits found in Rule 67.21 are generally similar to the comparable adhesive rule found at San Joaquin Valley APCD (SJVAPCD) Rule 4653 (Adhesives and Sealants). Like South Coast AQMD, SJVAPCD typically has the most stringent air pollution controls in the nation. In 2017, South Coast AQMD amended their adhesive Rule 1168 (Adhesive and Sealant Applications) and reduced VOC contents for a variety of products, including certain flooring adhesives, plastic welding products, and various types of sealants. As such, the possible incorporation of more stringent VOC limits found at South Coast AQMD are potential RACM (Measure G.8), if such limits were determined to be feasible, cost-effective, and adopted. As a result, the District has included this RACM measure in the RACM analysis found in Attachment G.

VOC Category #6: Commercial Cooking (Charbroiling/Deep Frying)

Charbroilers and deep fryers are typically used in the restaurant industry to cook meat and other types of food and fueled by natural gas. As food cooks, fat drippings burn on the heating elements, creating flame and smoke. The resulting smoke and vapors are primarily composed of particulate matter (PM) and water, but also include measurable amounts of VOC. Absent a secondary emission control device being installed, such VOC is typically exhausted into the atmosphere. The category will comprise 2% of the total emissions inventory for VOC in 2032. The District does not currently have a rule controlling emissions from commercial cooking operations. Nonetheless, emission control devices are available that achieve significant VOC and PM reductions. Several air districts in California now regulate commercial cooking equipment, including SJVAPCD Rule 4692 (Commercial Charbroiling) and South Coast AQMD Rule 1138 (Control of Emissions from Restaurant Operations). Consequently, the possible incorporation of VOC controls found at other air districts is potential RACM (Measure G.15), if it was determined to be feasible, cost-effective, and adopted. As a result, the District has included this RACM measure in the RACM analysis found in Attachment G.

VOC Category #7: Asphalt Production/Paving

The manufacture and application of asphalt to pave parking lots, driveways, and streets, emits VOC from evaporating petroleum distillate that is used to liquify the product for easier handling. The category will comprise 2% of the total emissions inventory for VOC in 2032. District Rule 67.7 regulates VOC emissions from asphalt operations and was determined to represent RACT in the companion 2020 RACT Demonstration for both ozone standards. When used for highways and roads, asphalts are required to meet specific standards for optimal safety and durability. Consequently, most air districts in California including South Coast AQMD, SJVAPCD, and the District, have left VOC standards relatively unchanged for years. Low-VOC alternatives that use biofuels and/or cold-mix production are suitable in some circumstance but have not exhibited similar durability and may not be economically feasible for all situations. Consequently, because District Rule 67.7 is as stringent as the comparable South Coast AQMD and SJVAPCD rules, and because the category represents RACT, there are no RACM available that would enable further emissions reductions in this source category.

VOC Category #8: Vehicle Refueling

Fuel dispensing has been regulated for decades in California, capturing VOC vapors displaced by the filling of vehicle gasoline tanks at refueling stations (Stage II Vapor Recovery). The advancement of zero-emission vehicle adoption has also contributed to reduced VOC emissions in the source category. The category will comprise only 1% of the total emissions inventory for VOC in 2032. District Rule 61.4 (Transfer of Volatile Organic Compounds into Vehicle Fuel Tanks) and Rule 61.4.1 (Transfer of Gasoline from Stationary Underground Storage Tanks into Vehicle Fuel Tanks) regulate Stage II Vapor Recovery in San Diego County. Concurrently, CARB implements statewide Enhanced Vapor Recovery program regulations to implement advanced state-of-the-art vapor control technology on an ongoing basis. Together, the emission control program for the source category is widely considered the most stringent in the nation, leaving no technological or economically feasible opportunity for further emission reductions. Consequently, there are no RACM available that would enable further emissions reductions in this source category.

VOC Category #9: Landfills

Collecting VOC emissions from landfills is a complicated process that is regulated at all local, State, and federal levels of government. In San Diego County, over 95% of VOC emissions from landfills are fugitive, meaning the emissions cannot reasonably pass through a stack or vent to be controlled. The VOC emissions that are controlled are done in compliance with local, State, and federal regulation. Because of these efforts, the category will only comprise 1% of the total emissions inventory for VOC in 2032. District Rules 59 (Control of Waste Disposal Site Emissions) and 59.1 (Municipal Solid Waste Landfills) regulate VOC emissions from all waste disposal sites in San Diego County. Rule 59.1 incorporates by reference federal control requirements (i.e. Subpart WWW). Landfills

Collecting emissions from landfills is a complicated process, regulated at all local, State, and federal levels of government

that comply with Rule 59 typically exceed the requirements found in Rule 59.1 and federal regulation. Methods to further control the fugitive or non-fugitive VOC emissions are not economically feasible. Consequently, because the source category's collectable emissions are already controlled to a degree consistent with federal regulation, there are no RACM available that would enable further emissions reductions in this source category.

VOC Category #10: Metal Parts / Metal Furniture Coatings

VOC is emitted from the application and curing of metal part and product coatings, mainly from surface preparation materials and from cleaning of coating equipment. The category will comprise 1% of the total emissions inventory for VOC in 2032. District Rule 67.3 (Metal Parts and Products Coating Operations) controls VOC emissions for the source category by limiting the VOC content of paints and cleaning solvents and specifies methods to minimize VOC emissions during equipment cleaning operations. Rule 67.3 also requires the use of high-transfer efficiency application equipment. The District determined Rule 67.3 to represent RACT in the companion 2020 RACT Demonstration for both ozone standards. One VOC product coating limit could potentially be decreased further, though the extent of its current use in San Diego County is negligible. Nonetheless, the possible incorporation of a more stringent VOC limit for this product category is potential RACM (Measure G.3), if it was determined to be feasible, cost-effective, and adopted. As a result, the District has included this RACM measure in the RACM analysis found in Attachment G.

Table 4-4
Top Ten Categories of NOx Emissions in 2032 (Non-Mobile)

Rank	Source Category	EIC Number(s)	NOx Emissions in 2017 (tpd)	NOx Emissions in 2032 (tpd)	% of Total VOC Emissions in SD County in 2032 (tpd)	Applicable Regulations	RACM Reductions Possible?
1	Stationary Reciprocating Internal Combustion Engines	010-040-0110-0000 010-040-0142-0000 010-040-1100-0000 010-040-1200-0000 020-040-0110-0000 020-040-0142-0000 050-040-0012-0000 050-040-0110-0000 050-040-0124-0000 050-040-1100-0000 050-040-1200-0000 050-040-1210-0000 052-040-1200-0000 060-040-0012-0000 060-040-0142-0000 060-040-0146-0000 060-040-1210-0000 099-040-1200-0000	1.263	1.223	1.79%	Proposed amended rule will be as stringent as State Diesel Engine ATCM, federal NSPS IIII, and SJVAPCD Rule 4702	No; Amendment proposed for July 2020. RACT.

Rank	Source Category	EIC Number(s)	NOx Emissions in 2017 (tpd)	NOx Emissions in 2032 (tpd)	% of Total VOC Emissions in SD County in 2032 (tpd)	Applicable Regulations	RACM Reductions Possible?
2	Stationary Internal Combustion Turbine Engines	010-045-0110-0000 010-045-0142-0000 010-045-1200-0000 020-045-0110-0000 020-045-1200-0000 050-045-0110-0000 050-045-1200-0000 052-045-0110-0000 060-045-0110-0000 060-045-0142-0000 060-045-1200-0000 060-045-1299-0000 060-045-1412-0000	1.011	0.993	1.45%	APCD Rules 69.3 & 69.3.1	**Yes;** RACM Measure G.11
3	Commercial Fuel Combustion (Various)	060-995-0110-0000 060-995-0120-0000 060-995-1220-0000 060-995-1500-0000	0.653	0.716	1.05%	APCD Rules 69.2, 69.2.1, 69.2.2, & 69.6	**Yes;** RACM Measures G.9, G.10, and G.13
4	Residential Fuel Combustion (Various)	610-995-0110-0000 610-995-0120-0000	0.335	0.332	0.49%	Incentive-based. APCD Rule 69.2.1	No; Amended Rule 69.2.1 includes new emission limits for pool heaters
5	Residential Fuel Combustion (Water Heating)	610-608-0110-0000	0.928	0.245	0.36%	APCD Rule 69.5.1	No; As stringent as SCAQMD Rule 1121.
6	Residential Fuel Combustion (Space Heating)	610-606-0110-0000 610-606-1220-0000	0.23	0.228	0.33%	APCD Rule 69.5	**Yes;** RACM Measure G.10
7	Landfill Flares	120-132-0136-0000	0.203	0.224	0.33%	APCD Proposed Landfill Flare Measure	No; Measure to be adopted by APCD in Spring 2021 to fulfill RACT.

Rank	Source Category	EIC Number(s)	NOx Emissions in 2017 (tpd)	NOx Emissions in 2032 (tpd)	% of Total VOC Emissions in SD County in 2032 (tpd)	Applicable Regulations	RACM Reductions Possible?
8	Asphalt Production/ Paving	430-424-7006-0000 540-560-0400-0000 540-562-0400-0000 540-564-0400-0000 540-566-0400-0000 540-590-0400-0000	0.18	0.218	0.32%	APCD Rule 67.7 and NSR	**Yes;** RACM Measure G.13
9	Man. and Industrial Fuel Combustion (Various)	050-995-0110-0000 050-995-0120-0000 050-995-1220-0000	0.188	0.199	0.29%	APCD Rules 69.2, 69.2.1, 69.2.2, & 69.6	**Yes;** RACM Measures G.9, G.10, and G.13
10	Residential Fuel Combustion (Cooking)	610-610-0110-0000	0.142	0.14	0.20%	N/A	No; Not economic-ally feasible

NOx Category #1: Stationary Reciprocating Internal Combustion Engines

Stationary reciprocating internal combustion engines are non-mobile piston engines that run on gaseous or liquid fuels. Though their use varies widely, examples of such engines can be found on compressors or rock crushers, or more typically used for emergency power systems critical to human life (i.e. emergency standby engines). Despite their widespread use, the category will comprise only 1% of the total emissions inventory for NOx in 2032. District Rule 69.4 (Stationary Reciprocating Internal Combustion Engines) and Rule 69.4.1 (Stationary Reciprocating Internal Combustion Engines - BARCT) regulate NOx emissions from existing stationary reciprocating internal combustion engines. New engines are regulated through Best Available Control Technology (BACT) requirements under State law through the District's NSR rules, and California's Diesel Engine Air Toxic Control Measure (ATCM) requirements for compression-ignition engines. BACT for new engines, under the District's NSR rules, is as stringent as the required federal RACT level of control.

An amendment to Rule 69.4.1 was approved in July 2020 to require all non-emergency engines to meet a Tier 4 engine standard, currently the cleanest available technology for compression-ignition equipment. The District has already been implementing the lower emission standard through enforcement of California's Diesel Engine ATCM and federal NSPS IIII. If adopted, the proposed amended rule will be similar in scope to SJVAPCD Rule 4702 (Internal Combustion Engines). The amendment also seeks to consolidate all the source category's requirements into one over-arching rule to simplify compliance and permitting. Furthermore, the District determined in the companion 2020 RACT Demonstration that amended Rule 69.4.1 will represent RACT for the source category upon the amendments taking effect. Because amended Rule 69.4.1 is as stringent as the comparable SJVAPCD rule (as well as applicable State/federal requirements), and because the category represents RACT, there are no RACM available that would enable further emissions reductions in this source category.

The District frequently receives applications for permits of new or modified stationary internal combustion engines.

NOx Category #2: Stationary Internal Combustion Turbine Engines

Stationary gas turbine engines are non-mobile internal combustion engines running on gaseous fuels that use pressurized air. Their use varies widely, but smaller turbine engines are often used at institutional and industrial facilities as part of cogeneration systems. Larger turbine engines are used in simple or combined cycle configurations to produce power for the electrical grid. The category will comprise only 1% of the total emissions inventory for NOx in 2032. District Rule 69.3 (Stationary Gas Turbine Engines) and Rule 69.3.1 (Stationary Gas Turbine Engines – BARCT) regulate NOx emissions in the source category. To address administrative issues found in the rule, the District is planning to propose an amendment to Rule 69.3.1 by Spring 2021. The future rulemaking also envisions incorporating all requirements found in Rule 69.3 into Rule 69.3.1, rendering Rule 69.3 duplicative and subject to repeal. Upon adoption, revised Rule 69.3.1 would cover the entire source category. The District determined in the companion 2020 RACT Demonstration that the proposed amended Rule 69.3.1 will represent RACT for the source category.

South Coast AQMD Rule 1134 (Emissions of Oxides of Nitrogen from Stationary Gas Turbines) was amended in 2019 to lower NOx emission limits for some turbine engines by January 1, 2024. Notably, the AQMD staff report for this amendment indicated half the turbines subject to the rule would already meet the more stringent emission NOx limits or would be exempt from upgrading because doing so would not be cost-effective or economically feasible. The remaining equipment requiring upgrades would be required to install Selective Catalytic Reduction (SCR) technology on existing turbines or be replaced with new turbines already equipped with SCR technology. Though the District's series of turbine rules will represent RACT once amended, the possible incorporation of more stringent NOx limits found at South Coast AQMD beginning in 2024 are potential RACM (Measure G.11), if it was determined to be feasible, cost-effective, and adopted. As a result, the District has included this RACM measure in the RACM analysis found in Attachment G.

NOx Category #3: Commercial Fuel Combustion (Various)

Commercial operations combust various types of fuel (primarily natural gas) in a variety of ways. These include space heating and cooling, cooking, water heating, refrigeration, and other processes. For inventory purposes, these miscellaneous commercial emissions are combined in the source category. The category will only comprise 1% of the total emissions inventory for NOx in 2032. The District regulates commercial fuel combustion through various local rules that apply to specific types of NOx-emitting equipment, such as boilers, steam generators, and process heaters (Rules 69.2, 69.2.1, and 69.2.2), as well as space heaters (Rule 69.6 – Natural Gas-Fired Fan-Type Central Furnaces). The companion 2020 RACT Demonstration determined these rules represent (or will represent) RACT for each respective category for both ozone standards. Nonetheless, potential RACM is available for Rule 69.2 (Measure G.9), Rule 69.6 (Measure G.10), as well as a possible new rule under evaluation for miscellaneous NOx sources such as commercial ovens or dehydrators (Measure G.13), if all were determined to be feasible, cost-effective, and adopted. As a result, the District has included these three RACM measures in the RACM analysis found in Attachment G.

NOx Category #4: Residential Fuel Combustion (Various)

Households combust natural gas in a variety of ways. These include but are not limited to clothes dryers, barbecues, and water heaters used for pools, spas, and hot tubs. Despite their widespread use in San Diego County, the category will comprise only 0.4% of the total emissions inventory for NOx in 2032. Notably, this category does not include combustion from water heating (see NOx Category #5 below) or cooking in ovens and stoves (see NOx Category #10 below); both of which have their own specific inventory categories. Energy-efficient appliances are now widely available and incentivized through programs such as the federal Energy Star program, which aims to educate consumers on annual energy costs for specific appliances. Older appliances are typically replaced with much more efficient models, resulting in less fuel being combusted and ultimately less NOx being emitted. As a result, local regulation of such residential equipment has not been necessary. One notable exception is NOx emission limits for heaters in pools and spas, which were included for the first time in amendments for Rule 69.2.1 in July 2020. Though zero-emission appliances exist (such as electric clothes dryers), they are not economically or technologically feasible in all residential situations, complicating any potential rulemaking. As such, upon the amendments for Rule 69.2.1 in 2020 taking effect, there are no RACM available that would enable further emissions reductions in this source category.

NOx Category #5: Residential Fuel Combustion (Water Heating)

Water heating is a source of residential fuel combustion. Cold water is typically brought into a special tank affixed typically with a natural gas burner. As the burner combusts, NOx emissions rise out of the tank through an internal vent and is eventually emitted outside of the home. Despite their widespread use, the category will comprise only 0.3% of the total emissions inventory for NOx in 2032. New water heaters sold in San Diego County are controlled through District Rule 69.5.1 (Natural Gas-Fired Water Heaters). Rule 69.5.1 applies to new residential-type water heaters operated with natural gas and limits NOx emissions to 10 nanograms per Joule (ng/J) of heat output. This limit aligns with South Coast AQMD Rule 1121 (Control of Nitrogen Oxides from Residential Type, Natural Gas-

Fired Water Heaters). Though zero-emission water heater options are available, they are not economically or technologically feasible in all residential situations, complicating any potential rulemaking. Consequently, because District Rule 69.5.1 is as stringent as the comparable South Coast AQMD rule, there are no RACM available that would enable further emissions reductions in this source category.

NOx Category #6: Residential Fuel Combustion (Space Heating)

Residential furnaces typically combust natural gas to heat the household. A typical, forced-air furnace burns natural gas, which in turn heats air being forced into the unit and then disburses the heated air throughout the home. As the burner combusts fuel, it releases NOx emissions that rise out of furnace chimney and are eventually emitted outside of the home. Despite their widespread use, the category will comprise only 0.3% of the total emissions inventory for NOx in 2032. The District controls residential heating through Rule 69.6 (Natural Gas-Fired Fan-Type Central Furnaces). The rule contains a NOx emission limit of 40 ng/J for new residential furnaces. In 2014, South Coast AQMD amended Rule 1111 (Reductions of NOx Emissions from Natural-Gas-Fired, Fan-Type Central Furnaces) to mandate a NOx limit of 14 ng/J on complying units. Compliant units took additional time to become commercially available, though recent analysis indicates may be more prevalent. Consequently, the potential lowering of NOx limits consistent with South Coast AQMD's rule is potential RACM (Measure G.10), if is found to be feasible, cost-effective, and adopted. As a result, the District has included this RACM measure (Measure G.10) in the RACM analysis found in Attachment G.

NOx Category #7: Landfill Flares

Four landfill facilities subject to District Rules 59 and 59.1 operate flares that combust landfill gas, which in turn emit NOx emissions. Flares serve as an emission control device, and a safety device during emergency situations. The category will comprise only 0.3% of the total emissions inventory for NOx in 2032. San Diego County has yet to adopt a local rule controlling NOx emissions from landfill flares, though such equipment is regulated already through federal regulation (40 CFR 60.18). As noted in the District's companion 2020 RACT Demonstration, the District has committed to adopting a landfill flare NOx control measure by Spring 2021 to fulfill RACT requirements for both ozone standards. Because of this commitment, the measure cannot be considered RACM. While it is anticipated the proposed rulemaking will require RACT levels of controls on affected flares, the District will concurrently assess the feasibility and cost-effectiveness of including "ultra-low" NOx emission limits as well. Such limits were recently adopted by South Coast AQMD Rule 1118.1 (Control of Emissions from Non-Refinery Flares), though analysis indicates such technologies is not cost-effective or economically feasible. Consequently, upon adoption of

Flares produce NOx emissions, but they are also critical safety devices in an emergency

the proposed local landfill flare measure in Spring 2021 fulfilling RACT requirements, there are no RACM available that would enable further emissions reductions in this source category.

NOx Category #8: Asphalt Production/Paving

The production of asphalt (specifically hot mix asphalt) is a source of NOx emissions. Natural gas is combusted during the aggregate drying and heating process of making hot mix asphalt, thus creating NOx emissions. The category will comprise only 0.3% of the total emissions inventory for NOx in 2032. In San Diego County, asphalt plants are required to have a permit to operate, and often trigger BACT requirements through the District's NSR program. Other California air districts have adopted rules requiring the use of low-NOx burners for asphalt manufacturing operations (among other miscellaneous NOx sources), including SCAQMD Rule 1147 (NOx Reductions from Miscellaneous Sources) and Sacramento Metropolitan Air Quality Management District Rule 419 (NOx from Miscellaneous Combustion Units). As a result, the possible incorporation of NOx controls for asphalt production plants are potential RACM (Measure G.13), if it was determined to be feasible, cost-effective, and adopted. As a result, the District has included this RACM measure in the RACM analysis found in Attachment G.

NOx Category #9: Manufacturing and Industrial Fuel Combustion (Various)

Manufacturing and industrial operations combust various types of fuel (primarily natural gas) in a variety of ways, including space heating or for use in boilers and burners for specific processes. These operations are combined into this category. The category will only comprise 0.2% of the total emissions inventory for NOx in 2032. The District regulates manufacturing and industrial fuel combustion through various local rules that apply to specific types of NOx-emitting equipment, such as boilers, steam generators, and process heaters (Rules 69.2, 69.2.1, 69.2.2) as well as Rule 69.6 (Natural Gas-Fired Fan-Type Central Furnaces). The companion 2020 RACT Demonstration determined these rules represent (or will represent) RACT for each respective category for both ozone standards. Nonetheless, potential RACM is available for Rule 69.2 (Measure G.9), Rule 69.6 (Measure G.10), as well as a possible new rule under evaluation for miscellaneous NOx emission sources like ovens and dehydrators (Measure G.13), if all were determined to be feasible, cost-effective, and adopted. As a result, the District has included these three RACM measures in the RACM analysis found in Attachment G.

NOx Category #10: Residential Fuel Combustion (Cooking)

Residential ovens and stoves combust natural gas to cook food, producing NOx emissions. The emissions and heat are usually vented through an exhaust fan sitting above the stove that leads outside the home. Despite their widespread use, the category will comprise only 0.2% of the total emissions inventory for NOx in 2032. New ovens and stoves manufactured today are more energy efficient, as insulation techniques have improved over time. This reduces the amount of natural gas being combusted, which in turn lowers NOx emissions overall. Though zero-emission (electric) ovens and stovetops are available, they are not always technologically or economically feasible in all residential situations, complicating any potential rulemaking. Instead, some local jurisdictions have started recently pursuing ordinances requiring new buildings to run only on electric appliances. However, such ordinances in California are very new, and have only been adopted in smaller, affluent areas where increased costs may not be as big a hindrance as it would be in less affluent areas. As a result, such requirements cannot be considered economically feasible, and therefore cannot be considered RACM. Consequently, there are no RACM available that would enable further emissions reductions in this source category.

4.2.1.7 RACM Cumulative Analysis

The combination of potential additional Reasonably Available Control Measures for stationary sources (Attachment G), TCMs (Attachment H), and mobile sources (Attachment I), if adopted and implemented in 2020, could provide no more than 1.3 tons of VOC and NOx reductions per day (Attachment J). This falls short of the 5.9 tons per day of NOx reductions that would be needed to advance attainment from 2032 to 2031, as illustrated in Table 4-2.

Additionally, CARB's commitment to reduce four additional tons of NOx per day (Section 4.3.5) further disqualifies the potential for advancing attainment by one year. In circumstances where predicted ozone levels in the attainment year are significantly lower than the standard, the RACM Demonstration is useful to determine whether the attainment year could be earlier. However, the predicted ozone design value in the 2032 attainment year for San Diego County is in fact equal to the standard with the inclusion of CARB's reduction commitment incorporated. In other words, the District faces a significant challenge simply to attain the 2015 ozone NAAQS by 2032 with existing measures as planned, let alone one year earlier with consideration of RACM. The predicted ozone level in 2032 can only be achieved through the addition of CARB's commitment that goes beyond the NOx inventory totals found in Attachment A.

Furthermore, by attaining one year earlier than predicted, the District would not achieve the planned stationary and mobile source emission reductions anticipated between 2031 and 2032 included in emission inventories and modeling. This would effectively increase the amount of reductions necessary for RACM, above what is represented in Table 4-2. For example, mobile source NOx emissions are predicted to be higher in 2031 than 2032 by approximately 0.25 tons per day. The same can be said for CARB's commitment of four tons of NOx per day by the predicted attainment year of 2032. It is likely that CARB's commitment of four tons would achieve less in 2031 with one less year of implementation. The "loss" of anticipated NOx reductions between 2031 and 2032 would require equal reductions from other RACM measures. Even with consideration of all potential RACM identified, there would not be sufficient NOx reductions to make up this gap. Consequently, it is clear that advancing attainment by one year is not practical nor feasible.

Therefore, none of the potential additional control measures are considered reasonably available and do not require adoption for the purposes of this 2015 ozone NAAQS RACM analysis and corresponding Attainment Plan.

4.2.2 <u>Reasonable Further Progress (RFP)</u>

CAA §172(c)(2) and §182(b)(1) require attainment plans to provide for ongoing reasonable further progress (RFP) in reducing emissions between the base year and attainment year.

RFP is defined in CAA §171(1) as "…such annual incremental reductions in emissions of the relevant air pollutant as are required…for the purpose of ensuring attainment of the applicable NAAQS by the applicable date." This requirement to demonstrate steady progress in emissions reductions between the baseline year (2017) and attainment year (2032) ensures that areas will not delay implementation of control programs until immediately before the attainment deadline.

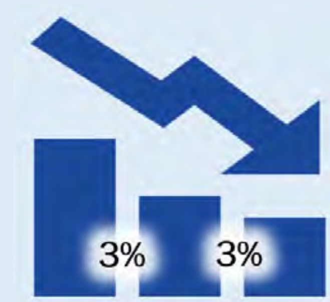
There are either one or two separate RFP requirements for nonattainment areas depending upon their classification. The first is a one-time requirement for a 15 percent reduction in VOC emissions over the first six years of the planning period for nonattainment areas classified as Moderate or above (CAA §182(b)(1)) (see Section 4.2.2.1). The second, which is for ozone nonattainment areas classified as Serious or worse, is a required three percent per year reduction of ozone precursor emissions, averaged over the first six years of the planning period, and for each subsequent three-year period thereafter until attainment occurs (CAA §182(c)(2)(B)) (see Section 4.2.2.3).

4.2.2.1 Fifteen Percent VOC-only Rate of Progress Requirements

The December 2018 EPA implementation rule for the 2015 ozone NAAQS,[141] established requirements for RFP that depend on the area's classification and whether the area has an approved 15 percent VOC-only rate of progress demonstration for a previous ozone standard that covers all of the current ozone nonattainment area. In 1997, the EPA approved a 15 percent rate of progress plan for San Diego County for the one-hour ozone standard covering the entire nonattainment area for the 2015 ozone standard.[142] This 15 percent VOC-only rate of progress requirement has been met for San Diego County.

4.2.2.2 RFP Requirements

Per the implementation rule under CAA §182(c)(2)(B), San Diego County must demonstrate an 18 percent reduction in ozone precursor emissions for the first six years of the attainment planning period of 2017 to 2023, beginning on January 1 of the year following the emissions inventory base year (i.e. January 1, 2018, or 2017 ozone season).[143] The six-year period concludes on January 1, 2024 (i.e. 2023 ozone season). An additional requirement is that areas classified Serious or worse must demonstrate average emissions reductions of three percent per year after the six-year period, which is averaged over each subsequent three-year period until the attainment year. As a result of this requirement, the years 2026, 2029, and 2032 have been included in the RFP analysis. Both VOC and NOx emissions reductions are needed to meet the RFP reduction targets. The San Diego County RFP demonstration is achieved by forecasted emissions reductions



To demonstrate Reasonable Further Progress (RFP), San Diego County must effectively demonstrate at least a 3% annual reduction in ozone precursor emissions between 2017-2032 for the 2015 ozone NAAQS.

occurring as a result of existing emissions control regulations as shown in the planning inventory (Attachment A, Table A-3). Due to the EPA's previous approval of the region's 15% VOC rate-of-progress demonstration[144] in 1997,[145] NOx substitution is used on a percentage basis to cover any shortfall in VOC reductions.

4.2.2.3 RFP Demonstration

The RFP Demonstration is provided in Table 4-5, which was developed in accordance with all applicable EPA guidance. The RFP Demonstration is achieved by forecasted emissions reductions resulting from existing air pollution control regulations. These are shown in the planning inventory in Attachment A, Table A-3, and demonstrates that San Diego County meets the RFP targets in the milestone years of 2023, 2026, 2029, and 2032 for the 2015 ozone NAAQS based on the ongoing implementation of existing local, State, and federal regulations to control and reduce ozone-forming emissions.

TABLE 4-5
RFP Demonstration, 2015 Ozone NAAQS

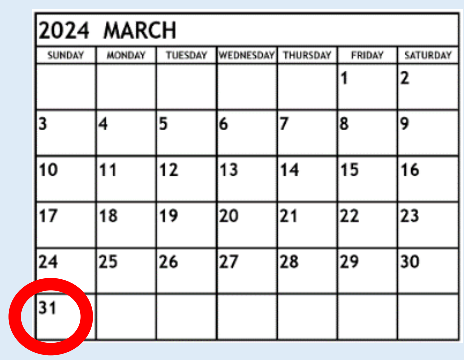
Line	Year	2017	2023	2026	2029	2032
A	Baseline VOC Emissions (tons/day)[146]	112.9	102.4	99.7	98.2	97.2
B	Change in VOC since 2017 (tons/day)		10.5	13.2	14.6	15.7
C	Change in VOC since 2017, %		9.3%	11.7%	13.0%	13.9%
D	Required % change since 2017		18%	27%	36%	45%
E	Shortfall (-)/ Surplus (+) in VOC, %		-8.7%	-15.3%	-23.0%	-31.1%
Line	**Year**	**2017**	**2023**	**2026**	**2029**	**2032**
F	Baseline NOx Emissions (tons/day)[147]	77.0	56.8	53.6	51.4	49.7
G	Change in NOx since 2017 (tons/day)		20.2	23.4	25.6	27.3
H	Change in NOx since 2017, %		26.3%	30.4%	33.3%	35.5%
I	NOx reductions since 2017 used for VOC substitution in this milestone year, %		8.7%	15.3%	23.0%	31.1%
J	NOx reductions since 2017 surplus after meeting VOC substitution needs in this milestone year, %		17.6%	15.1%	10.3%	4.3%
K	RFP shortfall (-), % (if any)		0.0%	0.0%	0.0%	0.0%
L	**RFP Met?**		**YES**	**YES**	**YES**	**YES**

Source: CARB. February 2020. Emission data obtained from 2019 CARB CEPAM emissions inventory (Version 1.00), San Diego Air Basin, Summer Day.

CAA §172(c)(9) also requires attainment plans to provide for contingency measures in case the EPA makes a formal finding that a nonattainment area failed to satisfy an RFP milestone or attainment requirement, thus necessitating implementation of the contingency measure(s).[148] The contingency measures requirement is intended to ensure emissions reductions progress continues. The EPA has interpreted this requirement to represent one year's worth of emission reduction progress for VOC or NOx, amounting to a three percent reduction of either pollutant based on an RFP baseline year, from measures that can take effect without further rulemaking action. This requirement is addressed in Section 4.4 and Attachment O of this Attainment Plan.

4.2.2.4 Milestone Compliance Demonstration Background

CAA Section 182(g)(2) requires Serious and worse Nonattainment Areas to submit RFP progress reports known as Milestone Compliance Demonstrations (MCDs) within 90 days after the date on which an applicable RFP milestone occurs. This demonstration ensures the region achieves the incremental emissions reductions projected in RFP demonstrations that ultimately help the region attain the NAAQS by the specified attainment date. The demonstration must be completed every three years through the region's attainment year. CARB determines whether San Diego County has achieved the necessary VOC and/or NOx emission reductions during the applicable milestone period. Actual emissions reductions must equal or exceed the reductions proposed in the District's RFP Demonstration (Section 4.2.2.3), which is a minimum of three percent per year.



The federal deadline for the District to submit the first MCD to the EPA for the 2015 ozone NAAQS is March 31, 2024

San Diego County today is classified as a Moderate Nonattainment Area for the 2015 ozone NAAQS. A forthcoming reclassification of this region to be a Severe Nonattainment Area for the 2015 ozone NAAQS necessitates the submittal of MCDs until the region attains the applicable NAAQS.[149] The next RFP milestone date is January 1, 2024, and as a result, the District will be required to submit a MCD by March 31, 2024 (see Section 4.2.2.5). Upon submittal of each MCD, the EPA will, within 90 days, make the determination as to whether the demonstration is adequate. Failure of the District to submit an adequate demonstration by the CAA deadlines could potentially result in several actions which included, but are not limited to: 1) Reclassifying the region to a worse nonattainment level such as "Extreme", or 2) Implementing a requirement to put in place additional emission control measures to cover the shortfall in emissions reductions.

4.2.2.5 Future Milestone Compliance Demonstrations

As noted in Section 4.2.2.4, CAA Section 182(g)(2) requires Serious and worse Nonattainment Areas to submit Milestone Compliance Demonstrations within 90 days after the date on which an applicable RFP milestone and/or attainment occurs. Future MCDs for the 2015 ozone NAAQS must be submitted to the EPA within 90 days of the dates listed below. The District commits to submitting the MCDs for the purposes of the 2015 ozone NAAQS as required:

- March 31, 2024 (January 1, 2024 + 90 days), through the 2023 ozone season;
- April 1, 2027 (January 1, 2027 + 90 days), through the 2026 ozone season;
- April 1, 2030 (January 1, 2030 + 90 days), through the 2029 ozone season;
- April 1, 2033 (January 1, 2033 + 90 days), through the 2032 ozone season).[150]

4.2.3 Section 185 Fee Rule

Although not expected, should the region miss the 2032 attainment deadline as a Severe Nonattainment Area for the 2015 ozone NAAQS, then CAA Section 185 requires each major stationary source of VOC and NOx emissions (those with emissions of 25 tons or more annually) in the region to pay an annual fee to the District for their emissions above a "baseline amount" until the region is redesignated to attainment of the NAAQS.

The federal deadline for the District (through CARB) to submit a Section 185 Fee rule to the EPA for the 2015 ozone NAAQS is August 3, 2028.

Pursuant to the reclassification of the region to a Severe Nonattainment Area, the District is required to submit a rule to implement CAA Section 185. The rule, which is required of Severe or worse Nonattainment Areas, must be adopted and submitted to the EPA as a federally enforceable SIP revision within ten years of the region's initial nonattainment designation for the NAAQS.[151] The rule only takes effect if the 2032 attainment year deadline is not met.

The region's initial nonattainment designation for the 2015 ozone NAAQS became effective August 3, 2018. Consequently, a local rule satisfying CAA Section 185 for the 2015 ozone NAAQS must be submitted to the EPA (through CARB) no later than August 3, 2028. The District commits to meeting this deadline. The program will outline all required procedures for assessment and collection of such fees should they be required.

The local adoption of a CAA Section 185 program by August 3, 2028, (or July 20, 2022 if such requirements can be incorporated at the same time as provisions for the 2008 ozone NAAQS), would not invoke the collection of fees at that time. Rather, the actual collection of fees would begin only if the region were to miss the 2032 attainment-year deadline for the 2015 ozone NAAQS.

For reference, CAA Section 185(b) outlines a standard computation method to calculate a source's fees, if required. The 1990 CAA Amendments set the fee at $5,000 per ton of VOC and NOx emitted by the source during the calendar year that are in excess of 80% of a facility's "baseline emissions."[152] The CAA also requires the fees to be adjusted annually for inflation based on the Consumer Price Index (CPI). The CPI-adjusted rate cross-references the methodology found in CAA Section 502(b)(3)(B)(v), which determines the presumptive minimum fee per Part 70 for Title V operating permits. Using Part 70 adjusted fees, the CPI-adjusted rate effective for calendar year 2018 for Section 185 fees is currently at $10,050.67 per ton of VOC and NOx emissions.[153]

4.2.3.1 Possible Alternative Section 185 Fee Program

EPA guidance (January 2010) on CAA Section 185 implementation allows for alternative approaches to satisfy the fee requirements if a NAAQS standard has been revoked and such alternatives are at least as stringent as standard CAA Section 185 fee programs.[154] For example, the South Coast AQMD and the San Joaquin Valley APCD have adopted and submitted stationary source fee rules to the EPA in compliance with CAA Section 185 requirements. However, those same air districts have supplemented their rules by also adopting and submitting alternative “fee-equivalent” CAA Section 185 programs applicable to mobile sources. These alternative programs are intended to provide a more equitable distribution of responsibility for emission reductions.

The District will gather input from stakeholders and review and assess all available methods to determine the appropriate approach for complying with CAA Section 185 in San Diego County. The District commits to submitting a corresponding rule to the EPA (through CARB) by August 3, 2028, fully satisfying CAA Section 185 requirements for the 2015 ozone NAAQS.

4.3 ATTAINMENT DEMONSTRATION

4.3.1 Background

Pursuant to CAA and EPA requirements,[155] the Attainment Demonstration summarizes the results of photochemical air quality modeling and supplemental Weight of Evidence analyses prepared by CARB. The Attainment Demonstration verifies that the Emission Control Measures discussed in this Attainment Plan (as well as additional State commitments, and reductions from recently adopted District rules not included in the emissions inventory found in Attachment A) will reduce ozone precursor emissions sufficiently to provide for attainment of the 2015 ozone NAAQS by August 3, 2033 (i.e. 2032 attainment year).

EPA Guidance establishes comprehensive procedures for demonstrating attainment of the NAAQS. These procedures include but are not limited to a Modeled Attainment Test,[156] and a Weight of Evidence Demonstration (see Section 4.3.6).

4.3.2 Modeled Attainment Test and Photochemical Modeling

CAA Section 182(c)(2)(A) requires that Serious and worse Nonattainment Areas, such as San Diego County, use a photochemical grid model to demonstrate attainment by specified dates. Ozone formation in the atmosphere is a complex photochemical process, and sophisticated photochemical air quality simulation modeling is used to help predict the amount of precursor emissions reductions needed for attainment of the 2015 ozone NAAQS. The air quality model mathematically simulates each of the physical and chemical processes that govern air pollution in the lower atmosphere. A few of the processes include, but are not limited to:

- Air pollutant releases into the air;
- Air pollutant transport and diffusion by the wind;
- Air pollutant creation and destruction in the air through chemical reactions;
- Deposition of pollutants onto the ground

Attachments K and L, as summarized in Table 4-6, describe the photochemical modeling and analysis performed by CARB:

TABLE 4-6
CARB Photochemical Modeling Technical Documents

Attachment	Technical Document Title	Description
K	Modeling Protocol and Attainment Demonstration for the 2020 San Diego County Ozone SIP	The modeling protocol includes details and procedures for conducting the photochemical modeling that forms the basis of the attainment demonstration for the SIP. The modeling attainment demonstration document provides details of the modeling results for the 2015 ozone NAAQS in San Diego County, which forms the scientific basis for the attainment demonstration.
L	Modeling Emissions Inventory for the Ozone State Implementation Plan in San Diego County	This document describes how the base and future year gridded photochemical modeling emissions inventory are prepared.

The area analyzed by a photochemical air pollution model is termed the modeling "region" or "domain." It is a geographical area divided into a three-dimensional array of grid cells. The model calculates air pollutant concentrations in each grid cell for each hour of the modeling period. Photochemical modeling must be performed for each air monitoring site within the nonattainment area. In San Diego County, two operational monitoring sites (Alpine and Kearny Villa Road) violate the 2015 ozone NAAQS. However, ambient ozone concentrations at the Kearny Villa Road site are far lower than observed historically at Alpine.[157] The Alpine site is in the inland foothills at an elevation of approximately 2,000 feet. Other monitoring sites in San Diego County have occasionally recorded exceedances of the 2008 ozone NAAQS on certain days. However, these sites either not record four or more annual exceedances of the standard or were not the highest recorded ozone level in the region on such exceedance days, and as such do not violate the standard.

Further information regarding air quality modeling, including photochemical grid models of the type used for this Attainment Plan, can be found on EPA’s website:

4.3.3 Summary of Results and Model-Predicted Attainment Year Design Value

As discussed in Table 4-7 and in Attachments K and L, the photochemical model predicts a 2032 design value in San Diego County of 70 ppb, which indicate ozone attainment in that year. To further substantiate the predicted 2032 attainment year, this Attainment Demonstration incorporates a supplementary Weight of Evidence Demonstration (Section 4.3.6 and Attachment M). This includes analyses of the monitored air quality, predicted emissions trends, and meteorology for the region. It concludes that attainment of the 2015 ozone NAAQS in 2032 is possible and serves as rationale supporting 2032 as San Diego County's attainment year for the 2015 ozone NAAQS. Combined with the Modeled Attainment Test, the results confirm that the existing emission control measures, along with emissions reduction commitments noted in the following sections, are adequate to continue reducing ozone concentrations to the level of the 2015 ozone NAAQS by August 3, 2033 (2032 attainment year).

TABLE 4-7
Calculation of Model-Predicted 2032 Design Values at San Diego County Monitoring Sites, 2015 Ozone NAAQS

Station Name	Station Number	2017 Baseline Design Value (ppb)	2032 Design Value (ppb)
Alpine	06-073-1006	84	70
Chula Vista	06-073-0001	62	61
Camp Pendleton	06-073-1008	70	64
Otay Mesa – Donovan	06-073-1014	70	64
San Diego – Kearny Villa Rd.	06-073-1016	70	66

4.3.4 Target Carrying Capacity

The Target Carrying Capacity represents the maximum levels of NOx and VOC emissions that the region's atmosphere can "carry" while still providing for attainment of the 2015 ozone NAAQS. This value was established through photochemical modeling that reflects the benefits of existing emissions control measures (State and local, adopted through December 2018), as incorporated in the emissions inventory found in Attachment A, Table A-1 for the predicted 2032 attainment year (98.3 tons of VOC per day and 69.0 tons of NOx per day).

The target carrying capacity for 2032 also reflects the benefit of three stationary source rule revisions proposed prior to the consideration of this Attainment Plan, as well as a commitment by CARB to further reduce mobile source emissions in the San Diego region by 2032 (see Section 4.3.5). Collectively, the proposed reductions will result in additional reductions of 5.66 tons of NOx per day by 2032 that are not included in the existing emission inventory (Attachment A, Table A-1), as described below:

- Amendments to District Rule 69.4.1 (Stationary Reciprocating Internal Combustion Engines), which will result in emissions reductions of 0.80 tons of NOx per day by 2032.

- o Amendments to District Rule 69.2.1 (Small Boilers, Process Heaters, and Steam Generators between 75,000 and 600,000 BTU/hour) and adoption of new District Rule 69.2.2 (Medium Boilers, Process Heaters, and Steam Generators between 2-5 million BTU/hour). Combined, the rules will result in emissions reductions of 0.86 tons of NOx per day by 2032.

- o Commitment by CARB to adopt three mobile source regulations estimated to collectively reduce emissions of NOx by four tons per day by 2032 in the San Diego region (see Section 4.3.5).

Consequently, the target carrying capacity established through photochemical modeling and incorporation of additional emission reductions is 98.3 tons of VOC per day and 63.3 tons of NOx.

4.3.5 CARB Commitment – State Control Measures for Mobile Sources

In March 2017, CARB adopted the 2016 State Strategy for the State Implementation Plan (2016 State SIP Strategy) that included additional control measures to reduce emissions from mobile sources that are primarily under State and federal jurisdiction, including on-road and off-road mobile sources. The 2016 State SIP Strategy includes California's SIP commitment to take action on defined new measures according to a schedule and to achieve aggregate emissions reductions in the South Coast and San Joaquin Valley. The 2016 State SIP Strategy also included a statement that if additional areas require emissions reductions to meet current ozone and PM2.5 standards, CARB will quantify area and year-specific reductions as part of individual area's attainment plans. In October 2018, CARB adopted an updated schedule for action on the measures in the *San Joaquin Valley Supplement to the 2016 State SIP Strategy for the State Implementation Plan* (Valley State SIP Strategy) that contained an updated and expanded version of the Heavy-Duty Vehicle Inspection and Maintenance Program measure, as well as a Valley-specific State commitment.

As a part of the San Diego County attainment demonstration for the 2015 ozone NAAQS, CARB is including a State commitment of four tons per day of NOx emissions reductions in 2032 from mobile sources that is needed to attain this standard. These reductions are beyond the emissions reductions from current programs that are included in the inventory provided with this Attainment Plan. The State's proposed commitment to achieve an aggregate emissions reduction of four tons per day of NOx in San Diego County by 2032 represents the estimated emissions reductions in San Diego County from three rules that CARB committed to adopt in the 2016 State SIP Strategy, and that is supplemented by the Valley State SIP Strategy (addressing emissions from heavy-duty diesel trucks, one of the largest sources of NOx emissions in San Diego County). While other measures in the 2016 State SIP Strategy will yield benefits in San Diego County, these emissions reductions represent the amount that is needed to demonstrate attainment of the 2015 ozone NAAQS in addition to the reductions from current programs. Table 4-8 below shows the three CARB measures providing the needed emissions reductions as well as the schedule by which CARB anticipates acting on each measure.

TABLE 4-8
CARB 2016 State SIP Strategy Measures and Schedule of Anticipated Action

Regulation	CARB Action	Implementation Begins
Heavy-Duty Low-NOx Engine Standard – California Action	2020	2024
Advanced Clean Trucks (Last Mile Delivery)	2020	2024
Heavy-Duty Vehicle Inspection and Maintenance Program	2021	2023

CARB staff is hard at work developing each of these measures. Since adoption of the 2016 State SIP Strategy, staff has held numerous workshops on the regulation that will meet the Heavy-Duty Low-NOx Engine standard measure requirement. This regulation, referred to as the Heavy-Duty Low-NOx Omnibus Regulation, is anticipated to be considered by the CARB Board by late 2020. The Advanced Clean Trucks Regulation was presented to the CARB Board in December 2019 and again in June 2020. Finally, beginning in 2019, CARB staff initiated public workshops on the development of a Heavy-Duty Inspection and Maintenance Program, which is anticipated for Board consideration in 2021.

Table 4-9 outlines CARB's commitment to achieve aggregate emissions reductions of four tons per day of NOx in San Diego County based upon implementation of the three measures described. While the table shows the anticipated emissions reductions associated with each measure, the measures as proposed by CARB staff or adopted by the Board may provide more or less reductions than the amount shown. The State's commitment is to achieve aggregate emissions reductions of four tons per day of NOx in San Diego County in 2032 to demonstrate attainment of the 2015 ozone NAAQS. CARB staff will propose the new State SIP Strategy commitment for San Diego County prior to CARB Board's adoption of the San Diego County Attainment Plan.

TABLE 4-9
San Diego County Expected Emissions Reductions from 2016 State SIP Strategy Measures

Regulation	NOx Reductions in 2032 (tpd)
Heavy-Duty Low-NOx Engine Standard – California Action	1.9
Advanced Clean Trucks (Last Mile Delivery)	0.4
Heavy-Duty Vehicle Inspection and Maintenance Program	1.7
Total Aggregate Commitment	**4.0**

4.3.6 Weight of Evidence Demonstration

EPA modeling guidance[158] recommends that nonattainment areas supplement their photochemical modeling results with a Weight of Evidence assessment to address the uncertainties inherent to photochemical modeling assessments.[159] The Weight of Evidence analysis includes air quality and emissions trends along with meteorological analyses to provide a better understanding of the overall air quality problem. It also provides insights about the mix of emissions reductions and the measures needed for attainment. Results of the analysis are considered in concert with the results of the Modeled Attainment Test. Together, these support the conclusions that: 1) Existing emissions control measures, if implemented in a timely manner, are sufficient to attain the 2015 ozone NAAQS by August 3, 2033 (2032 attainment year), and 2) An earlier attainment year is not feasible. The complete Weight of Evidence Demonstration prepared by CARB for both the 2008 and 2015 ozone NAAQS, is found in Attachment M.

The Weight of Evidence in this Attainment Plan confirms that local emissions and transport of ozone and ozone precursors from the South Coast air basin (and Mexico on occasion) contribute to elevated ozone levels in San Diego County. Unfavorable meteorological conditions in late spring through early fall typically contribute to exceedances along the inland/foothills in the region, as temperatures rise and air stagnates. Nonetheless, despite these challenges, numerous analyses presented in the Weight of Evidence confirm that emission controls are working as designed, and as a result have and will continue to lower ozone design values through the attainment year, and result in fewer exceedance days.

4.3.7 Summary

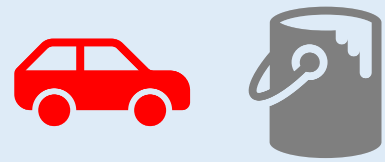
In summary, photochemical modeling performed by CARB as part of this Attainment Plan demonstrates that attainment of the 2015 ozone NAAQS is predicted by 2032. This conclusion is consistent with the additional analyses presented in the Weight of Evidence Demonstration, where observed ozone levels, meteorology, and precursor emissions are used as a basis for this conclusion. This analysis complements the SIP-required Modeled Attainment Test by providing additional support for the Attainment Demonstration, where ozone concentrations, air pollutant emissions, and exceedance days are all predicted to decrease.

4.4 CONTINGENCY MEASURES

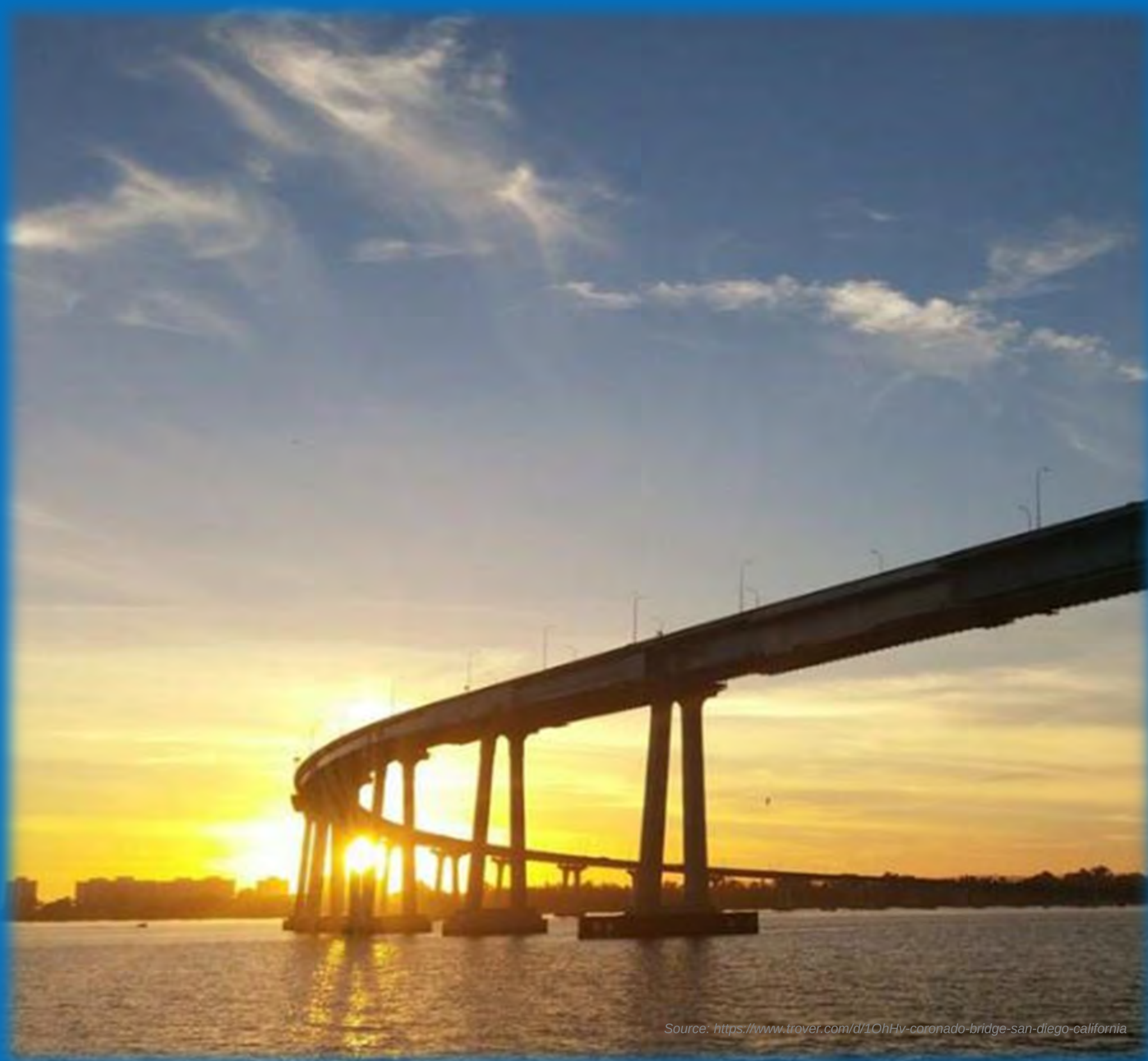
CAA Sections 172(c)(9) and 182 (c)(9) require ozone Nonattainment Areas to include contingency measures (i.e. additional air pollution controls) in SIPs that will go into effect without further regulatory action on the part of the District, State or the EPA if attainment is not achieved as predicted. Further, EPA guidance recommends that SIPs contain trigger mechanisms for such contingency measures, such as a schedule for implementation if the area fails to satisfy an RFP milestone or attainment deadline.[160]

The CAA did not establish a specific amount of emission reductions that must be achieved through the implementation of contingency measures. However, where the EPA has approved other air district's SIPs and in implementation rules, the EPA has recommended that contingency measures should provide emissions reductions equating to approximately one year's worth of RFP, or three percent of the VOC or NOx baseline emissions inventory.[161]

Contingency measures in San Diego County have historically relied solely upon mobile source control programs at the State level, which will be implemented regardless of contingency measure requirements and result in an on-going emissions reduction trend. This said, recent litigation concluded that regions cannot rely solely on already implemented measures.[162] For that reason, the District has proposed to include an additional contingency measure in this Attainment Plan to withdraw the small container exemption provision found in District Rule 67.0.1 (Architectural Coatings). This measure will be enacted (without further Board action) only if the EPA makes a formal finding that San Diego County failed to meet an RFP milestone or attainment deadline, or to submit an MCD, thus necessitating implementation of the contingency measures.[163] Coupled with ongoing emissions reductions from mobile sources, the contingency measure included in this Attainment Plan will provide emissions reductions equivalent to one year's worth of RFP for VOC or NOx should they be necessary. This measure will provide additional emissions reductions beyond those relied upon in the Attainment Demonstration. A discussion of the District's contingency measure and CARB's mobile source reductions for this Attainment Plan is included in Attachment O.



Future emission reductions from existing regulations, District measure(s), and CARB measure(s) comprise the suite of local contingency measures in San Diego County



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5.0 CONCLUSIONS

Pursuant to CAA requirements and EPA guidance, the District and CARB have conducted numerous and diverse analyses that include the Modeled Attainment Test and several analyses of air quality, emissions, and meteorological data. These enable the determination of whether timely attainment of the 2008 and 2015 ozone NAAQS is likely for San Diego County as a Severe Nonattainment Area for each of the two ozone standards. The results of modeling and Weight of Evidence analyses provide persuasive support to a conclusion that the Emission Control Measures defined in this Attainment Plan are sufficient to continue reducing ozone concentrations throughout San Diego County to the level of the 2008 ozone NAAQS by the conclusion of the 2026 ozone season, and to the level of the 2015 ozone NAAQS by the conclusion of the 2032 ozone season.

ATTACHMENT A
EMISSION INVENTORIES AND DOCUMENTATION FOR BASELINE, RFP, AND ATTAINMENT YEARS

Table A-1
Emission Inventory of Ozone Precursors in San Diego County Air Pollution Control District (tons per day)

SOURCE CATEGORY	VOC							
	2011	2017	2020	2023	2026	2029	2031	2032
ELECTRIC UTILITIES	0.0407	0.0836	0.0708	0.0666	0.0735	0.0683	0.0654	0.0648
COGENERATION	0.0431	0.045	0.0533	0.0543	0.0548	0.0554	0.0557	0.0558
MANUFACTURING AND INDUSTRIAL	0.0761	0.0689	0.0691	0.0695	0.07	0.0716	0.0722	0.0729
FOOD AND AGRICULTURAL PROCESSING	0.0261	0.0133	0.0114	0.0095	0.008	0.0068	0.0062	0.0059
SERVICE AND COMMERCIAL	0.2192	0.2097	0.2161	0.218	0.2217	0.2263	0.2292	0.2308
OTHER (FUEL COMBUSTION)	0.1001	0.0457	0.0372	0.0373	0.0375	0.0376	0.0378	0.0378
SEWAGE TREATMENT	0.0277	0.0238	0.0242	0.0246	0.0251	0.0257	0.026	0.026
LANDFILLS	1.1603	1.3866	1.4206	1.4496	1.4781	1.5057	1.523	1.5313
INCINERATORS	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
OTHER (WASTE DISPOSAL)	0.2428	0.2569	0.263	0.2687	0.274	0.279	0.2822	0.2837
LAUNDERING	0.096	0.1018	0.1042	0.1066	0.1087	0.1107	0.112	0.1126
DEGREASING	1.3973	1.5132	1.5345	1.5061	1.487	1.4561	1.4406	1.4353
COATINGS AND RELATED PROCESS SOLVENTS	6.1945	6.1892	6.5918	6.7661	7.043	7.3322	7.5324	7.6383
PRINTING	4.3413	4.4907	4.8462	5.0951	5.3875	5.7064	5.9176	6.0252
ADHESIVES AND SEALANTS	2.0315	2.613	2.768	2.7923	2.822	2.8504	2.8805	2.9074
OTHER (CLEANING AND SURFACE COATINGS)	0.1133	0.1307	0.1381	0.1399	0.1444	0.1497	0.1539	0.1561
PETROLEUM MARKETING	8.618	8.3409	6.6041	5.4504	4.6557	4.1924	3.9936	3.9184
OTHER (PETROLEUM PRODUCTION AND MARKETING)	0.0003	0	0	0	0	0	0	0
CHEMICAL	1.6483	0.9102	0.9589	1.0186	1.103	1.1936	1.2546	1.2854
FOOD AND AGRICULTURE	0.0989	0.053	0.0549	0.0557	0.0575	0.0594	0.0605	0.061

SOURCE CATEGORY	VOC							
	2011	2017	2020	2023	2026	2029	2031	2032
MINERAL PROCESSES	0.2557	0.2255	0.2451	0.2508	0.2552	0.2621	0.2693	0.2734
METAL PROCESSES	0.0078	0.0081	0.0086	0.0088	0.0092	0.0096	0.0099	0.0101
OTHER (INDUSTRIAL PROCESSES)	0.6692	0.8707	0.9276	0.9569	0.9957	1.028	1.0545	1.071
STATIONARY SUBTOTAL	**27.4083**	**27.5806**	**26.9478**	**26.3455**	**26.3117**	**26.6271**	**26.9772**	**27.2033**
CONSUMER PRODUCTS	18.4737	17.6586	18.0396	18.4066	18.7471	19.0661	19.2647	19.3637
ARCHITECTURAL COATINGS AND RELATED PROCESS SOLVENTS	11.5998	9.0222	9.2355	9.4406	9.6303	9.8094	9.9203	9.9749
PESTICIDES / FERTILIZERS	0.5961	0.6378	0.6217	0.6069	0.5932	0.5804	0.5724	0.5685
ASPHALT PAVING / ROOFING	1.6485	2.1715	2.3069	2.2182	2.1102	2.058	2.0654	2.0733
RESIDENTIAL FUEL COMBUSTION	0.6822	0.544	0.5449	0.5458	0.5449	0.5444	0.5436	0.5432
FARMING OPERATIONS	1.4708	1.2683	1.1941	1.1314	1.0783	1.0326	1.0059	0.9934
CONSTRUCTION AND DEMOLITION	0	0	0	0	0	0	0	0
PAVED ROAD DUST	0	0	0	0	0	0	0	0
UNPAVED ROAD DUST	0	0	0	0	0	0	0	0
FUGITIVE WINDBLOWN DUST	0	0	0	0	0	0	0	0
FIRES	0.0643	0.0675	0.069	0.0706	0.072	0.0733	0.0741	0.0746
MANAGED BURNING AND DISPOSAL	0.1897	0.0887	0.0886	0.0884	0.0883	0.0882	0.0881	0.088
COOKING	2.065	2.1912	2.2429	2.2927	2.3389	2.3822	2.4093	2.4225
OTHER (MISCELLANEOUS PROCESSES)	0	0	0	0	0	0	0	0
AREAWIDE SUBTOTAL	**36.7901**	**33.6498**	**34.3432**	**34.8012**	**35.2032**	**35.6346**	**35.9438**	**36.1021**
LIGHT DUTY PASSENGER (LDA)	13.3484	6.7136	5.2268	4.4175	3.8924	3.5011	3.2645	3.1495
LIGHT DUTY TRUCKS - 1 (LDT1)	3.7899	2.0505	1.6068	1.3136	1.0866	0.8969	0.7642	0.7052
LIGHT DUTY TRUCKS - 2 (LDT2)	5.337	3.5502	2.8946	2.4802	2.1691	1.9021	1.728	1.6402
MEDIUM DUTY TRUCKS (MDV)	3.7372	2.7238	2.2504	1.8447	1.5648	1.3568	1.2346	1.1798
LIGHT HEAVY DUTY GAS TRUCKS - 1 (LHDGT1)	1.2249	0.9646	0.7586	0.626	0.5342	0.4893	0.4408	0.4109
LIGHT HEAVY DUTY GAS TRUCKS - 2 (LHDGT2)	0.1285	0.1066	0.0912	0.0754	0.0626	0.0527	0.0472	0.0439

SOURCE CATEGORY	VOC							
	2011	**2017**	**2020**	**2023**	**2026**	**2029**	**2031**	**2032**
MEDIUM HEAVY DUTY GAS TRUCKS (MHDGT)	0.2901	0.1291	0.0867	0.0657	0.0551	0.0499	0.0481	0.0477
HEAVY HEAVY DUTY GAS TRUCKS (HHDGT)	0.0459	0.004	0.0021	0.0014	0.0009	0.0008	0.0008	0.0008
LIGHT HEAVY DUTY DIESEL TRUCKS - 1 (LHDDT1)	0.2441	0.2193	0.2062	0.1931	0.1819	0.1739	0.1704	0.1691
LIGHT HEAVY DUTY DIESEL TRUCKS - 2 (LHDDT2)	0.0638	0.0648	0.0648	0.0644	0.0639	0.064	0.0643	0.0644
MEDIUM HEAVY DUTY DIESEL TRUCKS (MHDDT)	0.9378	0.4612	0.2809	0.0151	0.0157	0.0159	0.0161	0.0162
HEAVY HEAVY DUTY DIESEL TRUCKS (HHDDT)	1.9421	0.6258	0.3875	0.127	0.1326	0.1353	0.1366	0.1375
MOTORCYCLES (MCY)	2.9212	2.739	2.5928	2.5108	2.4394	2.3791	2.3465	2.3374
HEAVY DUTY DIESEL URBAN BUSES (UBD)	0.0805	0.0382	0.01	0.0112	0.0123	0.0134	0.0141	0.0144
HEAVY DUTY GAS URBAN BUSES (UBG)	0.0006	0.001	0.0011	0.001	0.0012	0.0014	0.0014	0.0014
SCHOOL BUSES – GAS (SBG)	0.0539	0.0051	0.006	0.0064	0.0056	0.0064	0.007	0.0074
SCHOOL BUSES - DIESEL (SBD)	0.0537	0.0093	0.0095	0.0092	0.0084	0.0067	0.0054	0.0047
OTHER BUSES – GAS (OBG)	0.0377	0.0275	0.023	0.0206	0.0184	0.0165	0.0159	0.0157
OTHER BUSES - MOTOR COACH - DIESEL (OBC)	0.0222	0.0098	0.0066	0.0011	0.0013	0.0014	0.0015	0.0015
ALL OTHER BUSES - DIESEL (OBD)	0.0417	0.0248	0.0102	0.0003	0.0003	0.0003	0.0003	0.0003
MOTOR HOMES (MH)	0.1053	0.0325	0.0219	0.0152	0.0113	0.0081	0.0066	0.0062
ONROAD SUBTOTAL	**34.4065**	**20.5007**	**16.5377**	**13.7999**	**12.258**	**11.072**	**10.3143**	**9.9542**
AIRCRAFT	3.665	3.7623	3.7862	3.8084	3.8306	3.8531	3.867	3.873
TRAINS	0.0615	0.0316	0.0212	0.0182	0.0144	0.0114	0.0094	0.0095
OCEAN GOING VESSELS	0.6922	0.856	0.8655	0.9232	0.9767	1.0241	1.0537	1.0694
COMMERCIAL HARBOR CRAFT	0.5984	0.5026	0.5021	0.4972	0.4961	0.4821	0.4719	0.4661
RECREATIONAL BOATS	16.5968	12.239	10.476	8.8749	7.4892	6.3668	5.7686	5.5347

SOURCE CATEGORY	VOC							
	2011	2017	2020	2023	2026	2029	2031	2032
OFF-ROAD RECREATIONAL VEHICLES	0.5781	0.4655	0.437	0.3994	0.3605	0.3302	0.3163	0.3111
OFF-ROAD EQUIPMENT	13.6352	12.0311	11.3751	11.3835	11.4393	11.608	11.7951	11.9062
FARM EQUIPMENT	0.6281	0.46	0.3942	0.3441	0.3037	0.2707	0.2526	0.2445
FUEL STORAGE AND HANDLING	2.3906	1.7612	1.5904	1.4597	1.3644	1.3009	0.8941	0.8887
OFFROAD SUBTOTAL	**38.8459**	**32.1093**	**29.4477**	**27.7086**	**26.2749**	**25.2473**	**24.4287**	**24.3032**
ERC Balance	-	-	0.71	0.71	0.71	0.71	0.71	0.71
SAFE Rule Adjustment	-	-	-	0.0074	0.0216	0.0348	0.0454	0.0509
TOTAL	**137.4508**	**113.8404**	**107.9864**	**103.3726**	**100.7794**	**99.3258**	**98.4194**	**98.3237**

SOURCE CATEGORY	NOx							
	2011	2017	2020	2023	2026	2029	2031	2032
ELECTRIC UTILITIES	0.5585	0.6361	0.5398	0.5082	0.5633	0.525	0.503	0.4977
COGENERATION	0.2186	0.229	0.2713	0.276	0.2794	0.282	0.2832	0.2837
MANUFACTURING AND INDUSTRIAL	0.9588	0.7325	0.7454	0.7534	0.7687	0.7882	0.8011	0.8095
FOOD AND AGRICULTURAL PROCESSING	0.3346	0.157	0.1356	0.1166	0.0996	0.084	0.0764	0.074
SERVICE AND COMMERCIAL	0.9449	1.031	1.0535	1.0653	1.0786	1.0948	1.1093	1.1157
OTHER (FUEL COMBUSTION)	0.9734	0.6863	0.5834	0.5854	0.5874	0.5896	0.5917	0.5922
SEWAGE TREATMENT	0.0669	0.106	0.1077	0.1088	0.1107	0.1126	0.1135	0.114
LANDFILLS	0.081	0.2034	0.208	0.2122	0.2163	0.2203	0.2227	0.2239
INCINERATORS	0.0031	0.0045	0.0045	0.0047	0.0048	0.0049	0.005	0.005
OTHER (WASTE DISPOSAL)	0	0	0	0	0	0	0	0
LAUNDERING	0	0	0	0	0	0	0	0
DEGREASING	0	0	0	0	0	0	0	0
COATINGS AND RELATED PROCESS SOLVENTS	0	0	0	0	0	0	0	0
PRINTING	0	0	0	0	0	0	0	0
ADHESIVES AND SEALANTS	0	0	0	0	0	0	0	0
OTHER (CLEANING AND SURFACE COATINGS)	0	0	0	0	0	0	0	0
PETROLEUM MARKETING	0.0077	0.0109	0.0102	0.0095	0.0088	0.0083	0.0081	0.0081
OTHER (PETROLEUM PRODUCTION AND MARKETING)	0	0	0	0	0	0	0	0
CHEMICAL	0	0	0	0	0	0	0	0
FOOD AND AGRICULTURE	0	0	0	0	0	0	0	0
MINERAL PROCESSES	0.1993	0.1839	0.1999	0.2044	0.2081	0.2137	0.2195	0.2229
METAL PROCESSES	0.0045	0.005	0.0054	0.0057	0.006	0.0063	0.0066	0.0067
OTHER (INDUSTRIAL PROCESSES)	0.0326	0.0802	0.0855	0.0882	0.0917	0.0947	0.0971	0.0986
STATIONARY SUBTOTAL	**4.3839**	**4.0658**	**3.9502**	**3.9384**	**4.0234**	**4.0244**	**4.0372**	**4.052**
CONSUMER PRODUCTS	0	0	0	0	0	0	0	0

SOURCE CATEGORY	NOx							
	2011	2017	2020	2023	2026	2029	2031	2032
ARCHITECTURAL COATINGS AND RELATED PROCESS SOLVENTS	0	0	0	0	0	0	0	0
PESTICIDES / FERTILIZERS	0	0	0	0	0	0	0	0
ASPHALT PAVING / ROOFING	0	0	0	0	0	0	0	0
RESIDENTIAL FUEL COMBUSTION	1.8486	1.667	1.4993	1.3238	1.1228	0.9919	0.9832	0.978
FARMING OPERATIONS	0	0	0	0	0	0	0	0
CONSTRUCTION AND DEMOLITION	0	0	0	0	0	0	0	0
PAVED ROAD DUST	0	0	0	0	0	0	0	0
UNPAVED ROAD DUST	0	0	0	0	0	0	0	0
FUGITIVE WINDBLOWN DUST	0	0	0	0	0	0	0	0
FIRES	0.0165	0.0172	0.0176	0.0181	0.0184	0.0188	0.0189	0.019
MANAGED BURNING AND DISPOSAL	0.0635	0.0247	0.0246	0.0245	0.0244	0.0244	0.0243	0.0243
COOKING	0	0	0	0	0	0	0	0
OTHER (MISCELLANEOUS PROCESSES)	0	0	0	0	0	0	0	0
AREAWIDE SUBTOTAL	**1.9286**	**1.7089**	**1.5415**	**1.3664**	**1.1656**	**1.0351**	**1.0264**	**1.0213**
LIGHT DUTY PASSENGER (LDA)	11.2071	4.8227	3.3809	2.6066	2.1563	1.9165	1.8249	1.7913
LIGHT DUTY TRUCKS - 1 (LDT1)	3.0591	1.4088	0.9709	0.6966	0.5154	0.3944	0.3276	0.3006
LIGHT DUTY TRUCKS - 2 (LDT2)	7.0627	3.5052	2.2967	1.5847	1.1769	0.9329	0.8196	0.7723
MEDIUM DUTY TRUCKS (MDV)	5.0859	2.6874	1.8422	1.2113	0.839	0.6268	0.5392	0.5063
LIGHT HEAVY DUTY GAS TRUCKS - 1 (LHDGT1)	1.1875	0.804	0.6169	0.4772	0.3738	0.3015	0.2636	0.2493
LIGHT HEAVY DUTY GAS TRUCKS - 2 (LHDGT2)	0.138	0.1028	0.086	0.0704	0.058	0.0486	0.0441	0.042
MEDIUM HEAVY DUTY GAS TRUCKS (MHDGT)	0.3864	0.2261	0.1467	0.097	0.0712	0.0587	0.0545	0.0533
HEAVY HEAVY DUTY GAS TRUCKS (HHDGT)	0.119	0.0117	0.008	0.0066	0.006	0.0059	0.0059	0.006

SOURCE CATEGORY	NOx							
	2011	2017	2020	2023	2026	2029	2031	2032
LIGHT HEAVY DUTY DIESEL TRUCKS - 1 (LHDDT1)	6.0225	3.8681	2.9438	2.1698	1.5533	1.089	0.854	0.7578
LIGHT HEAVY DUTY DIESEL TRUCKS - 2 (LHDDT2)	1.516	0.9976	0.7741	0.588	0.4382	0.3291	0.2748	0.2515
MEDIUM HEAVY DUTY DIESEL TRUCKS (MHDDT)	9.1408	5.4491	4.1993	2.2631	2.4642	2.6205	2.7127	2.7562
HEAVY HEAVY DUTY DIESEL TRUCKS (HHDDT)	22.4308	11.2627	9.1242	6.0796	6.2162	6.2201	6.2649	6.2985
MOTORCYCLES (MCY)	0.7386	0.7455	0.6958	0.6639	0.6443	0.6322	0.6266	0.6245
HEAVY DUTY DIESEL URBAN BUSES (UBD)	1.0126	0.2668	0.0931	0.0592	0.0652	0.0711	0.0748	0.0766
HEAVY DUTY GAS URBAN BUSES (UBG)	0.0045	0.0065	0.0059	0.0056	0.0068	0.0078	0.0066	0.0063
SCHOOL BUSES – GAS (SBG)	0.0517	0.0139	0.014	0.0132	0.0079	0.0072	0.0065	0.0065
SCHOOL BUSES - DIESEL (SBD)	0.8027	0.7938	0.7731	0.7195	0.6304	0.4924	0.3851	0.334
OTHER BUSES – GAS (OBG)	0.1199	0.0739	0.0525	0.0383	0.0288	0.0224	0.0197	0.0187
OTHER BUSES - MOTOR COACH - DIESEL (OBC)	0.2945	0.1646	0.126	0.0597	0.0637	0.0662	0.0678	0.0681
ALL OTHER BUSES - DIESEL (OBD)	0.3539	0.2197	0.1352	0.0647	0.0678	0.0697	0.071	0.0709
MOTOR HOMES (MH)	0.4601	0.2742	0.2207	0.1824	0.1551	0.1331	0.1216	0.1165
ONROAD SUBTOTAL	**71.1943**	**37.7051**	**28.506**	**19.6574**	**17.5385**	**16.0461**	**15.3655**	**15.1072**
AIRCRAFT	4.0929	6.9081	7.8545	8.0473	8.2376	8.4299	8.5499	8.6065
TRAINS	1.7054	1.5484	1.1882	1.0906	0.9681	0.8559	0.3909	0.39
OCEAN GOING VESSELS	13.5357	17.1449	17.4091	18.2718	19.0687	19.6986	19.9945	20.1712
COMMERCIAL HARBOR CRAFT	8.3492	5.1084	4.8405	4.4999	4.3338	4.1667	4.0514	3.984
RECREATIONAL BOATS	3.0793	2.5915	2.4304	2.2941	2.1788	2.0819	2.0274	2.004
OFF-ROAD RECREATIONAL VEHICLES	0.0115	0.0096	0.0103	0.0109	0.0116	0.012	0.0124	0.0126
OFF-ROAD EQUIPMENT	15.5842	15.6073	14.4842	13.4436	12.7053	12.2823	12.1233	12.0572
FARM EQUIPMENT	2.6409	2.1265	1.878	1.5968	1.3628	1.1679	1.0559	1.0051

SOURCE CATEGORY	NOx							
	2011	**2017**	**2020**	**2023**	**2026**	**2029**	**2031**	**2032**
FUEL STORAGE AND HANDLING	0	0	0	0	0	0	0	0
OFFROAD SUBTOTAL	**48.9991**	**51.0447**	**50.0952**	**49.255**	**48.8667**	**48.6952**	**48.2057**	**48.2306**
ERC Balance	-	-	0.56	0.56	0.56	0.56	0.56	0.56
SAFE Rule Adjustment	-	-	-	0.0049	0.0124	0.0179	0.0220	0.0239
TOTAL	**126.5059**	**94.5245**	**84.6529**	**74.7821**	**72.1666**	**70.3787**	**69.2168**	**68.9950**

Source: 2019 CARB CEPAM emissions inventory, San Diego Air District, Version 1.00.

Table A-2
Emission Inventory of Ozone Precursors in San Diego County Air Pollution Control District and South Coast Air District, Combined (tons per day)

SOURCE CATEGORY	VOC								
	2011	2017	2020	2023	2025	2026	2029	2031	2032
ELECTRIC UTILITIES	0.7878	0.4711	0.4601	0.4886	0.5007	0.5036	0.4985	0.4957	0.4951
COGENERATION	0.1889	0.0523	0.0609	0.0624	0.063	0.0631	0.0637	0.0641	0.0644
OIL AND GAS PRODUCTION (COMBUSTION)	0.1082	0.0886	0.0906	0.0926	0.0922	0.0922	0.0929	0.0932	0.0933
PETROLEUM REFINING (COMBUSTION)	1.1433	1.0531	1.0531	1.0531	1.0531	1.0531	1.0531	1.0531	1.0531
MANUFACTURING AND INDUSTRIAL	4.6928	4.1131	4.1622	4.217	4.2325	4.2382	4.2721	4.3158	4.3427
FOOD AND AGRICULTURAL PROCESSING	0.0614	0.0492	0.0487	0.0483	0.0475	0.0472	0.0463	0.0459	0.0462
SERVICE AND COMMERCIAL	4.8894	4.5033	4.4884	4.4434	4.4221	4.4173	4.4377	4.4769	4.497
OTHER (FUEL COMBUSTION)	0.4168	1.0535	1.0471	1.081	1.0948	1.1014	1.12	1.133	1.1395
SEWAGE TREATMENT	0.2137	0.2969	0.3118	0.3209	0.327	0.33	0.3391	0.345	0.3476
LANDFILLS	9.7069	9.9516	10.1705	10.3902	10.5384	10.6062	10.8054	10.9385	11.0015
INCINERATORS	0.0626	0.0527	0.0556	0.0578	0.059	0.0597	0.0612	0.0619	0.0625
SOIL REMEDIATION	0.0057	0.0014	0.0014	0.0014	0.0014	0.0014	0.0015	0.0016	0.0016
OTHER (WASTE DISPOSAL)	7.0492	7.3985	7.9959	9.1427	9.939	10.0352	10.3259	10.5182	10.6149
LAUNDERING	0.2557	0.2714	0.2817	0.2883	0.2925	0.2945	0.3008	0.3048	0.3068
DEGREASING	13.0258	12.2714	13.4548	14.4023	14.7602	14.9284	15.4603	15.8216	16.0168
COATINGS AND RELATED PROCESS SOLVENTS	25.3183	25.3685	27.3926	28.611	29.3129	29.6403	30.6576	31.3445	31.7044
PRINTING	5.3858	5.3202	5.7323	6.0223	6.2323	6.3352	6.6735	6.8974	7.0115
ADHESIVES AND SEALANTS	5.8587	6.8323	7.4546	7.871	8.0398	8.1269	8.3872	8.5713	8.6804
OTHER (CLEANING AND SURFACE COATINGS)	2.1075	3.6492	3.9656	4.2231	4.3268	4.3768	4.5308	4.6356	4.6895
OIL AND GAS PRODUCTION	2.475	2.272	2.3223	2.3732	2.3667	2.3688	2.3824	2.391	2.3935
PETROLEUM REFINING	5.1358	4.4142	4.381	4.3816	4.3819	4.3823	4.3827	4.3833	4.3834

SOURCE CATEGORY	VOC								
	2011	2017	2020	2023	2025	2026	2029	2031	2032
PETROLEUM MARKETING	30.8142	22.3811	19.9743	18.3266	17.4051	17.0002	16.0386	15.5208	15.4971
OTHER (PETROLEUM PRODUCTION AND MARKETING)	0.0599	0.2376	0.252	0.2638	0.2695	0.272	0.2801	0.2853	0.2884
CHEMICAL	6.4826	5.0715	5.5048	5.8684	6.0178	6.0935	6.3214	6.4753	6.5527
FOOD AND AGRICULTURE	1.1422	0.589	0.6193	0.6405	0.6495	0.6543	0.6678	0.6764	0.6808
MINERAL PROCESSES	0.5384	0.6034	0.6365	0.6514	0.6587	0.6624	0.6755	0.6872	0.6933
METAL PROCESSES	0.0387	0.064	0.0669	0.0701	0.0716	0.0722	0.0746	0.0764	0.0773
WOOD AND PAPER	0.2234	0.1182	0.1237	0.1296	0.1336	0.1356	0.1416	0.1455	0.1475
GLASS AND RELATED PRODUCTS	0	0.0054	0.0059	0.0063	0.0064	0.0065	0.0066	0.0068	0.0068
ELECTRONICS	0.0009	0.0261	0.0313	0.0359	0.038	0.0391	0.0427	0.045	0.0464
OTHER (INDUSTRIAL PROCESSES)	3.7941	7.3084	7.6431	7.9029	8.0257	8.0821	8.2516	8.3706	8.4345
STATIONARY SUBTOTAL	**131.9837**	**125.8892**	**129.789**	**133.4677**	**135.3597**	**136.0197**	**138.3932**	**140.1817**	**141.3705**
CONSUMER PRODUCTS	110.0177	108.1251	110.1225	112.4478	113.999	114.74	116.9188	118.3672	119.0724
ARCHITECTURAL COATINGS AND RELATED PROCESS SOLVENTS	26.3456	20.8083	21.3877	21.8828	22.2022	22.351	22.8006	23.0909	23.2357
PESTICIDES / FERTILIZERS	2.1744	2.3114	2.3101	2.3076	2.3081	2.3076	2.3091	2.3114	2.3129
ASPHALT PAVING / ROOFING	2.7107	3.3817	3.6906	3.6732	3.6452	3.6377	3.6558	3.7096	3.7409
RESIDENTIAL FUEL COMBUSTION	3.0259	2.8639	2.8459	2.8293	2.8213	2.8177	2.8127	2.8121	2.8117
FARMING OPERATIONS	4.4641	3.786	3.4469	3.1758	3.1155	3.0854	3.0083	2.9663	2.9487
CONSTRUCTION AND DEMOLITION	0	0	0	0	0	0	0	0	0
PAVED ROAD DUST	0.0004	0	0	0	0	0	0	0	0
UNPAVED ROAD DUST	0	0	0	0	0	0	0	0	0
FUGITIVE WINDBLOWN DUST	0	0	0	0	0	0	0	0	0
FIRES	0.3629	0.3661	0.3676	0.3692	0.3701	0.3706	0.3719	0.3727	0.3732
MANAGED BURNING AND DISPOSAL	0.7141	0.6686	0.6684	0.6683	0.6684	0.6683	0.6683	0.6684	0.6684

SOURCE CATEGORY	VOC								
	2011	2017	2020	2023	2025	2026	2029	2031	2032
COOKING	3.0853	3.2808	3.3844	3.4635	3.5145	3.5393	3.611	3.6573	3.6795
OTHER (MISCELLANEOUS PROCESSES)	0	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003
AREAWIDE SUBTOTAL	**152.9011**	**145.5922**	**148.2244**	**150.8178**	**152.6446**	**153.5179**	**156.1568**	**157.9562**	**158.8437**
LIGHT DUTY PASSENGER (LDA)	76.8664	42.5563	31.9294	26.4255	23.4647	22.3182	19.7202	18.1937	17.4596
LIGHT DUTY TRUCKS - 1 (LDT1)	19.302	11.4216	8.8225	7.2313	6.2834	5.8806	4.8585	4.1558	3.8382
LIGHT DUTY TRUCKS - 2 (LDT2)	28.8107	20.6996	16.6453	14.4593	13.1432	12.5992	11.2477	10.3522	9.8908
MEDIUM DUTY TRUCKS (MDV)	22.0831	17.7884	14.7378	12.0858	10.6543	10.0909	8.7898	8.0447	7.7135
LIGHT HEAVY DUTY GAS TRUCKS - 1 (LHDGT1)	4.7242	3.9862	3.0364	2.3877	2.1109	2.0034	1.8311	1.6486	1.5425
LIGHT HEAVY DUTY GAS TRUCKS - 2 (LHDGT2)	0.6039	0.5334	0.4375	0.3433	0.2975	0.2772	0.2286	0.2021	0.1883
MEDIUM HEAVY DUTY GAS TRUCKS (MHDGT)	1.4524	0.7626	0.5498	0.4564	0.4176	0.4052	0.3772	0.3707	0.3694
HEAVY HEAVY DUTY GAS TRUCKS (HHDGT)	0.331	0.024	0.0097	0.0064	0.0056	0.0053	0.0052	0.0055	0.0056
LIGHT HEAVY DUTY DIESEL TRUCKS - 1 (LHDDT1)	0.5782	0.5231	0.4633	0.4098	0.3867	0.3754	0.3502	0.3402	0.3371
LIGHT HEAVY DUTY DIESEL TRUCKS - 2 (LHDDT2)	0.1755	0.17	0.1563	0.1436	0.139	0.1367	0.1323	0.1312	0.1311
MEDIUM HEAVY DUTY DIESEL TRUCKS (MHDDT)	3.7237	2.0541	1.314	0.0818	0.0854	0.0871	0.0915	0.0945	0.0961
HEAVY HEAVY DUTY DIESEL TRUCKS (HHDDT)	11.2899	4.1191	2.8033	1.1198	1.1838	1.2094	1.2725	1.3128	1.3326
MOTORCYCLES (MCY)	11.2261	11.5774	11.8495	12.1567	12.1419	12.1257	12.2016	12.2556	12.2739
HEAVY DUTY DIESEL URBAN BUSES (UBD)	0.7602	0.3019	0.1083	0.0705	0.072	0.0728	0.075	0.0765	0.0771
HEAVY DUTY GAS URBAN BUSES (UBG)	0.0057	0.006	0.0063	0.0054	0.0043	0.0049	0.0054	0.0059	0.0064
SCHOOL BUSES – GAS (SBG)	0.1712	0.0476	0.0573	0.0606	0.064	0.0656	0.0731	0.078	0.0799
SCHOOL BUSES - DIESEL (SBD)	0.2652	0.0446	0.0437	0.0393	0.0366	0.0348	0.0291	0.0246	0.0225

SOURCE CATEGORY	VOC								
	2011	2017	2020	2023	2025	2026	2029	2031	2032
OTHER BUSES – GAS (OBG)	0.18	0.1388	0.1198	0.1101	0.1058	0.1041	0.1002	0.0983	0.0981
OTHER BUSES - MOTOR COACH - DIESEL (OBC)	0.1272	0.0635	0.0428	0.0075	0.0081	0.0085	0.0092	0.0098	0.0098
ALL OTHER BUSES - DIESEL (OBD)	0.1497	0.0927	0.0462	0.0023	0.0025	0.0025	0.0026	0.0027	0.0027
MOTOR HOMES (MH)	0.3766	0.1272	0.0833	0.0579	0.048	0.0432	0.0318	0.0273	0.0259
ONROAD SUBTOTAL	**183.2029**	**117.0381**	**93.2625**	**77.661**	**70.6553**	**67.8507**	**61.4328**	**57.4307**	**55.5011**
AIRCRAFT	7.0077	7.3807	7.6449	7.9057	8.0731	8.1494	8.3828	8.5002	8.5399
TRAINS	1.1636	0.627	0.4204	0.3609	0.3123	0.2872	0.2264	0.1879	0.1884
OCEAN GOING VESSELS	2.4345	2.971	3.1871	3.4737	3.671	3.7884	4.1442	4.3712	4.4814
COMMERCIAL HARBOR CRAFT	1.7848	1.6065	1.5948	1.582	1.5839	1.5741	1.5296	1.4977	1.48
RECREATIONAL BOATS	62.3063	45.9426	39.3184	33.3046	29.7232	28.1002	23.8867	21.642	20.7619
OFF-ROAD RECREATIONAL VEHICLES	3.2369	2.5812	2.4376	2.2484	2.1212	2.0578	1.9092	1.8434	1.819
OFF-ROAD EQUIPMENT	77.7154	63.8109	60.6841	59.5812	59.6952	59.9069	60.9234	62.0539	62.7174
FARM EQUIPMENT	1.6683	1.1923	1.0092	0.8757	0.807	0.7749	0.6939	0.6518	0.6334
FUEL STORAGE AND HANDLING	14.9451	10.8208	9.6964	8.8362	8.3921	8.2054	7.7747	5.323	5.2812
OFFROAD SUBTOTAL	**172.2626**	**136.933**	**125.9929**	**118.1684**	**114.379**	**112.8443**	**109.4709**	**106.0711**	**105.9026**
ERC Balance	-	-	0.71	0.71	0.71	0.71	0.71	0.71	0.71
SAFE Rule Adjustment	-	-	-	0.0427	0.0973	0.1242	0.2011	0.2641	0.2968
TOTAL	**640.3503**	**525.4525**	**497.9788**	**480.8676**	**473.8459**	**471.0668**	**466.3648**	**462.6138**	**462.6247**

SOURCE CATEGORY	NOx								
	2011	2017	2020	2023	2025	2026	2029	2031	2032
ELECTRIC UTILITIES	2.4178	2.9965	5.7775	4.6238	4.6697	4.6912	4.6536	4.6321	4.6271
COGENERATION	0.7548	0.3049	0.5612	0.4909	0.4936	0.4944	0.497	0.4982	0.4987
OIL AND GAS PRODUCTION (COMBUSTION)	1.4544	1.171	1.3937	1.2284	1.2286	1.2287	1.2311	1.2324	1.2329
PETROLEUM REFINING (COMBUSTION)	8.2321	9.3105	7.8057	4.7535	4.7535	4.7535	4.7535	4.7535	4.7535
MANUFACTURING AND INDUSTRIAL	15.4215	12.3793	12.1456	11.8524	11.8812	11.8925	11.9598	12.0491	12.1045
FOOD AND AGRICULTURAL PROCESSING	0.7433	0.5216	0.468	0.4517	0.4411	0.4353	0.4204	0.4137	0.4119
SERVICE AND COMMERCIAL	14.0763	11.0151	11.2529	11.0437	11.0534	11.0675	11.1635	11.2733	11.3271
OTHER (FUEL COMBUSTION)	5.0945	6.3895	5.3192	4.9508	4.9893	5.0081	5.063	5.1003	5.1186
SEWAGE TREATMENT	0.0782	0.1073	0.109	0.1102	0.1115	0.1121	0.114	0.115	0.1155
LANDFILLS	0.6757	0.6246	0.6625	0.6923	0.7063	0.713	0.7343	0.7483	0.7552
INCINERATORS	1.5488	1.3433	1.4979	1.4863	1.5074	1.5179	1.5499	1.5717	1.5817
SOIL REMEDIATION	0	0	0	0	0	0	0	0	0
OTHER (WASTE DISPOSAL)	0.0009	0.0377	0.039	0.0405	0.0413	0.0417	0.0429	0.0437	0.0441
LAUNDERING	0	0	0	0	0	0	0	0	0
DEGREASING	0	0	0	0	0	0	0	0	0
COATINGS AND RELATED PROCESS SOLVENTS	0.0074	0.0059	0.0061	0.0061	0.0061	0.0062	0.0063	0.0065	0.0065
PRINTING	0	0	0	0	0	0	0	0	0
ADHESIVES AND SEALANTS	0	0	0	0	0	0	0	0	0
OTHER (CLEANING AND SURFACE COATINGS)	0.1329	0.0609	0.0905	0.0766	0.0769	0.077	0.0775	0.0777	0.0779
OIL AND GAS PRODUCTION	0.0031	0.0144	0.0158	0.0154	0.0156	0.0157	0.0159	0.0161	0.0161
PETROLEUM REFINING	1.4198	1.013	1.0091	0.7283	0.7284	0.7285	0.7286	0.7287	0.7287
PETROLEUM MARKETING	0.015	0.0589	0.0309	0.03	0.0295	0.0293	0.029	0.0288	0.0288
OTHER (PETROLEUM PRODUCTION AND MARKETING)	0.0058	0.0192	0.0198	0.0201	0.0203	0.0204	0.0206	0.0208	0.0209

SOURCE CATEGORY	NOx								
	2011	2017	2020	2023	2025	2026	2029	2031	2032
CHEMICAL	0.0061	0.1064	0.1067	0.1072	0.1073	0.1074	0.1074	0.1074	0.1074
FOOD AND AGRICULTURE	0	0.0084	0.0085	0.0087	0.0089	0.0089	0.0091	0.0092	0.0092
MINERAL PROCESSES	0.5122	0.5973	0.6509	0.5706	0.5735	0.5748	0.5808	0.587	0.5904
METAL PROCESSES	0.0305	0.227	0.143	0.1018	0.102	0.1021	0.1024	0.1027	0.1028
WOOD AND PAPER	0	0	0	0	0	0	0	0	0
GLASS AND RELATED PRODUCTS	0	0	0	0	0	0	0	0	0
ELECTRONICS	0	0.0009	0.0011	0.0013	0.0014	0.0014	0.0015	0.0016	0.0017
OTHER (INDUSTRIAL PROCESSES)	0.055	0.1896	0.2003	0.2047	0.2082	0.2099	0.215	0.2186	0.2205
STATIONARY SUBTOTAL	**52.6861**	**48.5032**	**49.3149**	**43.5953**	**43.755**	**43.8375**	**44.0771**	**44.3364**	**44.4817**
CONSUMER PRODUCTS	0	0	0	0	0	0	0	0	0
ARCHITECTURAL COATINGS AND RELATED PROCESS SOLVENTS	0	0	0	0	0	0	0	0	0
PESTICIDES / FERTILIZERS	0	0	0	0	0	0	0	0	0
ASPHALT PAVING / ROOFING	0	0	0	0	0	0	0	0	0
RESIDENTIAL FUEL COMBUSTION	14.3598	12.1793	11.5604	10.9583	10.5802	10.3987	9.9873	9.8249	9.7415
FARMING OPERATIONS	0	0	0	0	0	0	0	0	0
CONSTRUCTION AND DEMOLITION	0	0	0	0	0	0	0	0	0
PAVED ROAD DUST	0	0	0	0	0	0	0	0	0
UNPAVED ROAD DUST	0	0	0	0	0	0	0	0	0
FUGITIVE WINDBLOWN DUST	0	0	0	0	0	0	0	0	0
FIRES	0.0935	0.0942	0.0946	0.0951	0.0953	0.0954	0.0958	0.0959	0.096
MANAGED BURNING AND DISPOSAL	0.3098	0.2637	0.2635	0.2634	0.2633	0.2633	0.2632	0.2631	0.2632
COOKING	0	0	0	0	0	0	0	0	0
OTHER (MISCELLANEOUS PROCESSES)	0	0.002	0.0012	0.0012	0.0012	0.0012	0.0012	0.0012	0.0012
AREAWIDE SUBTOTAL	**14.7631**	**12.5392**	**11.9197**	**11.318**	**10.94**	**10.7586**	**10.3475**	**10.1851**	**10.1019**

SOURCE CATEGORY	NOx								
	2011	2017	2020	2023	2025	2026	2029	2031	2032
LIGHT DUTY PASSENGER (LDA)	62.7375	30.4178	20.4198	15.2978	12.9309	12.0746	10.4942	9.8589	9.6058
LIGHT DUTY TRUCKS - 1 (LDT1)	15.1114	7.795	5.3556	3.9021	3.1576	2.8642	2.2105	1.8469	1.6965
LIGHT DUTY TRUCKS - 2 (LDT2)	36.5341	20.2849	13.3086	9.4098	7.6305	6.9747	5.6127	4.9805	4.7128
MEDIUM DUTY TRUCKS (MDV)	28.8604	17.6693	12.2691	8.1477	6.249	5.558	4.1469	3.562	3.3405
LIGHT HEAVY DUTY GAS TRUCKS - 1 (LHDGT1)	4.5635	3.3556	2.4752	1.835	1.5385	1.4139	1.1354	0.9944	0.9461
LIGHT HEAVY DUTY GAS TRUCKS - 2 (LHDGT2)	0.6343	0.4983	0.3917	0.3014	0.2589	0.2403	0.1973	0.1772	0.1693
MEDIUM HEAVY DUTY GAS TRUCKS (MHDGT)	2.057	1.3807	0.916	0.6369	0.5205	0.48	0.3985	0.3728	0.3655
HEAVY HEAVY DUTY GAS TRUCKS (HHDGT)	0.7388	0.0749	0.0446	0.0356	0.0346	0.0332	0.0357	0.0376	0.0391
LIGHT HEAVY DUTY DIESEL TRUCKS - 1 (LHDDT1)	19.4307	13.1738	9.4848	6.6186	5.2113	4.6025	3.1773	2.4721	2.1996
LIGHT HEAVY DUTY DIESEL TRUCKS - 2 (LHDDT2)	5.9151	4.0753	2.9674	2.1085	1.6899	1.5109	1.1029	0.9065	0.8287
MEDIUM HEAVY DUTY DIESEL TRUCKS (MHDDT)	49.6679	33.5663	26.5529	13.4831	14.5355	14.9803	16.1253	16.9012	17.2434
HEAVY HEAVY DUTY DIESEL TRUCKS (HHDDT)	152.9084	87.9638	73.9839	51.2574	54.2075	55.1987	57.5925	59.4731	60.2699
MOTORCYCLES (MCY)	2.4493	2.7186	2.8047	2.8814	2.8723	2.8722	2.892	2.8966	2.8943
HEAVY DUTY DIESEL URBAN BUSES (UBD)	8.9857	2.4143	1.2021	0.3775	0.384	0.3879	0.3997	0.4072	0.4107
HEAVY DUTY GAS URBAN BUSES (UBG)	0.0279	0.0315	0.0294	0.0256	0.0234	0.0244	0.0285	0.0287	0.0297
SCHOOL BUSES – GAS (SBG)	0.169	0.0694	0.0775	0.0758	0.0704	0.0683	0.0656	0.0616	0.0598
SCHOOL BUSES - DIESEL (SBD)	3.2174	3.0612	2.9889	2.7022	2.4877	2.3698	1.972	1.693	1.5604
OTHER BUSES – GAS (OBG)	0.5346	0.3322	0.2396	0.1791	0.1521	0.1405	0.1158	0.1047	0.1006
OTHER BUSES - MOTOR COACH - DIESEL (OBC)	1.7526	1.0944	0.8384	0.4019	0.4268	0.4333	0.4531	0.4656	0.4691

SOURCE CATEGORY	NOx								
	2011	**2017**	**2020**	**2023**	**2025**	**2026**	**2029**	**2031**	**2032**
ALL OTHER BUSES - DIESEL (OBD)	1.7178	1.2282	0.8801	0.4312	0.4594	0.4683	0.5017	0.526	0.5353
MOTOR HOMES (MH)	1.6639	1.0695	0.8777	0.7476	0.688	0.6608	0.5901	0.5557	0.5407
ONROAD SUBTOTAL	**399.6773**	**232.275**	**178.108**	**120.8562**	**115.5288**	**113.3568**	**109.2477**	**108.3223**	**108.0178**
AIRCRAFT	18.3669	22.3071	24.2879	25.6635	26.6271	27.1492	28.6535	29.3697	29.5846
TRAINS	24.0109	20.2011	16.626	14.7678	13.2149	12.4194	10.2759	8.5364	8.5484
OCEAN GOING VESSELS	44.6532	50.0032	52.1268	55.3809	56.9309	58.3578	61.9787	63.3823	62.778
COMMERCIAL HARBOR CRAFT	25.0568	17.241	16.1157	15.1324	14.7472	14.5687	14.0255	13.6532	13.4364
RECREATIONAL BOATS	11.528	9.7037	9.1002	8.5885	8.296	8.1574	7.794	7.5908	7.5034
OFF-ROAD RECREATIONAL VEHICLES	0.0561	0.0469	0.0501	0.0526	0.0546	0.0553	0.0574	0.0591	0.0599
OFF-ROAD EQUIPMENT	93.1519	79.1006	67.9472	57.9494	53.2164	51.4589	47.5354	46.1919	45.8163
FARM EQUIPMENT	6.3945	5.1207	4.5112	3.8208	3.432	3.2567	2.7936	2.5318	2.4144
FUEL STORAGE AND HANDLING	0	0	0	0	0	0	0	0	0
OFFROAD SUBTOTAL	**223.2183**	**203.7243**	**190.7651**	**181.3559**	**176.5191**	**175.4234**	**173.114**	**171.3152**	**170.1414**
ERC Balance	-	-	0.56	0.56	0.56	0.56	0.56	0.56	0.56
SAFE Rule Adjustment	-	-	-	0.0287	0.0613	0.0723	0.1039	0.1276	0.1386
TOTAL	**690.3448**	**497.0417**	**430.6677**	**357.7141**	**347.3642**	**344.0086**	**337.4502**	**334.8466**	**333.4414**

Source: 2019 CARB CEPAM emissions inventory, San Diego and South Coast Air District, Version 1.00.

Table A-3
Emission Inventory of Ozone Precursors in San Diego Air Basin, for RFP and Contingency Measure Analysis (tons per day)

SOURCE CATEGORY	VOC								
	2011	2017	2020	2023	2026	2027	2029	2032	2033
ELECTRIC UTILITIES	0.0407	0.0836	0.0708	0.0666	0.0735	0.0723	0.0683	0.0648	0.0641
COGENERATION	0.0431	0.045	0.0533	0.0543	0.0548	0.0551	0.0554	0.0558	0.0558
MANUFACTURING AND INDUSTRIAL	0.0761	0.0689	0.0691	0.0695	0.07	0.0707	0.0716	0.0729	0.0733
FOOD AND AGRICULTURAL PROCESSING	0.0261	0.0133	0.0114	0.0095	0.008	0.0076	0.0068	0.0059	0.0058
SERVICE AND COMMERCIAL	0.2192	0.2097	0.2161	0.218	0.2217	0.2232	0.2263	0.2308	0.2322
OTHER (FUEL COMBUSTION)	0.1001	0.0457	0.0372	0.0373	0.0375	0.0375	0.0376	0.0378	0.0379
SEWAGE TREATMENT	0.0277	0.0238	0.0242	0.0246	0.0251	0.0254	0.0257	0.026	0.0261
LANDFILLS	1.1603	1.3866	1.4206	1.4496	1.4781	1.4875	1.5057	1.5313	1.5395
INCINERATORS	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
OTHER (WASTE DISPOSAL)	0.2428	0.2569	0.263	0.2687	0.274	0.2757	0.279	0.2837	0.2852
LAUNDERING	0.096	0.1018	0.1042	0.1066	0.1087	0.1094	0.1107	0.1126	0.1132
DEGREASING	1.3973	1.5132	1.5345	1.5061	1.487	1.4764	1.4561	1.4353	1.4313
COATINGS AND RELATED PROCESS SOLVENTS	6.1945	6.1892	6.5918	6.7661	7.043	7.1377	7.3322	7.6383	7.7472
PRINTING	4.3413	4.4907	4.8462	5.0951	5.3875	5.4937	5.7064	6.0252	6.1345
ADHESIVES AND SEALANTS	2.0315	2.613	2.768	2.7923	2.822	2.8251	2.8504	2.9074	2.9365
OTHER (CLEANING AND SURFACE COATINGS)	0.1133	0.1307	0.1381	0.1399	0.1444	0.1461	0.1497	0.1561	0.1586
PETROLEUM MARKETING	8.618	8.3409	6.6041	5.4504	4.6557	4.4773	4.1924	3.9184	3.8511
OTHER (PETROLEUM PRODUCTION AND MARKETING)	0.0003	0	0	0	0	0	0	0	0
CHEMICAL	1.6483	0.9102	0.9589	1.0186	1.103	1.1339	1.1936	1.2854	1.3163
FOOD AND AGRICULTURE	0.0989	0.053	0.0549	0.0557	0.0575	0.0581	0.0594	0.061	0.0615
MINERAL PROCESSES	0.2557	0.2255	0.2451	0.2508	0.2552	0.2568	0.2621	0.2734	0.2776
METAL PROCESSES	0.0078	0.0081	0.0086	0.0088	0.0092	0.0094	0.0096	0.0101	0.0103

SOURCE CATEGORY	VOC								
	2011	2017	2020	2023	2026	2027	2029	2032	2033
OTHER (INDUSTRIAL PROCESSES)	0.6692	0.8707	0.9276	0.9569	0.9957	1.0066	1.028	1.071	1.089
STATIONARY SUBTOTAL	**27.4083**	**27.5806**	**26.9478**	**26.3455**	**26.3117**	**26.3856**	**26.6271**	**27.2033**	**27.4471**
CONSUMER PRODUCTS	18.4737	17.6586	18.0396	18.4066	18.7471	18.8558	19.0661	19.3637	19.4591
ARCHITECTURAL COATINGS AND RELATED PROCESS SOLVENTS	11.5998	9.0222	9.2355	9.4406	9.6303	9.691	9.8094	9.9749	10.0297
PESTICIDES/FERTILIZERS	0.5961	0.6378	0.6217	0.6069	0.5932	0.5889	0.5804	0.5685	0.5647
ASPHALT PAVING / ROOFING	1.6485	2.1715	2.3069	2.2182	2.1102	2.0791	2.058	2.0733	2.082
RESIDENTIAL FUEL COMBUSTION	0.6822	0.544	0.5449	0.5458	0.5449	0.5448	0.5444	0.5432	0.5427
FARMING OPERATIONS	1.4708	1.2683	1.1941	1.1314	1.0783	1.0623	1.0326	0.9934	0.9816
CONSTRUCTION AND DEMOLITION	0	0	0	0	0	0	0	0	0
PAVED ROAD DUST	0	0	0	0	0	0	0	0	0
UNPAVED ROAD DUST	0	0	0	0	0	0	0	0	0
FUGITIVE WINDBLOWN DUST	0	0	0	0	0	0	0	0	0
FIRES	0.0643	0.0675	0.069	0.0706	0.072	0.0724	0.0733	0.0746	0.0749
MANAGED BURNING AND DISPOSAL	0.1897	0.0887	0.0886	0.0884	0.0883	0.0883	0.0882	0.088	0.088
COOKING	2.065	2.1912	2.2429	2.2927	2.3389	2.3537	2.3822	2.4225	2.4357
OTHER (MISCELLANEOUS PROCESSES)	0	0	0	0	0	0	0	0	0
AREAWIDE SUBTOTAL	**36.7901**	**33.6498**	**34.3432**	**34.8012**	**35.2032**	**35.3363**	**35.6346**	**36.1021**	**36.2584**
LIGHT DUTY PASSENGER (LDA)	13.3484	6.7136	5.2268	4.4175	3.8924	3.7522	3.5011	3.1495	3.0458
LIGHT DUTY TRUCKS - 1 (LDT1)	3.7899	2.0505	1.6068	1.3136	1.0866	1.0206	0.8969	0.7052	0.6542
LIGHT DUTY TRUCKS - 2 (LDT2)	5.337	3.5502	2.8946	2.4802	2.1691	2.0776	1.9021	1.6402	1.5563
MEDIUM DUTY TRUCKS (MDV)	3.7372	2.7238	2.2504	1.8447	1.5648	1.4882	1.3568	1.1798	1.1266
LIGHT HEAVY DUTY GAS TRUCKS - 1 (LHDGT1)	1.2249	0.9646	0.7586	0.626	0.5342	0.515	0.4893	0.4109	0.3723
LIGHT HEAVY DUTY GAS TRUCKS - 2 (LHDGT2)	0.1285	0.1066	0.0912	0.0754	0.0626	0.059	0.0527	0.0439	0.042

SOURCE CATEGORY	VOC								
	2011	2017	2020	2023	2026	2027	2029	2032	2033
MEDIUM HEAVY DUTY GAS TRUCKS (MHDGT)	0.2901	0.1291	0.0867	0.0657	0.0551	0.0529	0.0499	0.0477	0.0473
HEAVY HEAVY DUTY GAS TRUCKS (HHDGT)	0.0459	0.004	0.0021	0.0014	0.0009	0.0008	0.0008	0.0008	0.0008
LIGHT HEAVY DUTY DIESEL TRUCKS - 1 (LHDDT1)	0.2441	0.2193	0.2062	0.1931	0.1819	0.1788	0.1739	0.1691	0.1681
LIGHT HEAVY DUTY DIESEL TRUCKS - 2 (LHDDT2)	0.0638	0.0648	0.0648	0.0644	0.0639	0.0639	0.064	0.0644	0.0645
MEDIUM HEAVY DUTY DIESEL TRUCKS (MHDDT)	0.9378	0.4612	0.2809	0.0151	0.0157	0.0157	0.0159	0.0162	0.0165
HEAVY HEAVY DUTY DIESEL TRUCKS (HHDDT)	1.9421	0.6258	0.3875	0.127	0.1326	0.1336	0.1353	0.1375	0.1384
MOTORCYCLES (MCY)	2.9212	2.739	2.5928	2.5108	2.4394	2.411	2.3791	2.3374	2.3344
HEAVY DUTY DIESEL URBAN BUSES (UBD)	0.0805	0.0382	0.01	0.0112	0.0123	0.0127	0.0134	0.0144	0.0148
HEAVY DUTY GAS URBAN BUSES (UBG)	0.0006	0.001	0.0011	0.001	0.0012	0.0013	0.0014	0.0014	0.0014
SCHOOL BUSES - GAS (SBG)	0.0539	0.0051	0.006	0.0064	0.0056	0.0058	0.0064	0.0074	0.0075
SCHOOL BUSES - DIESEL (SBD)	0.0537	0.0093	0.0095	0.0092	0.0084	0.008	0.0067	0.0047	0.004
OTHER BUSES - GAS (OBG)	0.0377	0.0275	0.023	0.0206	0.0184	0.0173	0.0165	0.0157	0.0156
OTHER BUSES - MOTOR COACH - DIESEL (OBC)	0.0222	0.0098	0.0066	0.0011	0.0013	0.0014	0.0014	0.0015	0.0015
ALL OTHER BUSES - DIESEL (OBD)	0.0417	0.0248	0.0102	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003
MOTOR HOMES (MH)	0.1053	0.0325	0.0219	0.0152	0.0113	0.0102	0.0081	0.0062	0.0057
ONROAD SUBTOTAL	**34.4065**	**20.5007**	**16.5377**	**13.7999**	**12.258**	**11.8263**	**11.072**	**9.9542**	**9.618**
AIRCRAFT	3.665	3.7623	3.7862	3.8084	3.8306	3.8382	3.8531	3.873	3.8798
TRAINS	0.0615	0.0316	0.0212	0.0182	0.0144	0.0134	0.0114	0.0095	0.0095
OCEAN GOING VESSELS	0.1673	0.186	0.1928	0.1996	0.2066	0.2088	0.2135	0.2217	0.2243
COMMERCIAL HARBOR CRAFT	0.2621	0.2006	0.2006	0.2015	0.2012	0.1995	0.1955	0.1886	0.1863
RECREATIONAL BOATS	16.5968	12.239	10.476	8.8749	7.4892	7.0867	6.3668	5.5347	5.3355

SOURCE CATEGORY	VOC								
	2011	**2017**	**2020**	**2023**	**2026**	**2027**	**2029**	**2032**	**2033**
OFF-ROAD RECREATIONAL VEHICLES	0.5781	0.4655	0.437	0.3994	0.3605	0.3485	0.3302	0.3111	0.3065
OFF-ROAD EQUIPMENT	13.6352	12.0311	11.3751	11.3835	11.4393	11.4813	11.608	11.9062	12.0206
FARM EQUIPMENT	0.6281	0.46	0.3942	0.3441	0.3037	0.2917	0.2707	0.2445	0.2367
FUEL STORAGE AND HANDLING	2.3906	1.7612	1.5904	1.4597	1.3644	1.3397	1.3009	0.8887	0.8851
OFFROAD SUBTOTAL	**37.9847**	**31.1373**	**28.4735**	**26.6893**	**25.2099**	**24.8078**	**24.1501**	**23.178**	**23.0843**
ERC Balance	-	-	0.71	0.71	0.71	0.71	0.71	0.71	0.71
SAFE Rule Adjustment	-	-	-	0.0074	0.0216	0.0259	0.0348	0.0509	0.0559
TOTAL	**136.5896**	**112.8684**	**107.0122**	**102.3533**	**99.7144**	**99.0919**	**98.2286**	**97.1985**	**97.1737**

SOURCE CATEGORY	NOx								
	2011	2017	2020	2023	2026	2027	2029	2032	2033
ELECTRIC UTILITIES	0.5585	0.6361	0.5398	0.5082	0.5633	0.5551	0.525	0.4977	0.4929
COGENERATION	0.2186	0.229	0.2713	0.276	0.2794	0.2805	0.282	0.2837	0.284
MANUFACTURING AND INDUSTRIAL	0.9588	0.7325	0.7454	0.7534	0.7687	0.7764	0.7882	0.8095	0.8163
FOOD AND AGRICULTURAL PROCESSING	0.3346	0.157	0.1356	0.1166	0.0996	0.0943	0.084	0.074	0.0716
SERVICE AND COMMERCIAL	0.9449	1.031	1.0535	1.0653	1.0786	1.0832	1.0948	1.1157	1.1218
OTHER (FUEL COMBUSTION)	0.9734	0.6863	0.5834	0.5854	0.5874	0.5882	0.5896	0.5922	0.5932
SEWAGE TREATMENT	0.0669	0.106	0.1077	0.1088	0.1107	0.1113	0.1126	0.114	0.1142
LANDFILLS	0.081	0.2034	0.208	0.2122	0.2163	0.2177	0.2203	0.2239	0.225
INCINERATORS	0.0031	0.0045	0.0045	0.0047	0.0048	0.0048	0.0049	0.005	0.005
OTHER (WASTE DISPOSAL)	0	0	0	0	0	0	0	0	0
LAUNDERING	0	0	0	0	0	0	0	0	0
DEGREASING	0	0	0	0	0	0	0	0	0
COATINGS AND RELATED PROCESS SOLVENTS	0	0	0	0	0	0	0	0	0
PRINTING	0	0	0	0	0	0	0	0	0
ADHESIVES AND SEALANTS	0	0	0	0	0	0	0	0	0
OTHER (CLEANING AND SURFACE COATINGS)	0	0	0	0	0	0	0	0	0
PETROLEUM MARKETING	0.0077	0.0109	0.0102	0.0095	0.0088	0.0086	0.0083	0.0081	0.008
OTHER (PETROLEUM PRODUCTION AND MARKETING)	0	0	0	0	0	0	0	0	0
CHEMICAL	0	0	0	0	0	0	0	0	0
FOOD AND AGRICULTURE	0	0	0	0	0	0	0	0	0
MINERAL PROCESSES	0.1993	0.1839	0.1999	0.2044	0.2081	0.2094	0.2137	0.2229	0.2264
METAL PROCESSES	0.0045	0.005	0.0054	0.0057	0.006	0.0061	0.0063	0.0067	0.0068
OTHER (INDUSTRIAL PROCESSES)	0.0326	0.0802	0.0855	0.0882	0.0917	0.0927	0.0947	0.0986	0.1004
STATIONARY SUBTOTAL	**4.3839**	**4.0658**	**3.9502**	**3.9384**	**4.0234**	**4.0283**	**4.0244**	**4.052**	**4.0656**
CONSUMER PRODUCTS	0	0	0	0	0	0	0	0	0

SOURCE CATEGORY	NOx								
	2011	2017	2020	2023	2026	2027	2029	2032	2033
ARCHITECTURAL COATINGS AND RELATED PROCESS SOLVENTS	0	0	0	0	0	0	0	0	0
PESTICIDES/FERTILIZERS	0	0	0	0	0	0	0	0	0
ASPHALT PAVING / ROOFING	0	0	0	0	0	0	0	0	0
RESIDENTIAL FUEL COMBUSTION	1.8486	1.667	1.4993	1.3238	1.1228	1.0584	0.9919	0.978	0.9731
FARMING OPERATIONS	0	0	0	0	0	0	0	0	0
CONSTRUCTION AND DEMOLITION	0	0	0	0	0	0	0	0	0
PAVED ROAD DUST	0	0	0	0	0	0	0	0	0
UNPAVED ROAD DUST	0	0	0	0	0	0	0	0	0
FUGITIVE WINDBLOWN DUST	0	0	0	0	0	0	0	0	0
FIRES	0.0165	0.0172	0.0176	0.0181	0.0184	0.0186	0.0188	0.019	0.0192
MANAGED BURNING AND DISPOSAL	0.0635	0.0247	0.0246	0.0245	0.0244	0.0244	0.0244	0.0243	0.0243
COOKING	0	0	0	0	0	0	0	0	0
OTHER (MISCELLANEOUS PROCESSES)	0	0	0	0	0	0	0	0	0
AREAWIDE SUBTOTAL	**1.9286**	**1.7089**	**1.5415**	**1.3664**	**1.1656**	**1.1014**	**1.0351**	**1.0213**	**1.0166**
LIGHT DUTY PASSENGER (LDA)	11.2071	4.8227	3.3809	2.6066	2.1563	2.0575	1.9165	1.7913	1.7664
LIGHT DUTY TRUCKS - 1 (LDT1)	3.0591	1.4088	0.9709	0.6966	0.5154	0.4696	0.3944	0.3006	0.2789
LIGHT DUTY TRUCKS - 2 (LDT2)	7.0627	3.5052	2.2967	1.5847	1.1769	1.082	0.9329	0.7723	0.7315
MEDIUM DUTY TRUCKS (MDV)	5.0859	2.6874	1.8422	1.2113	0.839	0.7542	0.6268	0.5063	0.4788
LIGHT HEAVY DUTY GAS TRUCKS - 1 (LHDGT1)	1.1875	0.804	0.6169	0.4772	0.3738	0.3472	0.3015	0.2493	0.2373
LIGHT HEAVY DUTY GAS TRUCKS - 2 (LHDGT2)	0.138	0.1028	0.086	0.0704	0.058	0.0544	0.0486	0.042	0.0403
MEDIUM HEAVY DUTY GAS TRUCKS (MHDGT)	0.3864	0.2261	0.1467	0.097	0.0712	0.066	0.0587	0.0533	0.0523
HEAVY HEAVY DUTY GAS TRUCKS (HHDGT)	0.119	0.0117	0.008	0.0066	0.006	0.0058	0.0059	0.006	0.0061

SOURCE CATEGORY	NOx								
	2011	2017	2020	2023	2026	2027	2029	2032	2033
LIGHT HEAVY DUTY DIESEL TRUCKS - 1 (LHDDT1)	6.0225	3.8681	2.9438	2.1698	1.5533	1.3811	1.089	0.7578	0.6721
LIGHT HEAVY DUTY DIESEL TRUCKS - 2 (LHDDT2)	1.516	0.9976	0.7741	0.588	0.4382	0.397	0.3291	0.2515	0.2316
MEDIUM HEAVY DUTY DIESEL TRUCKS (MHDDT)	9.1408	5.4491	4.1993	2.2631	2.4642	2.522	2.6205	2.7562	2.7988
HEAVY HEAVY DUTY DIESEL TRUCKS (HHDDT)	22.4308	11.2627	9.1242	6.0796	6.2162	6.2343	6.2201	6.2985	6.3315
MOTORCYCLES (MCY)	0.7386	0.7455	0.6958	0.6639	0.6443	0.639	0.6322	0.6245	0.6231
HEAVY DUTY DIESEL URBAN BUSES (UBD)	1.0126	0.2668	0.0931	0.0592	0.0652	0.0671	0.0711	0.0766	0.0784
HEAVY DUTY GAS URBAN BUSES (UBG)	0.0045	0.0065	0.0059	0.0056	0.0068	0.0071	0.0078	0.0063	0.0068
SCHOOL BUSES - GAS (SBG)	0.0517	0.0139	0.014	0.0132	0.0079	0.0072	0.0072	0.0065	0.0058
SCHOOL BUSES - DIESEL (SBD)	0.8027	0.7938	0.7731	0.7195	0.6304	0.5892	0.4924	0.334	0.2881
OTHER BUSES - GAS (OBG)	0.1199	0.0739	0.0525	0.0383	0.0288	0.026	0.0224	0.0187	0.0175
OTHER BUSES - MOTOR COACH - DIESEL (OBC)	0.2945	0.1646	0.126	0.0597	0.0637	0.0645	0.0662	0.0681	0.0681
ALL OTHER BUSES - DIESEL (OBD)	0.3539	0.2197	0.1352	0.0647	0.0678	0.0681	0.0697	0.0709	0.0706
MOTOR HOMES (MH)	0.4601	0.2742	0.2207	0.1824	0.1551	0.1473	0.1331	0.1165	0.1117
ONROAD SUBTOTAL	**71.1943**	**37.7051**	**28.506**	**19.6574**	**17.5385**	**16.9866**	**16.0461**	**15.1072**	**14.8957**
AIRCRAFT	4.0929	6.9081	7.8545	8.0473	8.2376	8.301	8.4299	8.6065	8.663
TRAINS	1.7054	1.5484	1.1882	1.0906	0.9681	0.9302	0.8559	0.39	0.372
OCEAN GOING VESSELS	2.3656	2.7454	2.8707	2.9767	3.0808	3.0981	3.1704	3.2535	3.2936
COMMERCIAL HARBOR CRAFT	3.7095	1.952	1.8626	1.7724	1.719	1.7008	1.6605	1.589	1.5644
RECREATIONAL BOATS	3.0793	2.5915	2.4304	2.2941	2.1788	2.1453	2.0819	2.004	1.9822
OFF-ROAD RECREATIONAL VEHICLES	0.0115	0.0096	0.0103	0.0109	0.0116	0.0117	0.012	0.0126	0.0129
OFF-ROAD EQUIPMENT	15.5842	15.6073	14.4842	13.4436	12.7053	12.52	12.2823	12.0572	12.006
FARM EQUIPMENT	2.6409	2.1265	1.878	1.5968	1.3628	1.2939	1.1679	1.0051	0.9572

SOURCE CATEGORY	NOx								
	2011	**2017**	**2020**	**2023**	**2026**	**2027**	**2029**	**2032**	**2033**
FUEL STORAGE AND HANDLING	0	0	0	0	0	0	0	0	0
OFFROAD SUBTOTAL	**33.1893**	**33.4888**	**32.5789**	**31.2324**	**30.264**	**30.001**	**29.6608**	**28.9179**	**28.8513**
ERC Balance	-	-	0.56	0.56	0.56	0.56	0.56	0.56	0.56
SAFE Rule Adjustment	-	-	-	0.0049	0.0124	0.0141	0.0179	0.0239	0.0258
TOTAL	**110.6961**	**76.9686**	**67.1366**	**56.7595**	**53.5639**	**52.6914**	**51.3443**	**49.6823**	**49.4150**

Source: 2019 CARB CEPAM emissions inventory, San Diego Air Basin, Version 1.00.

CARB EMISSION INVENTORY DOCUMENTATION FOR THE SAN DIEGO COUNTY EIGHT-HOUR OZONE STATE IMPLEMENTATION PLAN

A.1 Introduction

Emissions inventories are one of the fundamental building blocks in the development of a State Implementation Plan (SIP). In simple terms, an emissions inventory is a systematic listing of the sources of air pollution along with the amount of pollution emitted from each source or category over a given time period. This document describes the emissions inventory included in the eight-hour Ozone SIP for the San Diego County Nonattainment Area, which covers the entirety of San Diego County. It also summarizes the revisions and improvements made to the inventory as part of this SIP.

The California Air Resources Board (CARB) and San Diego County Air Pollution Control District (District) have developed a comprehensive, accurate, and current emissions inventory consistent with the requirements set forth in Section 182(a)(1) and Section 182(a)(3)(A) of the federal Clean Air Act. CARB and District staff conducted a thorough review of the inventory to ensure that the emission estimates reflect accurate emission reports for point sources, and that estimates for mobile and areawide sources are based on the most recent models and methodologies.

CARB also reviewed the growth profiles for point and areawide source categories and updated them as necessary to ensure that the emission projections are based on data that reflect historical trends, current conditions, and recent economic and demographic forecasts. Growth forecasts for most point and areawide sources were developed by CARB.

A.2 Emissions Inventory Overview

Emissions inventories are estimates of the amount and type of pollutants emitted into the atmosphere by industrial facilities, mobile sources, and areawide sources, such as consumer products and paint. They are fundamental components of an air quality plan, and serve critical functions, such as:

1) the primary input to air quality modeling used in attainment demonstrations;
2) the emissions data used for developing control strategies; and
3) a means to track progress in meeting the emission reduction commitments.

The United States Environmental Protection Agency (U.S. EPA) regulations require that the emissions inventory contain emissions data for the two precursors to ozone formation: oxides of nitrogen (NOx) and volatile organic compounds (VOC). The inventory included in this plan substitutes VOC with reactive organic gases (ROG), which in general represent a slightly broader group of compounds than those in U.S. EPA's list of VOCs.

A.3 Agency Responsibilities

CARB and District staff worked jointly to develop the emissions inventory for the San Diego Ozone Nonattainment Area. The District worked closely with operators of major stationary facilities in their jurisdiction to develop the point source emission estimates. CARB staff developed the emission inventory for mobile sources, both on-road and off-road. The District and CARB shared responsibility for developing estimates for the nonpoint (areawide) sources, such as consumer products and agricultural burning. CARB worked with several State and local agencies, such as the Department of Transportation (Caltrans), the Department of Motor Vehicles (DMV), the Department of Pesticide Regulation (DPR), and the California Energy Commission (CEC) to assemble activity information necessary to develop the mobile and areawide source emission estimates.

A.4 Inventory Base Year

The base year inventory forms the basis for all future year projections and establishes the emission levels against which progress in emission reductions will be measured. Since U.S. EPA regulations establish that the base year inventory should be preferably consistent with the triennial reporting schedule required under the Air Emissions Reporting Requirements (AERR) rule, CARB selected 2017 as the base year.

A.5 Forecasted Inventories

In addition to a base year inventory, U.S. EPA regulations also require future year inventory projections for specific milestone years. Forecasted inventories are a projection of the base year inventory that reflects expected growth trends for each source category and emission reductions due to adopted control measures. CARB develops emission forecasts by applying growth and control profiles to the base year inventory.

Growth profiles for point and areawide sources are derived from surrogates, such as economic activity, fuel usage, population, housing units, etc., that best reflect the expected growth trends for each specific source category. Growth projections were obtained primarily from government entities with expertise in developing forecasts for specific sectors, or, in some cases, from econometric models. Control profiles, which account for emission reductions resulting from adopted rules and regulations, are derived from data provided by the regulatory agencies responsible for the affected emission categories.

Projections for mobile source emissions are generated by models that predict activity rates and vehicle fleet turnover by vehicle model year along with activity inputs from the metropolitan planning organization (MPO). As with stationary sources, the mobile source models include control algorithms that account for all adopted regulatory actions.

A.6 Temporal Resolution

Planning inventories typically include annual as well as seasonal (summer and winter) emission estimates. Annual emission inventories represent the total emissions over an entire year (tons per year), or the daily emissions produced on an average day (tons per day).

Seasonal inventories account for temporal activity variations throughout the year, as determined by category-specific temporal profiles. Since ozone concentrations tend to be highest during the summer months, the emission inventory used in the SIP is based on the summer season (May through October).

A.7 Geographical Scope

The inventories presented in this SIP include emissions for the San Diego Ozone Nonattainment Area, which consists of the entirety of San Diego County.

A.8 Quality Assurance and Quality Control

CARB has established a quality assurance and quality control (QA/QC) process involving CARB and District staff to ensure the integrity and accuracy of the emissions inventories used in the development of air quality plans. QA/QC occurs at the various stages of SIP emission inventory development. Base year emissions are assembled and maintained in the California Emission Inventory Development and Reporting System (CEIDARS). CARB inventory staff works with District staff, who are responsible for developing and reporting point source emission estimates, to verify these data are accurate. The locations of point sources, including stacks, are checked to ensure they are valid. Areawide source emission estimates are reviewed by CARB and District staff before their inclusion in the emission inventory. Additionally, CEIDARS is designed with automatic system checks to prevent errors, such as double counting of emission sources. The system also makes various reports available to assist staff in their efforts to identify and reconcile anomalous emissions.

Future year emissions are estimated using the California Emission Projection Analysis Model (CEPAM), 2019 SIP Baseline Emission Projections, Version 1.00. Growth and control factors are reviewed for each category and year along with the resulting emission projections. Year-to-year trends are compared to similar and past datasets to ensure general consistency. Emissions for specific categories are checked to confirm they reflect the anticipated effects of applicable control measures. Mobile categories are verified with mobile source staff for consistency with the on-road and off-road emission models.

A summary of the information supporting the San Diego ozone SIP emissions inventory is presented in the sections below.

A.9 Point Sources

The inventory reflects actual emissions from industrial point sources reported to the District by the facility operators through calendar year 2017, in accordance with the requirements set forth in U.S. EPA's AERR rule. The data elements in the 2017 baseline inventory are consistent with the data elements required by the AERR rule. Estimation methods include source testing, direct measurement by continuous emissions monitoring systems, or engineering calculations.

Table A-4 lists the point source categories that occur in San Diego County.

Table A-4
Point Source Categories

Source Category	Subcategory
Fuel Combustion	Electrical Utilities
Fuel Combustion	Cogeneration
Fuel Combustion	Manufacturing and Industrial
Fuel Combustion	Food and Agricultural Processing
Fuel Combustion	Service and Commercial
Fuel Combustion	Other (Fuel Combustion)
Waste Disposal	Sewage Treatment
Waste Disposal	Landfills
Waste Disposal	Incinerators
Waste Disposal	Other (Waste Disposal)
Cleaning and Surface Coatings	Laundering
Cleaning and Surface Coatings	Degreasing
Cleaning and Surface Coatings	Coatings and Thinners
Cleaning and Surface Coatings	Printing
Cleaning and Surface Coatings	Adhesives and Sealants
Cleaning and Surface Coatings	Other (Cleaning and Surface Coatings)
Petroleum Production and Marketing	Petroleum Marketing
Industrial Processes	Chemical
Industrial Processes	Food and Agriculture
Industrial Processes	Mineral Processes
Industrial Processes	Metal Processes
Industrial Processes	Other (Industrial Processes)

The point source inventory includes emissions from stationary aggregated sources, which are categories such as internal combustion engines and gasoline dispensing facilities that are not inventoried individually but are estimated as a group and reported as an aggregated total. Estimates for the following categories were developed by CARB:

A.9.1 Agricultural Diesel Irrigation Pumps

This category includes emissions from the operation of diesel-fueled stationary and mobile agricultural irrigation pumps. The emission estimates are based on a 2003 CARB methodology using statewide population and include replacements due to the Carl Moyer Program. Emissions are grown based on projected acreage for irrigated farmland from the California Department of Conservation's Farmland Mapping and Monitoring Program (FMMP), 2008. Additional information on this category is available on the CARB website.

A.9.2 Stationary Nonagricultural Diesel Engines

This category includes emissions from backup and prime generators and pumps, air compressors, and other miscellaneous stationary diesel engines that are widely used throughout the industrial, service, institutional, and commercial sectors. The emission estimates, including emission forecasts, are based on a 2003 CARB methodology derived from the OFFROAD model. Additional information on this methodology is available on the CARB website.

A.9.3 Laundering

This category includes emissions from perchloroethylene (perc) dry cleaning establishments. The emission estimates are based on a 2002 CARB methodology that used nationwide perc consumption rates allocated to the county level based on population and an emission factor of 10.125 pounds per gallon used. Emissions were grown from the original estimates to 2017 and future-years based on DOF population forecasts, 2017. Additional information on this methodology is available on the CARB website.

A.9.4 Degreasing

This category includes emissions from solvents in degreasing operations in the manufacturing and maintenance industries. The emissions estimates are based on a 2000 CARB methodology using survey and industry data, activity factors, emission factors and a user's fraction. Growth for this category is based on CARB/Regional Economic Models, Inc. (REMI) version 2.2.2 industry-specific economic output. Additional information on this methodology is available on the CARB website.

A.9.5 Coatings and Thinners

This category includes emissions from coatings and related process solvents. Auto refinishing emissions estimates are based on a 1990 CARB methodology using production data and a composite emission factor derived from surveys. Growth is based on projected number of vehicles from CARB's on-road mobile sources model (EMFAC2014). Estimates for industrial coatings emissions are based on a 1990 CARB methodology using production and survey data, and emission factors derived from surveys. Estimates for thinning and cleaning solvents are based on a 1991 CARB methodology, census data and a default emission factor developed by CARB. Growth for these categories is projected using REMI county economic forecasts, version 2.2.2. Additional information on these methodologies is available on the CARB website.

A.9.6 Adhesives and Sealants

This category includes emissions from solvent-based and water-based solvents contained in adhesives and sealants. Emissions are estimated based on a 1990 CARB methodology using production data and default emission factors. Growth for this category is based on REMI county economic forecasts, version 2.2.2. Additional information on this methodology is available on the CARB website.

A.9.7 Gasoline Dispensing Facilities

CARB staff developed an updated methodology to estimate emissions from fuel transfer and storage operations at gasoline dispensing facilities (GDFs) in 2015. The methodology addresses emissions from underground storage tanks, vapor displacement during vehicle refueling, customer spillage, and hose permeation. The updated methodology uses emission factors developed by CARB staff that reflect more current in-use test data and accounts for the emission reduction benefits of onboard refueling vapor recovery (ORVR) systems. The emission estimates are based on 2012 statewide gasoline sales data from the California Board of Equalization that were apportioned to the county level using fuel consumption estimates from EMFAC. Additional information on this category is available on the CARB website.

A.10 Areawide Sources

Areawide sources are categories such as consumer products, fireplaces, and agricultural burning (see Table A-5) for which emissions occur over a wide geographic area. Emissions for these categories are estimated by both CARB and District using various models and methodologies.

Table A-5
Areawide Sources

Source Category	Subcategory
Solvent Evaporation	Consumer Products
Solvent Evaporation	Architectural Coatings and Related Solvents
Solvent Evaporation	Pesticides/Fertilizers
Solvent Evaporation	Asphalt Paving and Roofing
Miscellaneous Processes	Residential Fuel Combustion
Miscellaneous Processes	Farming Operations
Miscellaneous Processes	Fires
Miscellaneous Processes	Managed Burning and Disposal
Miscellaneous Processes	Cooking

A summary of the areawide methodologies is presented below:

A.10.1 Consumer Products

The consumer products category reflects the four most recent surveys conducted by CARB staff for the years 2003, 2006, 2008, and 2010. Together these surveys collected updated product information and ingredient information for approximately 350 product categories. Based on the survey data, CARB staff determined the total product sales and total VOC emissions for the various product categories. The growth trend for most consumer product subcategories is based on DOF human population growth projections, 2017. A notable exception is aerosol coatings: staff determined that a no-growth profile would be more appropriate for this category based on survey data that show relatively flat sales of these products over the last decade. Additional information on CARB's consumer products surveys is available on the CARB website.

A.10.2 Architectural Coatings

The architectural coatings category reflects emission estimates based on a comprehensive CARB survey for the 2004 calendar year. The emission estimates include benefits of the 2000 CARB Suggested Control Measures. These emissions are grown based on DOF population forecasts, 2017. Additional information about CARB's architectural coatings program is available on the CARB website.

A.10.3 Pesticides

DPR develops month-specific emission estimates for agricultural and structural pesticides. Each calendar year, DPR updates the inventory based on the Pesticides Use Report, which provides updated information from 1990 to the most current data year available. The inventory includes estimates through the 2016 calendar year. Emission forecasts for years 2017 and beyond are based on the average of the most recent five years. Growth for agricultural pesticides is based on CARB projections of farmland acres per FMMP, 2016. Growth for structural pesticides is based on DOF population growth projections, 2017. Additional information about CARB's pesticides program is available on the CARB website.

A.10.4 Asphalt Paving/Roofing

Asphalt paving and roofing emissions were grown from 1991 estimates, except for cutback asphalt which was grown from 2000 estimates. Emissions are estimated based on tons of asphalt applied and a default emission factor for each type of asphalt operation. The growth profile for both categories is based on county economic forecasts from the REMI forecasting model, version 2.2.2.

A.10.5 Residential Wood Combustion

CARB staff updated the methodology to reflect 2005 fuel use, and more recent emission factors and calculation approaches. The emission estimates reflect emission factors from U.S. EPA's National Emission Inventory. CARB assumes no growth for this category based on the relatively stagnant residential wood fuel use over the past decade (according to the American Community Survey and US Energy Information Administration). Additional information on this methodology is available on the CARB website.

A.10.6 Farming Operations

CARB staff updated the Livestock Husbandry methodology to reflect livestock population data based on the USDA's 2007 Census of Agriculture, and ammonia emission factors for dairy support cattle. A seasonal adjustment was added to account for the suppression of dust emissions in months in which rainfall occurs. Growth profiles are based on CARB's projections of Census of Agriculture's historical livestock population trends. No growth is assumed for dairy and feedlots. Additional information on CARB's methodology is available on the CARB website.

A.10.7 Fires

Emissions from structural and automobile fires were estimated based on a 1999 CARB methodology using the number of fires and the associated emission factors. Estimates for structural fires are calculated using the amount of the structure that is burned, the amount and content of the material burned, and emission factors derived from test data. Estimates for automobile fires are calculated using the weight of the car and components and composite emission factors derived from AP-42 emission factors. Growth is based on DOF population forecasts, 2017. Additional information on this methodology is available on the CARB website.

A.10.8 Managed Burning & Disposal

CARB updated the emissions inventory to reflect burn data reported by District staff for 2017. Emissions are calculated using crop specific emission factors and fuel loadings. Temporal profiles reflect monthly burn activity. Growth for agricultural burning is based on CARB projections of FMMP farmland acres, 2016. No growth is assumed for burning associated with weed abatement. CARB's methodology for managed burning is available on the CARB website. Additional background information is available on the CARB website.

A.10.9 Commercial Cooking

The commercial cooking emissions were grown from a 1996 estimate. The emissions estimates were developed from the number of restaurants, the number and types of cooking equipment, the food type, and default emission factors. The growth profile reflects DOF population forecasts, 2017.

A.11 Point and Areawide Source Emissions Forecasting

Emission forecasts (2018 and subsequent years) are based on growth profiles that in many cases incorporate historical trends up to the base year or beyond. The growth surrogates used to forecast the emissions from these categories are presented below in Table A-6.

(CONTINUED ON NEXT PAGE)

Table A-6
Growth Surrogates for Point and Areawide Sources

Source Category	Subcategory	Growth Surrogate
Electric Utilities	Natural Gas	California Energy Commission (CEC) Integrated Energy Policy Report forecast, 2017
Electric Utilities	Other Fuels	Energy Information Administration (EIA) Annual Energy Outlook, 2018
Cogeneration	All	CEC forecast, 2017
Manufacturing and Industrial	Natural Gas	CEC forecast, 2014
Manufacturing and Industrial	Other Fuels	EIA forecast, 2018
Food and Agricultural Processing	Ag Irrigation I. C. Engines	FMMP irrigated farmland acreage, 2008
Food and Agricultural Processing	Others	REMI economic forecast, version 2.2.2; EIA forecast, 2018
Service and Commercial	Natural Gas	CEC forecast, 2014
Service and Commercial	Other Fuels	EIA forecast, 2018
Other (Fuel Combustion)	Diesel	Modeled estimate, 2003
Other (Fuel Combustion)	Other than diesel	EIA forecast, 2018
Waste Disposal	All	DOF population forecast, 2017
Laundering	Dry Cleaning	DOF population forecast, 2017
Degreasing	All	CARB/REMI economic forecast, version 2.2.2
Coatings & Thinners	Auto Refinishing	Vehicles from CARB EMFAC2014 model
Coatings & Thinners	Others	REMI economic forecast, version 2.2.2
Printing	All	REMI economic forecast, version 2.2.2
Adhesives & Sealants	All	REMI economic forecast, version 2.2.2
Petroleum Marketing	Natural Gas Transmission	CEC forecast, 2014
Petroleum Marketing	Others	Fuel use from CARB EMFAC2014 model
Petroleum Production & Marketing	All	DOF population forecast, 2017
Chemical	All	REMI economic forecast, version 2.2.2
Food & Agriculture	All	REMI economic forecast, version 2.2.2
Mineral Processes	All	REMI version 2.2.2; EIA forecast, 2018
Metal Processes	All	REMI economic forecast, version 2.2.2
Other Industrial Processes	All	REMI economic forecast, version 2.2.2

Source Category	Subcategory	Growth Surrogate
Consumer Products	Consumer Products	DOF population forecast, 2017
Consumer Products	Aerosol Coatings	No growth
Architectural Coatings & Related Process Solvents	All	DOF population forecast, 2017
Pesticides & Fertilizers	Agricultural Pesticides	CARB projection of farmland acres per FMMP, 2016
Pesticides & Fertilizers	Structural Pesticides	DOF population forecast, 2017
Asphalt Paving & Roofing	All	REMI economic forecast, version 2.2.2
Residential Fuel Combustion	Natural Gas	CEC forecast, 2014
Residential Fuel Combustion	Other Fuels	No growth
Farming Operations	Dairy / Feedlots	No growth
Farming Operations	Other Livestock	CARB projection of livestock population per Census of Agriculture, 2012
Fires	All	DOF population forecast, 2017
Managed Burning and Disposal	Agricultural Burning, Prunings & Field Crops	FMMP farmland acreage projection, 2016
Managed Burning and Disposal	Others	No growth
Cooking	All	DOF population forecast, 2017

The emissions inventory reflects emission reductions from point and areawide sources subject to District rules and CARB regulations. The rules and regulations reflected in the inventory are listed below in Table A-7.

(CONTINUED ON NEXT PAGE)

Table A-7
District and CARB Stationary Source Control Rules and Regulations Included in the Inventory

Agency	Rule/Reg No.	Rule Title	Source Categories Impacted
DISTRICT	69.2	Industrial and Commercial Boilers, Process Heaters and Steam Generators	Electric generation
DISTRICT	69.2.1	Small Boilers, Process Heaters and Steam Generators	Service and commercial
DISTRICT	69.5.1	Natural Gas-Fired Water Heaters	Residential fuel combustion
ARB	ARCH_SCM	Architectural Coatings 2000 SCM (Suggested Control Measures)	Architectural coatings
ARB	ARB_R003	Consumer Product Regulations & Amendments	Consumer products
ARB	ARB_R003_A	Consumer Product Regulations & Amendments	Consumer products
ARB	ARB_R007	Aerosol Coating Regulations	Consumer products / Aerosol coatings
ARB	GDF_HOSREG	Gasoline Dispensing Facility (GDF) Hose Emission Regulation	Petroleum marketing
ARB	ORVR	Fueling emissions from ORVR vehicles	Petroleum marketing

A.13 On-Road Mobile Sources

Emissions from on-road mobile sources, which include passenger vehicles, buses, and trucks, were estimated using outputs from CARB's EMFAC2017 model. The on-road emissions were calculated by applying EMFAC2017 emission factors to the transportation activity data provided by the San Diego Association of Government's (SANDAG) 2018 adopted Regional Transportation Improvement Program.

EMFAC2017 includes data on California's car and truck fleets and travel activity. Light-duty motor vehicle fleet age, vehicle type, and vehicle population were updated based on 2016 DMV data. The model also reflects the emissions benefits of CARB's recent rulemakings such as the Pavley Standards and Advanced Clean Cars Program, and includes the emissions benefits of CARB's Truck and Bus Rule and previously adopted rules for other on-road diesel fleets.

EMFAC2017 utilizes a socio-econometric regression modeling approach to forecast new vehicle sales and to estimate future fleet mix. Light-duty passenger vehicle population includes 2016 DMV registration data along with updates to mileage accrual using Smog Check data. Updates to heavy-duty trucks include model year specific emission factors based on new test data, and population estimates using DMV data for in-state trucks and International Registration Plan (IRP) data for out-of-state trucks. Additional information and documentation on the EMFAC2017 model is available on the CARB website.

A.13 <u>Off-Road Mobile Sources</u>

Emissions from off-road sources were estimated using a suite of category-specific models or, where a new model was not available, the OFFROAD2007 model. Many of the newer models were developed to support recent regulations, including in-use off-road equipment, ocean-going vessels and others. The sections below summarize the updates made to specific off-road categories.

A.13.1 Aircraft

District staff submitted an update to San Diego's commercial aircraft emissions in 2019. This update was based on the LeighFisher report, February 2016 (see Attachment C).

A.13.2 Ocean-Going Vessels (OGV)

CARB staff updated the OGV activity growth rates and NOx emission calculations in December 2016. These were based on 2014 data on vessel visits, 2014 data from the Ports of LA/LB on vessel power, and US EPA sources for emission rates. Growth factors are based on the Freight Analysis Framework. Additional information on CARB's general OGV methodology is available online for the 2019 update on the CARB website - or the 2014 update on the CARB website.

A.13.3 Cargo Handling Equipment (CHE)

The emissions inventory for the Cargo Handling Equipment category was updated to reflect new information on equipment population, activity, recessionary impacts on growth, and engine load in 2011. The information includes regulatory reporting data which provide an accounting of all the cargo handling equipment in the State including their model year, horsepower and activity. Background and supporting documents for the Cargo Handling Equipment Regulation are available on the CARB website.

A.13.4 Pleasure Craft and Recreational Vehicles

A new model was developed in 2014 to estimate emissions from pleasure craft and another new model was developed in 2018 to estimate emissions from recreational vehicles. In both cases, population, activity, and emission factors were re-assessed using new surveys, DMV registration information, and emissions testing. Additional information is available on the CARB website.

A.13.5 In-Use Off-Road Equipment

This category covers construction, industrial, mining, oil drilling, and ground support equipment. CARB developed this model in 2010 to support the analysis for amendments to the In-Use Off-Road Diesel Fueled Fleets Regulation. Population is based on reporting data, while activity, load and fuel use are based on survey data and statewide fuel estimates. Additional information is available on the CARB website.

A.13.6 Locomotives

The locomotive model is based primarily on population and activity data reported to CARB by the major rail lines for calendar year 2011. To estimate emissions, CARB used duty cycle, fuel consumption and activity data from the two main rail companies. Activity is forecasted for individual train types and is consistent with CARB's ocean-going vessel and truck growth rates. Fuel efficiency improvements are projected to follow Federal Railroad Association projections and turnover assumptions are consistent with U.S. EPA projections. The model was updated in 2016 with revised growth rates, and revised turnover assumptions. Additional information is available on the CARB website. Additional locomotive categories (Switchers, Short Haul (Class III), Passenger) are all documented individually on the CARB website.

A.13.7 Transport Refrigeration Units (TRU)

This model reflects updates to activity, population, growth and turn-over data, and emission factors developed to support the 2011 amendments to the Airborne Toxic Control Measure for In-Use Diesel-Fueled Transport Refrigeration Units. Additional information is available on the CARB website.

A.13.8 Fuel Storage and Handling

Emissions for fuel storage and handling were estimated using the OFFROAD2007 model. Additional information is available on the CARB website.

A.13.9 Diesel Agricultural Equipment

The inventory for agricultural diesel equipment (such as tractors, harvesters, combines, sprayers and others) was revised based on a voluntary survey of farmers, custom operators, and first processors conducted in 2009. The survey data, along with information from the 2007 USDA Farm Census, was used to revise almost every aspect of the agricultural inventory, including population, activity, age distribution, fuel use, and allocation. This updated inventory replaces general information on farm equipment in the United States with one specific to California farms and practices. The updated inventory was compared against other available data sources such as Board of Equalization fuel reports, USDA tractor populations and age, and Eastern Research Group tractor ages and activity, to ensure the results were reasonable and compared well against outside data sources. Agricultural growth rates through 2050 were developed through a contract with URS Corp. Additional information is available on the CARB website.

A.14 Mobile Source Forecasting

Table A-8 below summarizes the data and methods used to forecast future-year mobile source emissions by broad source category groupings.

TABLE A-8
Growth Surrogates for Mobile Sources

Category	Subcategory	Growth Methodology
On-Road Sources	All	Match total VMT projections provided by SANDAG (2018 Regional Transportation Improvement Program)
Off-Road Gasoline Fueled Equipment	Lawn & Garden	1994 Household growth projection from the Center for Continuing Study of the California Economy
Off-Road Gasoline Fueled Equipment	Off-Road Equipment	Employment growth projection (2010 for most categories)
Off-Road Gasoline Fueled Equipment	Recreational Boats (PC2013)	2014 Nationwide Housing Starts (short-term) and historical human population growth (long-term)
Off-Road Gasoline Fueled Equipment	Recreational Vehicles (RV2018)	2000 California Building Permits (short-term) and historical human population growth (long-term)
Off-Road Diesel-Fueled Equipment	Commercial Harbor Craft	Growth rates provided by District, except for tugs and fishing vessels. Fishing fleet growth rates were adjusted to reflect a decline in fish landings. Assumed no growth for tugboats. Data vintage is primarily 2006, with minor updates in 2008.
Off-Road Diesel-Fueled Equipment	Construction & Mining	California construction employment data from U. S. Bureau of Labor Statistics (2009)
Off-Road Diesel-Fueled Equipment	Farm Equipment	2011 study of forecasted growth by URS Corp (2010)
Off-Road Diesel-Fueled Equipment	Industrial Equipment	California construction employment data from U.S. Bureau of Labor Statistics (2009)
Off-Road Diesel-Fueled Equipment	Ocean-Going Vessels	Projected commodity tonnage in the Freight Analysis Framework (FAF) Model developed by the Federal Highway Administration (2016)
Off-Road Diesel-Fueled Equipment	Trains (line haul)	International/premium train growth tied to OGV forecast; Domestic train growth tied truck growth (2016)
Off-Road Diesel-Fueled Equipment	Transport Refrigeration Units	Projection of historical Truck/Trailer TRU sales from ACT Research, adjusted for recession. (2010)

A.15 <u>External Adjustments</u>

External adjustments were made to the inventory to account for military growth, and other unaccounted regulatory factors. The external adjustments reflected in the inventory are listed below in Table A-9.

Table A-9
External Adjustment IDs and Description

Adjustment ID	Adjustment Description
LSI_2006	Fleet Requirements for Forklifts and other Industrial Equipment
LSI_2008	Large Spark Ignition Engines
NonAg_ICE	Update non-ag internal combustion engines to reflect 2003 ATCM and 2010 rule amendment
SD_AUTOREF	Baseline correction for auto refinishing
SD_FIBER	Baseline correction for fiberglass manufacturing
SD_MIL2019	Additional growth in military tactical equipment, aircrafts, and ships
SD_MIL_AIR	Growth in military tactical equipment, aircrafts, ships, and airport

ATTACHMENT B
PLANNED MILITARY PROJECTS SUBJECT TO GENERAL CONFORMITY

TABLE B-1
Projected Emissions and Preliminary Schedule for USMC and DoN, Projects through 2035

Year	Annual Emissions Change, tons per day	
	NO_x	VOC
2011	0.00	0.01
2012	0.25	0.04
2013	0.19	0.05
2014	0.19	0.00
2015	0.77	0.24
2016	0.35	0.04
2017	0.32	0.04
2018	0.32	0.04
2019	0.32	0.04
2020	0.39	0.04
2021	0.12	0.01
2022	0.30	0.01
2023	0.30	0.01
2024	0.30	0.01
2025	0.59	0.50
2026	0.12	0.001
2027	0.12	0.001
2028	0.12	0.001
2029	0.12	0.001
2030	0.12	0.001
2031	0.12	0.001
2032	0.12	0.001
2033	0.12	0.001
2034	0.12	0.001
2035	0.12	0.001
Total	**5.91**	**1.08**

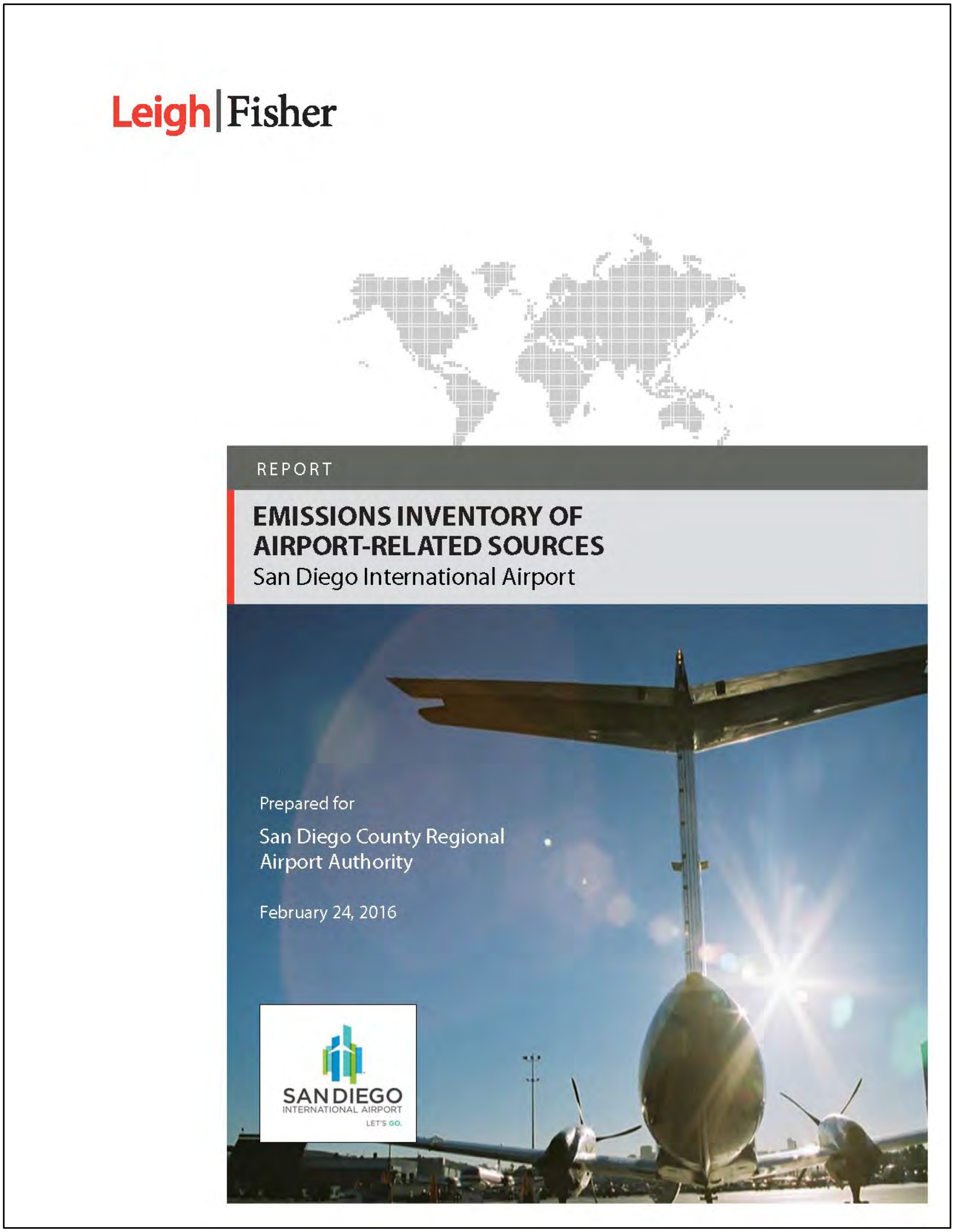
Source: Letter to the District from the Department of the Navy and U.S. Marine Corps. February 29, 2016.

TABLE B-2
Revised Projected Emissions and Preliminary Schedule for USMC and DoN, Projects through 2037

Year	Annual Emissions Change, tons per day	
	NO_x	VOC
2018	0.84	0.14
2019	0.58	0.06
2020	1.87	0.34
2021	0.47	0.04
2022	0.46	0.06
2023	0.15	0.04
2024	0.03	0.00
2025	0.17	0.02
2026	0.30	-0.01
2027	0.43	-0.03
2028	0.30	0.02
2029	0.30	0.02
2030	0.30	0.02
2031	0.30	0.02
2032	0.30	0.02
2033	0.30	0.02
2034	0.30	0.02
2035	0.30	0.02
2036	0.30	0.02
2037	0.30	0.02
Total	**8.34**	**0.86**

Source: Report to the District from the Department of the Navy and U.S. Marine Corps. December 2018.

ATTACHMENT C
PLANNED SAN DIEGO INTERNATIONAL AIRPORT PROJECTS SUBJECT TO GENERAL CONFORMITY


Leigh|Fisher

REPORT

EMISSIONS INVENTORY OF AIRPORT-RELATED SOURCES

San Diego International Airport

Prepared for

San Diego County Regional Airport Authority

February 24, 2016

SAN DIEGO INTERNATIONAL AIRPORT

LET'S GO.

LeighFisher

REPORT

EMISSIONS INVENTORY OF AIRPORT-RELATED SOURCES

San Diego International Airport

Prepared for

San Diego County Regional Airport Authority

February 24, 2016

Leigh|Fisher

PREFACE

This study, conducted by the San Diego County Regional Airport Authority (the Authority), inventories the air pollutant emissions associated with operations and construction related to the San Diego International Airport (the Airport). It was undertaken in response to the California Air Resources Board (CARB) expectation that the San Diego Air Basin's ozone status will be reclassified to "moderate non-attainment." When this happens, San Diego County's Air Pollution Control District (APCD) will be required to prepare basin-wide emissions inventories for each ozone precursor, in support of revisions to the local ozone State Implementation Plan (SIP). The results from this study can be incorporated by APCD into the revisions being made to the local ozone SIP. They will represent the Airport's anticipated air pollution emissions through 2040. The methodology described in this document assumes that any future emission reduction initiatives, not explicitly accounted for in the modeling assumptions, would be considered voluntary actions. These voluntary actions could include, but are not limited to, installing remote ground power equipment, utilizing geothermal energy, purchasing electric or other alternative fuel vehicles and equipment, or reducing aircraft emissions.

EMISSION SOURCES:
All major sources of pollutant emissions at the Airport were reviewed in this study. The emission sources included:

- **Aircraft:** Takeoffs, landings, taxiing, power, and conditioned air needs
- **Ground Support Equipment:** Equipment supporting aircraft operations
- **Roadways:** Vehicular activity in, around, and enroute to / from the airport
- **Parking:** Vehicular activity in the Airport's parking structures
- **Construction:** Routine and growth construction projects to maintain and enhance Airport operations
- **Stationary Sources:** Boilers, emergency generators, fuel storage, and paint activities owned by the Authority

Emissions from training fires are not included in this study.

STUDY TIMEFRAME:
Emissions were estimated for five separate milestone years:

- Baseline Year—2012
- Forecast Year—2017
- Anticipated Attainment Year—2020
- Anticipated Maintenance Year—2030
- Anticipated Maintenance Year—2040

STUDY POLLUTANTS:
The focus of this study was specifically ozone and its precursors. However, whenever possible, emissions were estimated for the following EPA criteria air pollutants and precursors:

- Ozone
- Nitrogen oxides (precursor to ozone)
- Volatile organic compounds (precursor to ozone)
- Carbon monoxide
- Sulfur oxides
- Particulate pollution (often referred to as particulate matter) with aerodynamic diameters less than 10 (PM_{10}) microns and 2.5 microns ($PM_{2.5}$)

This study was prepared by LeighFisher, Inc. Questions related to this study should be directed to Darcy Zarubiak at 650-579-7722.

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1 INTRODUCTION

1.1 SAN DIEGO INTERNATIONAL AIRPORT

San Diego International Airport (the Airport) is owned and operated by the San Diego County Regional Airport Authority (the Authority). The Airport is located three miles west of the downtown business district, and is located on a 661-acre land-constrained site. As shown in Figure 1-1, it is bordered to the east by downtown San Diego; to the south by North Harbor Drive and the harbor itself; to the west by a marine channel and residential areas; and to the north by Interstate 5, the U.S. Marine Corps Recruit Depot, in addition to residential and other developments. Vehicle access is provided via Harbor Drive, for the 1.5-mile route, west of Interstate 5.

The Airport provides non-stop service to over 49 domestic and nine international destinations, with passenger service provided by 14 domestic carriers and five international carriers, including seven low-cost carriers. In addition, the Airport accommodates the majority of regional cargo demand via passenger airlines (belly cargo) and dedicated all-cargo air carriers.

The Airport is classified in the National Plan of Integrated Airport System (NPIAS) as a large-hub commercial service airport. Hub classifications are based on the number of passengers enplaned at the Airport, and a "large hub" classification means that the Airport accommodates at least 1.0 percent of total enplaned passengers in the United States, ranking it as one of the nation's busiest airports. The Airport is the busiest single-runway airport in the United States and has more than 190,000 annual aircraft operations.

The Authority is a leader in the San Diego community's efforts to be sustainable and strives to improve air quality in the region while maintaining the positive economic impacts and quality transportation services provided at the Airport. As such, the Authority is interested in ensuring that current and future criteria pollutant emissions emitted by Airport-related sources are properly represented in the emissions inventory of the California State Implementation Plan (SIP).

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Figure 1-1
SAN DIEGO INTERNATIONAL AIRPORT

Source: LeighFisher, February 2016.

1.2 THE CLEAN AIR ACT AND CRITERIA POLLUTANTS

Under the Federal Clean Air Act, the United States Environmental Protection Agency (EPA) has established health and environmentally protective standards for ozone in the air we breathe. EPA and others have instituted a variety of multi-faceted programs to meet these standards. The Clean Air Act requires EPA to set National Ambient Air Quality Standards (NAAQS) for six common air pollutants that can harm human health, the environment, and cause property damage. These commonly found air pollutants (also known as "criteria pollutants") are found all over the United States. They are ozone, nitrogen oxides (NO_X) and volatile organic compounds (VOCs), both of which are precursors to ozone, carbon monoxide (CO), sulfur oxides (SO_X), and particle pollution (often referred to as particulate matter) with aerodynamic diameters of 10 microns (PM_{10}) and 2.5 microns ($PM_{2.5}$), and lead. EPA calls these pollutants "criteria" air pollutants because it regulates them by developing human health-based and/or environmentally-based criteria (science-based guidelines) for setting permissible levels. Of these six pollutants, ground-level ozone and particulates are the most widespread health threats.

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AIR POLLUTION CONTROL DISTRICT
COUNTY OF SAN DIEGO

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The set of limits based on human health are called primary standards. Another set of limits intended to prevent environmental and property damage are called secondary standards. If the air quality in a geographic area meets or exceeds the national standard, it is called an attainment area; areas that don't meet the national standard are called nonattainment areas. In order to improve air quality, states must draft a SIP to improve the air quality in nonattainment areas. SIPs outline the measures that the state will take in order to improve air quality and contain "budgets" of emissions from various sources of air pollution. Once a nonattainment area meets the standards, EPA will re-designate the area to attainment, but it will require the area to demonstrate "maintenance" of the NAAQS standards for a subsequent 20-year period.

On March 12, 2009, the California Air Resources Board (CARB) proposed nonattainment boundaries pursuant to the 2008 8-hour ozone standard. These boundaries identified San Diego County (the County) as a marginal nonattainment area. The designation of 'marginal nonattainment' meant that the San Diego Air Pollution Control Board (APCD) was not required to develop a new SIP, instead the APCD was only required to adhere to the requirements of the December 5, 2012 maintenance plan for the 1997 8-hour standard covering the County. Based on the most recent air pollution measurements, the County is unlikely to attain the 2008 8-hour ozone standard and will be bumped up to moderate ozone nonattainment for the 2008 ozone standard. If this happens, APCD will be required to prepare revisions to the local ozone SIP to satisfy the Clean Air Act, §172(c)(3) and §182(a)(1), which includes emissions inventory reporting requirements for the San Diego nonattainment area under the 2008 8-hour ozone standard.

The County is also in maintenance for the NAAQS for CO. However, it is the local ozone SIP that is currently under revision.

1.3 IMPORTANCE OF OZONE EMISSIONS

What is ozone?

Ozone occurs both in the Earth's upper atmosphere (stratosphere) and at ground level (troposphere). Ozone is a gas composed of three atoms of oxygen and is a highly reactive molecule. Stratospheric ozone is created when ultraviolet (UV) radiation from sunlight strikes the air in the stratosphere, splitting oxygen molecules (O_2) into atomic oxygen (O). The atomic oxygen quickly combines with oxygen molecules to form ozone (O_3). Tropospheric ozone is formed near ground level when NO_x and VOC, emitted by fossil fuel combustion sources, undergo a series of complex interactions with UV radiation.

The formation of ground level ozone is conceptually illustrated in Figure 1-2.

Health Effects of Ozone

Near ground level, ozone is formed when pollutants emitted by cars, power plants, industrial boilers, refineries, chemical plants, and other sources chemically react in the presence of sunlight. Ozone at ground level is a harmful air pollutant.

Even relatively low levels of tropospheric ozone can cause adverse health effects. People with lung disease, children, older adults, and people who are active outdoors may be particularly sensitive to tropospheric ozone. Breathing ozone can trigger a variety of health problems including chest pain, coughing, throat irritation, and congestion. It can worsen bronchitis, emphysema, and asthma. Ground level ozone also can reduce lung function and inflame the linings of the lungs. Repeated exposure can permanently scar lung tissue.

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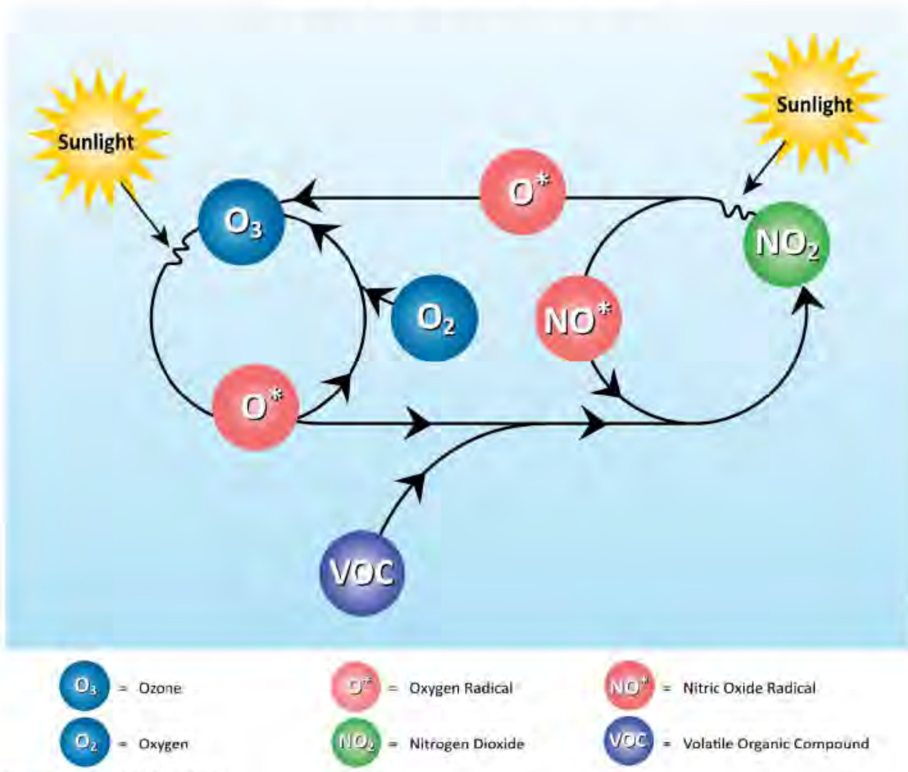
Figure 1-2
FORMATION OF GROUND LEVEL OZONE



Source: LeighFisher, May 2014.

The primary objective of this project is to ensure that an accurate and robust inventory of all on-Airport emission sources is included in the SIP so if the Federal Aviation Administration (FAA) makes a future environmental determination regarding a development project at the Airport, conformity can be demonstrated via the requirements of 40 CFR 93.158 (a) (1).

The purpose of this report is to present a comprehensive inventory of all Airport-related emission sources. The emissions inventory has been prepared with a goal to be included in the SIP and used to support the development of appropriate emission budgets for the County's emissions inventories.

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1.4 APPROACH

In developing the emissions inventory, the overarching goal was to ensure accuracy by using actual operational data, rather than air quality model defaults and assumptions, whenever appropriate. The overall approach to meeting this goal was based on the following:

- Interviewing Authority staff and relevant stakeholders
- Consulting Authority reports and operational records
- Utilizing commercial databases
- Utilizing FAA data
- Using forecasting studies already prepared for the Authority

The emission sources included in this inventory are:

Aircraft Engines: aircraft typically represent the largest category of on-airport sources of emissions, which occur during landing, departure, taxiing, and idling on taxiways and ramp areas.

Auxiliary Power Units (APUs): emissions generated by aircraft APUs occur most often when an aircraft is parked (1) at the gate, (2) at a cargo ramp, (3) at a remote hardstand, and (4) at a maintenance ramp or hangar.

Ground Support Equipment (GSE): encompasses all equipment that is needed to service aircraft on the ground during a normal turn around and primarily includes belt loaders and baggage tractors.

Other GSE includes catering trucks, pushback tractors, lavatory trucks, potable water trucks, airline support staff vehicles, and ground power units operated by fixed base operators (FBOs).

Roadways and Parking Facilities: roadway emissions include emissions throughout the air basin from Authority-owned, commercial, and private vehicles on trips to and from the Airport. Parking facility emissions refer to emissions from vehicles in Authority-owned parking facilities.

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Construction Activities: emissions resulting from routine and growth-related construction activities and regular maintenance are generally associated with the following types of construction projects:

- Demolition and construction of buildings
- Roadway pavement
- Garage structures
- Hangars
- Utility plants and distribution systems
- Roadway and transit structures
- Runway/taxiway repair

Stationary Sources: includes emissions associated with Authority-owned natural gas boilers and emergency diesel generators, Jet A fuel tank storage, and paint used for airfield marking.

Sections 3 to 8 describe the assumptions and methodology in computing emissions for each source group.

1.5 AIR QUALITY MODELING

As required by 40 CFR 93.159(d), the County is statutorily required to provide emissions inventories for each precursor and nonattainment pollutant at the Airport. As agreed to by APCD staff on February 25, 2015, emissions were calculated for the following SIP milestone years:

- Baseline Year—2012
- Forecast Year—2017
- Anticipated Attainment Year—2020
- Anticipated Maintenance Year—2030
- Anticipated Maintenance Year—2040

Actual ozone and ozone precursor inventories were prepared for the 2012 Baseline Year, while forecast emission inventories were prepared for ozone and each ozone precursor for the 2017 Forecast Year, the Anticipated Attainment year, and the two Anticipated Maintenance years.

Although the Airport is not located in an area designated as nonattainment or maintenance for any other criteria air pollutant than ozone and CO, emission estimates for other criteria air pollutants were provided as available.

Accordingly, emissions inventories were prepared for the following EPA criteria air pollutants and precursors, whenever possible:

- Ozone
- NO_X (precursor to ozone)
- VOC (precursor to ozone)
- CO
- SO_X
- PM_{10}
- $PM_{2.5}$

Some sources used to estimate emissions did not report PM_{10} and/or $PM_{2.5}$ but instead reported Particulate Matter (PM) or Total Suspended Particulate (TSP). PM and TSP are assumed to be equivalent, and define as particulate matter with an aerodynamic diameter less than 30 microns.

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A variety of tools were used to calculate Airport-related emissions, primarily FAA's Emissions and Dispersion Modeling System (EDMS). However whenever possible, to ensure accurate results, actual operational data was used rather than relying default model values.

* * * * *

This report provides a brief overview of the concepts, methodology, data inputs, and summarizes emission results for various scenarios modeled to support the development of the ozone inventory for the Airport. The report has been structured so that the emissions calculation methodologies and assumptions are summarized for every major source group of Airport-related emissions. Additional data is provided in the individual appendices for each emission source group.

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2 METHODOLOGY

2.1 MODELING TOOLS

This emissions inventory was developed for Airport-related sources using FAA's EDMS program, minimally using FAA's Aviation Environmental Design Tool (AEDT) program, and using additional models and databases to attain more accurate emission information when needed. Aircraft operation emissions, APU emissions, and stationary source emissions (Chapters 3, 4, and 8, respectively) were modeled exclusively with FAA tools EDMS and AEDT. GSE emissions (Chapter 4) were modeled using a combination of EDMS and the CARB 2011 Inventory Model for Off-Road Emissions (OFFROAD). Parking and roadways, and construction-related emissions, were the only Airport-related sources modeled with no reliance on EDMS. Parking and roadways were modeled using data from CARB's EMFAC 2014 database (EMFAC), and construction-related emissions were modeled using data from the OFFROAD model and the Airport Construction Emissions Inventory Tool (ACEIT), an FAA-designed tool specific for construction activities at airports.

2.1.1 Emissions and Dispersion Modeling System (EDMS)

EDMS was designed to assess the air quality impacts of airport emission sources, particularly aviation sources. Historically, its use has been required by the FAA when assessing aviation emission sources at airports* and has been recognized by the EPA** as a preferred tool for modeling aircraft emissions. As of May 29th, 2015, FAA now requires the use of AEDT when assessing aviation emission sources at airports. However, the use of EDMS for this project started in March 2015, prior to the release of AEDT, and is consistent with FAA's policy on using AEDT only for new modeling efforts. AEDT was minimally used for the Forecast Years to estimate emissions from aircraft that are not included in EDMS–specifically the Airbus A320-NEO and the Boeing 737-MAX.

The FAA developed EDMS in the mid-1980s in cooperation with the United States Air Force. The model has become increasingly sophisticated over time and provides users with the ability to conduct emission inventories and dispersion analysis for all of the major emission sources in an airport environment. EDMS develops time- and location-varying emissions from mobile sources, such as, aircraft engines, APUs, GSE, ground access vehicles, training fires, and stationary sources, such as generators, commercial kitchens, cooling towers, boilers, and bulk liquid storage tanks. EDMS incorporates specific details on types of aircraft and typical aircraft schedules for taxi, takeoff and landing to develop a more precise representation of airport emissions.

Figure 2-1 graphically illustrates the components of FAA's EDMS.

2.1.2 Other Tools

- **OFFROAD:** CARB's OFFROAD model's emission factors were used to model GSE and construction emissions, respectively. The model contains detailed data about California's off-road vehicle fleet, by air basin, for four categories: Airport Ground Support, Construction and Mining, Industrial, and Oil Drilling. Each category has data related to the unique equipment specific to that category. Key data, such as assumed age, horsepower, load factor, annual emissions, and air basin made it possible to calculate emission factors more accurately for the GSE and construction equipment at the Airport rather than using the EDMS defaults.

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*Federal Register, Volume 63, No. 70, April 13, 1998.
***Guidelines on Air Quality Models (Revised) with Supplements A and B*, EPA-450/2-78-027R, U.S. Environmental Protection Agency, July 1, 1997. Codified in 40 CFR Part 51, Appendix W.

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- **ACEIT:** ACEIT is a tool that was developed as part of an Airport Cooperative Research Program (ACRP) project on estimation of airport construction emissions (ACRP Report 102, Guidance for Estimating Airport Construction Emissions, 2014). It contains a listing of construction equipment with key default operating parameters - horsepower, load factor, and operating time (annual hours) – that are specific to airport projects.
- **EMFAC:** EMFAC 2014 is the most recently available estimate of on-road vehicle emissions in California with county-level emissions for 42 classes of vehicles. EMFAC uses emission coefficients for criteria air pollutants and has assumptions regarding the mix of vehicle types, age, fuels, and driving speeds that are specific to San Diego County. It also includes assumptions for combustion, resting loss/evaporation, and particulates from brake and tire degradation.

2.2 COMPUTATION METHODS

2.2.1 EDMS

Aircraft-related emissions and stationary source emissions were inventoried using EDMS. EDMS has an internal database of emission factors for airport pollutant sources for all criteria air pollutants. These emission factors are typically in units of mass per unit of time or distance (e.g., grams/second, or grams/mile). The EDMS database of emission factors reflects differences in emissions based on fuel type, fuel burn, engine power load, manufacture year, and manufacturer, among many other characteristics.

These emission factors are used by EDMS to calculate a total estimated emission inventory for a specified time period by multiplying the emission factor for the particular source, by the time, distance, or number of events input by the user. The result is the estimated total emissions for each source group and ultimately total estimated emissions for the study period.

Airport-specific information such as latitude and longitude coordinates of the official Airport Reference Point (ARP) and elevation of the ARP above sea level are provided within EDMS. All other Airport-specific information must be estimated and input into the program.

2.2.2 Other Methods

Emissions not directly related to aircraft were modeled by obtaining detailed information about the emission factors and operating parameters specific to each piece of equipment. The key operating parameters required to estimate emissions were:

- **Age:** as the equipment gets older the engine can degrade and emit more pollutants, and tightening emission standards over the years has greatly reduced emissions, and continues to do so.
- **Horsepower:** the power rating of the engine. Generally speaking, as the horsepower increases, so do the emissions.
- **Load Factor**: refers to the time-weighted average of engine utilization relative to full power.
- **Operating Time:** refers to the annual utilization time of the equipment. Depending on the type of equipment, it can be in annual hours or annual miles travelled.

When a piece of equipment's operating parameters and emissions factor were known, emissions were estimated by the following formula:

Annual Emissions *= Population x* HP_{avg} *x Load Factor x Annual Hours x Emissions Factor (g/HP-Hr)*

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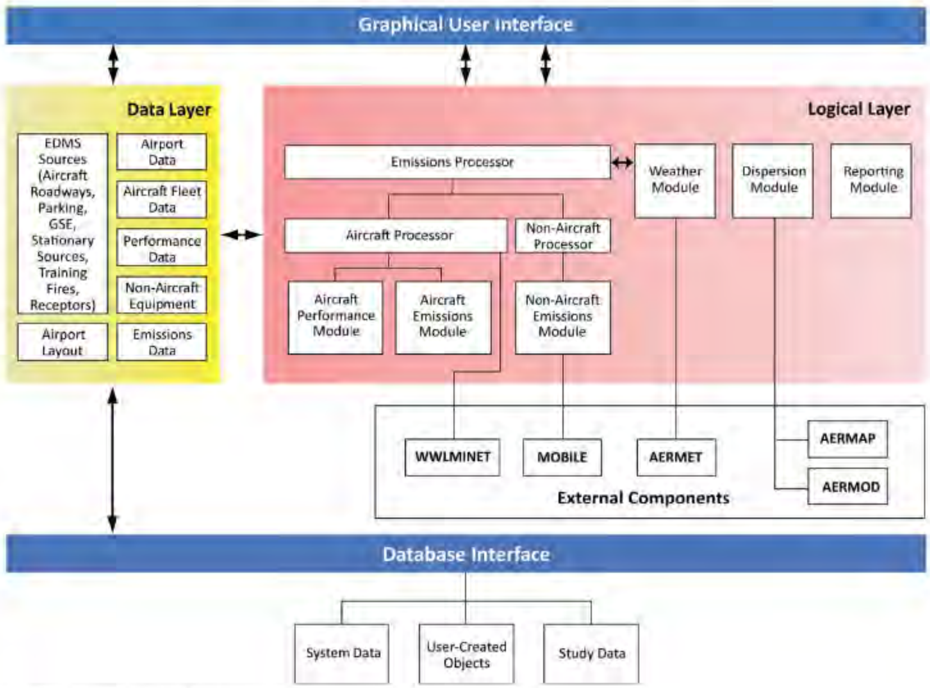
Figure 2-1
EMISSIONS AND DISPERSION MODELING SYSTEM



Source: Federal Aviation Administration.

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3 AIRCRAFT OPERATIONS

3.1 INTRODUCTION

Aircraft emissions typically represent the largest portion of emissions from any category of on-airport sources for most criteria air pollutants. To estimate emissions from aircraft sources, a series of operational data must be collected for model inputs.

Typically, these inputs include 1) aircraft operations (individual takeoff and landing), 2) unique aircraft frame type and engine model combinations (fleet mix), 3) operating time in the air, and 4) taxiing time.

The data for this analysis was gathered from a variety of sources, including:

- **FAA OPSNET Data (OPSNET):** the official source of National Air System (NAS) air traffic operations and delay data. OPSNET indicates how many operations occur annually by aircraft category. The OPSNET aircraft categories are:
  - a) Air Carrier: an aircraft with seating capacity of more than 60 seats or a maximum payload capacity of more than 18,000 pounds carrying passengers or cargo for hire or compensation.
  - b) Air Taxi: aircraft designed to have a maximum seating capacity of 60 seats or less or a maximum payload capacity of 18,000 pounds or less carrying passengers or cargo for hire or compensation.
  - c) General Aviation: takeoffs and landings of all civil aircraft, except those classified as air carriers or air taxis.
  - d) Military: all classes of military takeoffs and landings at FAA and FAA-contracted facilities.
- **San Diego Airport's Noise Monitoring System (NMS):** a system that records flight data for aircraft operations at the Airport. Data fields captured include an aircraft's tail number, airline, aircraft type, operation time, and operation origin/destination. Some operations have missing data fields.
- **JP Airline-Fleets International (JP-Fleets):** a catalogue listing aircraft frame type and engine model configurations for airlines, air taxi services, large non-commercial government, and corporate operators.
- **FAA Aircraft Registration Database (FAREDA):** a system that maintains registrations of United States civil aircraft, and includes aircraft frame type and engine model.
- **FAA Aviation System Performance Metrics (ASPM):** an FAA system that provides average taxi times for aircraft at federalized airports in the United States.

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3.1.1 Aircraft Operations

The standard EDMS input is the number of total annual operations for each unique aircraft-engine combination. Annual operations for historical years are recorded in OPSNET, and forecast year operations are based on professional judgment and consultant forecasts. Aircraft operations in this report are segmented into Passenger, Cargo, General Aviation, and Military. Final emission estimates are also summarized by aircraft engine type (jet or piston), as requested by APCD. Emissions will be incorporated into the SIP by engine type.

3.1.2 Fleet Mix (Aircraft Frame Type & Engine Model)

The fleet mix represents the specific aircraft frame type and engine combinations that operate at the Airport in a given year.

Matching operations to the correct aircraft and engine model is essential to accurately estimate emissions from aircraft operations. EDMS estimates emissions based on a specific aircraft type matched with a specific engine model. EDMS provides a suggested default engine model for most aircraft types. However, for the most accurate estimate it is important to identify the actual engines that an airline has chosen to use for an aircraft. This is made possible given that the NMS data includes aircraft tail numbers that can be referenced in JP-Fleets and FAREDA to determine each operation's aircraft frame type and engine model.

3.1.3 Airborne Mode and Ground Mode Operating Times

As discussed in Section 2, EDMS models aircraft landing-takeoff cycles in six modes of operation. Airborne modes include approach, takeoff, and climb out, and ground modes include taxi-in, startup, and taxi-out. The modes "taxi-out" and "taxi-in" have identical emission factors, as well as any time spent idling, which uses the same emission factors and is often referred to as the "taxi/idle" mode.

EDMS uses two different methods of calculating emissions from the airborne modes of operation (climb out, approach, and takeoff):

1. Static operating times developed by the International Civil Aviation Organization and EPA.

2. Dynamic operating times using the methodology presented in the Society of Automotive Engineers Aerospace Information Report 1845.

Since the FAA mandates the use of the dynamic performance model for airport analyses, the internal dynamic performance module in EDMS was used to compute times-in-mode. This module is also more precise and takes into account aircraft frame type, engine, weight, approach angle, elevation, and weather. However, the module does not take into account any delay due to queuing or congestion in the airspace.

3.1.4 Taxi Times

Aircraft taxiing times can be broken down into two components—unimpeded and delay. Unimpeded taxi time represents the time that it would take an aircraft to (1) taxi from the arrival runway to the gate, and (2) depart from the terminal to the departure runway without being delayed by other aircraft. Annual average taxi-in and taxi-out times were obtained from FAA's ASPM database for 2012. The annual average taxi times include the unimpeded taxi time and any associated delay, and are applicable to both runway ends.

3.2 EMISSIONS METHODOLOGY FOR THE BASELINE YEAR

The methodology for estimating emissions in the baseline year (2012) is described below.

3.2.1 Aircraft Operations for the Baseline Year

OPSNET indicated there were 187,314 aircraft operations at the Airport in 2012, which were recorded as: Air Carrier, Air Taxi, General Aviation, and Military. However, to align with the Airport Development Plan's growth forecast, and to assign accurate APU times to aircraft (discussed in detail in chapter 4), the OPSNET operations had to be segmented into the following four report categories: Passenger, Cargo, General Aviation, and Military. The methodology to distribute OPSNET operations into report categories is as follows:

1. **Determine total operations for the baseline year:** the total number of annual operations for air carrier, air taxi, general aviation, and military were acquired from OPSNET, and are listed in Table 3-1.
   a. Air carrier and air taxi operations are a combination of passenger and cargo aircraft.
   b. General Aviation and Military operations do not overlap with another category.

Table 3-1
BASELINE ANNUAL OPERATIONS

Year	Air Carrier	Air Taxi	General aviation	Military	**Total**
2012	151,790	24,940	9,918	666	**187,314**

Source: OPSNET.

2. **Distribute OPSNET operations into the four report categories:** The NMS data was used to accomplish this by segmenting NMS operations into two separate category types:
   a. **Air carrier or air taxi**, based on the NMS operation's aircraft frame type.
   b. **Commercial, cargo, or General Aviation**, based on the NMS operation's airline. General aviation included all operations that were not identified as a commercial or cargo operation.

Table A-1 and A-2 in Appendix A list the passenger and cargo airlines, and air carrier and air taxi airframe types, respectively.

With the commercial-to-cargo ratios, the OPSNET air carrier and air taxi operations could be distributed into passenger and cargo operations. General Aviation and Military operations remained as listed in OPSNET. Table 3-2 presents this process and the aircraft operations by report category used for the baseline year.

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Table 3-2
ANNUAL OPERATIONS BY REPORT CATEGORY

OPSNET	Air Carrier 151,790		Air Taxi 24,940		General aviation 9,918	Military 666	Total 187,314
NMS Breakdown	*Passenger 98%*	*Cargo 2%*	*Passenger 94%*	*Cargo 6%*			
OPSNET x NMS %	*148,754*	*3,036*	*23,444*	*1,496*			
Report Operations	Passenger **172,198**		Cargo **4,532**		General aviation **9,918**	Military **666**	Total **187,314**

Source: OPSNET, NMS, LeighFisher, February 2016.

3.2.2 Aircraft Fleet Mix for the Baseline Year

The fleet mix, i.e., aircraft frame types and engine combinations, for the baseline year was derived from the NMS data and two aircraft data sources: (1) JP Fleets and (2) FAREDA. JP Fleets was used as the primary source due to its greater amount of detail. The tail numbers from the NMS data were matched to JP Fleets or FAREDA to determine the specific aircraft frame type and engine model. Overall, there were a total of 39 aircraft frame types, and a total of 71 aircraft frame types and engine combinations.

A total of 11% of operations from the NMS data were excluded from the fleet mix analysis—six percent of operations listed in the NMS data had no tail number, and five percent of NMS operations were excluded for one of the following reasons:

1. No match was found in the aircraft databases (JP-Fleets or FAREDA).
2. No logical match could be made to an aircraft in EDMS.
3. General aviation aircraft with fewer than 10 annual operations were excluded because they represented a small fraction of operations, and due to inconsistencies in the databases naming conventions, were frequently already represented in the flight mix under a different nomenclature.

Fleet mix for the four primary report categories was determined using the following sources:

1. Passenger: NMS and JP-Fleets
2. Cargo: NMS and JP-Fleets
3. General Aviation: NMS, JP-Fleets, and FAREDA
4. Military: Professional Judgment. Military aircraft accounted for only 666 operations in OPSNET (0.36%). Given the small number of military operations and a lack of available data on military aircraft types used at the Airport, all military operations were assumed to take place in C130s with the EDMS default engine.

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Professional judgment was used to determine which aircraft are powered by jet engine and which aircraft are powered by piston engine. Based on input from APCD, turboprop aircraft were categorized as being powered by a piston engine, even if not powered by Aviation Gasoline (Avgas). Information describing the engine type for each aircraft is presented in Tables A-3 through A-5 in the appendix, and below is a list of aircraft included in the category of piston-powered.

Aircraft Classified as Powered by a Piston Engine

- Bombardier de Havilland Dash 8 Q400
- Cessna 172 Skyhawk *(a)*
- Cessna 208 Caravan
- Embraer EMB120 Brasilia
- Piaggio P.180 Avanti
- Pilatus PC-12
- Piper PA46-TP Meridian
- Raytheon Super King Air 200
- Raytheon Super King Air 300

(a) The Cessna 172 Skyhawk is the only aircraft in this list that is fueled with Aviation Gasoline (Avgas).

Given the large number of NMS data operations that could be matched to an aircraft database and a defensible EDMS aircraft/engine configuration (approximately 89%), it was determined that this methodology provided an accurate fleet mix. The resulting fleet mix, with all aircraft and engine combinations, and their proportion of annual operations, is presented by category in Appendix A, Tables A-3 through A-5.

Once a defensible fleet mix with aircraft, engine model, and proportional representation was established, the report category annual operations (Table 3-2) were proportionally distributed to each unique aircraft-engine combination, and are listed in Appendix A, Tables A-6 through A-8.

3.2.3 Airborne Operating Times for the Baseline Year

As stated in this chapter's introduction, the internal dynamic performance module in EDMS was used to compute times-in-mode for airborne operating times.

3.2.4 Taxi Times for the Baseline Year

As stated in this chapter's introduction, annual average taxi-in and taxi-out times were obtained from FAA's ASPM database for 2012. As the Airport's terminal complexes are centrally located with respect to the runway, it was assumed that the average taxi-in and taxi-out times were the same for all aircraft types and airport gates. According to ASPM, the average taxi-in and taxi-out times were 3.78 minutes and 13.37 minutes, respectively.

3.3 EMISSIONS METHODOLOGY FOR FORECAST YEARS

Emissions for the forecast years (2017, 2020, 2030, 2040) were estimated as described below.

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3.3.1 Aircraft Operations for Forecast Years

Forecasts from the San Diego International Airport Development Plan were used to estimate the number of aircraft operations in forecast years by report category, and are presented in Table 3-3.

Table 3-3
ANNUAL OPERATIONS BY AIRCRAFT CATEGORY FOR FORECAST YEARS

Year	Passenger	Cargo	General aviation	Military	Total
2017	178,406	7,098	11,162	700	197,366
2020	185,270	7,441	11,492	700	204,903
2030	208,281	8,648	12,581	700	230,210
2040	228,298	9,283	13,536	700	251,817

Source: San Diego International Airport Development Plan.

3.3.2 Fleet Mix for the Forecast Years

3.3.2.1 Passenger Fleet Mix for Forecast Years

Detailed information for the passenger category was available in the Airport Development Plan, and included the percentage of annual operations attributed to each aircraft type. The aircraft/engine composition for the forecast years was the same proportion as used in the baseline year.

Over the study timeframe (2012 through 2040), certain passenger aircraft are removed from the fleet mix as they age and are replaced with newer aircraft. Table 3-4 lists the passenger aircraft expected to be retired during the study timeframe. The A320NEO, the A350, the B737MAX, and an increase in the number of B787s are expected to replace the aircraft being retired. As EDMS does not include data for the A320NEO or the B737MAX, the operations associated with those aircraft were modeled with AEDT.

The annual operations by unique aircraft-engine combination are listed in Appendix A, Table A-2.

Table 3-4
PASSENGER AIRCRAFT TO BE RETIRED DURING STUDY TIMEFRAME

A320	CRJ-100/200
B717	MD-80/90
B737-300/400/500	Q400
B757-200/300	

Source: LeighFisher, February 2016.

3.3.2.1 Cargo, General Aviation, and Cargo Fleet Mix for Forecast Years

The baseline fleet mix for Cargo, General Aviation, and Military was used for the forecast years.

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3.2.3 Airborne Operating Times for Forecast Years

Similar to the baseline year's airborne times, the internal dynamic performance module in EDMS was used to compute times-in-mode for airborne operating times. No changes were made to airborne times throughout the study timeframe.

3.3.4 Taxi Times for Forecast Years

Given that the physical layout of the runway and taxiways at the Airport are not expected to change in the study timeframe, it was assumed that taxi-in and taxi-out times, including delay time, remain unchanged at 3.78 minutes and 13.37 minutes, respectively.

3.4 ESTIMATED EMISSIONS

Table 3-5 and Figure 3-1 presents the total aircraft emissions for the baseline and forecast years. Tables 3-6 and 3-7 present the emissions by jet engine and piston engine, respectively, and will be the emission values incorporated into the SIP. Tables 3-8 through 3-12 present the emissions by aircraft market category and mode (airborne or ground) for each study year.

Table 3-5
TOTAL EMISSIONS FROM AIRCRAFT OPERATIONS
(Tons)

Year	NO_x	VOC	CO	SO_x	PM_{10}	$PM_{2.5}$
2012	787.4	123.3	652.6	77.8	11.6	11.6
2017	900.5	136.0	693.1	85.8	12.6	12.6
2020	975.7	142.4	725.7	91.8	14.1	14.1
2030	1,203.7	162.5	849.9	110.3	19.7	19.7
2040	1,405.5	177.6	973.5	127.2	24.6	24.6

Source: LeighFisher, February 2016.

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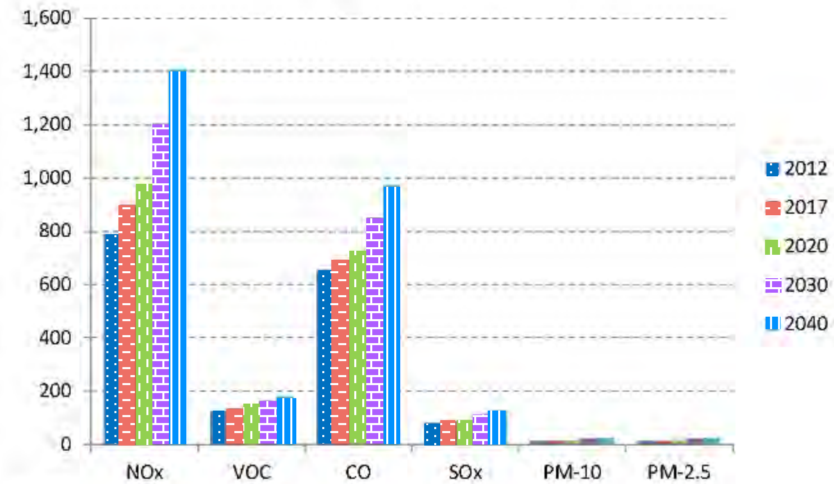
Figure 3-1
TOTAL AIRCRAFT EMISSIONS



Source: LeighFisher, February 2016.

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Table 3-6
JET AIRCRAFT ENGINE EMISSIONS – FOR INCLUSION INTO CALIFORNIA SIP
(Tons)

Year	Mode	NO_x	VOC	CO	SO_x	PM_{10}	$PM_{2.5}$
2012	Airborne	673.7	10.5	73.3	45.6	7.0	7.0
	Ground	109.9	109.9	554.0	31.2	4.5	4.5
	Total	**783.5**	**120.3**	**627.4**	**76.9**	**11.4**	**11.4**
2017	Airborne	776.4	11.1	75.8	51.2	7.8	7.8
	Ground	121.5	121.6	598.5	34.0	4.7	4.7
	Total	**897.9**	**132.7**	**674.4**	**85.1**	**12.5**	**12.5**
2020	Airborne	846.5	11.7	82.2	55.8	9.1	9.1
	Ground	127.3	127.4	628.3	35.5	4.8	4.8
	Total	**973.8**	**139.2**	**710.6**	**91.3**	**14.0**	**14.0**
2030	Airborne	1,060.4	14.1	108.4	70.4	14.6	14.6
	Ground	142.4	144.9	731.2	39.6	5.1	5.1
	Total	**1,202.8**	**158.9**	**839.6**	**110.0**	**19.6**	**19.6**
2040	Airborne	1,250.3	16.0	133.2	83.8	19.3	19.3
	Ground	154.9	159.1	832.4	43.2	5.3	5.3
	Total	**1,405.2**	**175.2**	**965.5**	**127.0**	**24.6**	**24.6**

Note: Numbers may not add due to rounding.

Source: LeighFisher, February 2016.

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Table 3-7
PISTON AIRCRAFT ENGINE EMISSIONS – FOR INCLUSION INTO CALIFORNIA SIP
(Tons)

Year	Mode	NO_x	VOC	CO	SO_x	PM_{10}	$PM_{2.5}$
2012	Airborne	2.2	0.6	5.2	0.4	0.1	0.1
	Ground	1.6	2.3	20.0	0.6	0.1	0.1
	Total	**3.8**	**2.9**	**25.3**	**1.0**	**0.1**	**0.1**
2017	Airborne	1.5	0.7	4.0	0.3	>0.0	0.0
	Ground	1.1	2.6	14.7	0.4	0.1	0.1
	Total	**2.6**	**3.3**	**18.7**	**0.7**	**0.1**	**0.1**
2020	Airborne	1.1	0.7	3.4	0.2	>0.0	>0.0
	Ground	0.8	2.5	11.7	0.3	0.1	0.1
	Total	**1.9**	**3.2**	**15.1**	**0.5**	**0.1**	**>0.**
2030	Airborne	0.6	0.8	2.6	0.1	>0.0	>0.0
	Ground	0.3	2.8	7.7	0.2	0.1	0.1
	Total	**0.9**	**3.6**	**10.2**	**0.3**	**0.1**	**0.1**
2040	Airborne	0.3	0.6	2.2	0.1	>0.0	>0.0
	Ground	0.1	1.8	5.7	0.1	>0.0	>0.0
	Total	**0.3**	**2.4**	**8.0**	**0.1**	**>0.0**	**>0.0**

Note: Numbers may not add due to rounding.

Source: LeighFisher, February 2016.

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Table 3-8
2012 AIRCRAFT EMISSIONS
(Tons)

Market Category	Mode	NO_x	VOC	CO	SO_x	PM_{10}	$PM_{2.5}$
Passenger	Airborne	618.5	7.1	66.6	42.6	6.4	6.4
	Ground	105.4	80.1	501.4	29.7	3.8	3.8
	Total	723.9	87.2	568.0	72.3	10.3	10.3
Cargo	Airborne	51.2	0.9	4.2	2.7	0.4	0.4
	Ground	4.4	13.9	41.7	1.4	0.4	0.3
	Total	55.7	14.8	45.9	4.1	0.8	0.8
General Aviation	Airborne	5.5	2.9	7.4	0.6	0.2	0.2
	Ground	1.5	16.9	29.1	0.6	0.3	0.3
	Total	7.0	19.8	36.5	1.3	0.5	0.5
Military	Airborne	0.6	0.2	0.4	0.1	>0.0	>0.0
	Ground	0.2	1.2	1.9	0.1	>0.0	>0.0
	Total	0.9	1.4	2.3	0.2	.0.0	.0.0
	Total Airborne	675.8	11.1	78.6	46.0	7.0	7.0
	Total Ground	111.5	112.2	574.1	31.8	4.6	4.6
	Total 2012 Emissions	787.4	123.3	652.6	77.8	11.6	11.6

Note: Numbers may not add due to rounding.

Source: LeighFisher, February 2016.

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Table 3-9
2017 AIRCRAFT EMISSIONS
(Tons)

Market Category	Mode	NO_x	VOC	CO	SO_x	PM_{10}	$PM_{2.5}$
Passenger	Airborne	711.6	7.3	66.3	47.5	7.1	7.1
	Ground	115.5	87.9	529.8	32.0	4.0	4.0
	Total	827.1	95.2	596.1	79.5	11.1	11.1
Cargo	Airborne	59.4	1.1	4.9	3.1	0.5	0.5
	Ground	5.2	16.2	48.7	1.6	0.4	0.4
	Total	64.6	17.3	53.6	4.7	0.9	0.9
General Aviation	Airborne	6.2	3.3	8.3	0.7	0.2	0.2
	Ground	1.7	18.9	32.7	0.7	0.4	0.4
	Total	7.9	22.1	40.9	1.4	0.6	0.6
Military	Airborne	0.7	0.2	0.4	0.1	>0.0	>0.0
	Ground	0.2	1.2	2.0	0.1	>0.0	>0.0
	Total	0.9	1.5	2.4	0.2	>0.0	>0.0
	Total Airborne	777.9	11.8	79.9	51.4	7.8	7.8
	Total Ground	122.6	124.2	613.2	34.4	4.8	4.8
	Total 2017 Emissions	900.5	136.0	693.1	85.8	12.6	12.6

Note: Numbers may not add due to rounding.

Source: LeighFisher, February 2016.

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Table 3-10
2020 AIRCRAFT EMISSIONS
(Tons)

Market Category	Mode	NO_X	VOC	CO	SO_X	PM_{10}	$PM_{2.5}$
Passenger	Airborne	778.5	7.7	71.6	51.9	8.4	8.4
	Ground	120.8	92.4	553.5	33.3	4.1	4.1
	Total	899.2	100.1	625.1	85.2	12.5	12.5
Cargo	Airborne	62.1	1.1	5.1	3.2	0.5	0.5
	Ground	5.4	16.9	50.9	1.7	0.4	0.4
	Total	67.5	18.0	56.0	4.9	1.0	1.0
General Aviation	Airborne	6.4	3.4	8.5	0.7	0.2	0.2
	Ground	1.7	19.4	33.6	0.7	0.4	0.4
	Total	8.1	22.8	42.2	1.5	0.6	0.6
Military	Airborne	0.7	0.2	0.4	0.1	>0.0	>0.0
	Ground	0.2	1.2	2.0	0.1	>0.0	>0.0
	Total	0.9	1.5	2.4	0.2	>0.0	>0.0
	Total Airborne	847.6	12.4	85.6	56.0	9.1	9.1
	Total Ground	128.1	130.0	640.0	35.8	4.9	4.9
	Total 2020 Emissions	975.7	142.4	725.7	91.8	14.1	14.1

Note: Numbers may not add due to rounding.

Source: LeighFisher, February 2016.

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Table 3-11
2030 AIRCRAFT EMISSIONS
(Tons)

Market Category	Mode	NO_X	VOC	CO	SO_X	PM_{10}	$PM_{2.5}$
Passenger	Airborne	981.2	9.6	95.2	65.9	13.7	13.7
	Ground	134.3	105.5	640.9	36.9	4.2	4.2
	Total	1,115.6	115.1	736.2	102.8	17.9	17.9
Cargo	Airborne	72.1	1.3	6.0	3.8	0.6	0.6
	Ground	6.3	19.7	59.2	2.0	0.5	0.5
	Total	78.4	21.0	65.1	5.7	1.1	1.1
General Aviation	Airborne	7.0	3.7	9.3	0.8	0.2	0.2
	Ground	1.9	21.3	36.8	0.8	0.4	0.4
	Total	8.9	25.0	46.2	1.6	0.6	0.6
Military	Airborne	0.7	0.2	0.4	0.1	>0.0	>0.0
	Ground	0.2	1.2	2.0	0.1	>0.0	>0.0
	Total	0.9	1.5	2.4	0.2	>0.0	>0.0
	Total Airborne	1,061.0	14.8	110.9	70.5	14.6	14.6
	Total Ground	142.7	147.7	738.9	39.7	5.1	5.1
	Total 2030 Emissions	**1,203.7**	**162.5**	**849.9**	**110.3**	**19.7**	**19.7**

Note: Numbers may not add due to rounding.

Source: LeighFisher, February 2016.

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Table 3-12
2040 AIRCRAFT EMISSIONS
(Tons)

Market Category	Mode	NO_x	VOC	CO	SO_x	PM_{10}	$PM_{2.5}$
Passenger	Airborne	1,162.7	11.0	118.4	78.7	18.4	18.4
	Ground	145.8	115.2	731.3	40.2	4.3	4.3
	Total	1,308.5	126.1	849.7	118.9	22.7	22.7
Cargo	Airborne	79.7	1.4	6.6	4.2	0.7	0.7
	Ground	6.9	21.7	65.2	2.2	0.6	0.6
	Total	86.5	23.1	71.8	6.3	1.2	1.2
General Aviation	Airborne	7.5	4.0	10.0	0.9	0.2	0.2
	Ground	2.0	22.9	39.6	0.9	0.4	0.4
	Total	9.5	26.8	49.6	1.7	0.7	0.7
Military	Airborne	0.7	0.2	0.4	0.1	>0.0	>0.0
	Ground	0.2	1.2	2.0	0.1	>0.0	>0.0
	Total	0.9	1.5	2.4	0.2	>0.0	>0.0
	Total Airborne	1,250.5	16.6	135.4	83.9	19.3	19.3
	Total Ground	155.0	161.0	838.1	43.3	5.3	5.3
	Total 2040 Emissions	**1,405.5**	**177.6**	**973.5**	**127.2**	**24.6**	**24.6**

Note: Numbers may not add due to rounding.

Source: LeighFisher, February 2016.

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4 AUXILIARY POWER UNITS

4.1 INTRODUCTION

Auxiliary Power Units (APUs) are on-board generators that provide electrical power to an aircraft while its engines are shut down. These generators supply the aircraft with power for comfort heating and cooling, lights, and electronics as well as pressurized air for restarting the jet engines.

If the aircraft is parked at a gate that can provide preconditioned air (PCA) and ground power—an "electrified" gate—then the aircraft's APU can be turned off while loading and unloading passengers. The APU, in effect, serves as a small jet engine and the calculations for the emissions generated by it are similar to those of an aircraft engine operating in one power setting only.

Typical PCA and ground power units are shown in the graphic below.

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4.2 AIRCRAFT/APU COMBINATION

Within EDMS there is an extensive list of aircraft/APU combinations. When detailed information could not be obtained from the airlines, the default APU type was used, as defined by EDMS for each aircraft type. Based on NMS data, EDMS data, and manufacturer research, there were certain aircraft that were equipped with an APU but did not have a default APU in EDMS. When an aircraft type was known to have an APU but the specific APU type was unknown and EDMS did not have a default APU for the aircraft type, either the APU with the lowest horsepower rating in EDMS was used, the GTCP 36-100 APU, or professional judgment was used to assign a more appropriate APU. Aircraft that had an APU assigned to it based on professional judgment included:

Aircraft	Assumption
Airbus A320-NEO	Same APU as Airbus A320-200
Airbus A350 *(a)*	Same APU as Boeing 777
Boeing 737-MAX *(a)*	Same APU as Boeing 737-900
Boeing 787-800	Same APU as Boeing 777
Boeing 787-900	Same APU as Boeing 777

(a) As mentioned in Chapter 3, the Airbus A320-NEO and Boeing 737-MAX were not listed in EDMS, and the aircraft operations associated with them were modeled in AEDT. However, because AEDT had no default APU for these aircraft and they were assumed to have the same APU as the A320-200 and B737-900, their APU emissions were modeled in EDMS.

4.3 APU TIMES COMPUTATION METHODOLOGY

4.3.1 Passenger Aircraft

For passenger aircraft operations, the time that an APU unit operates depends on the time that an aircraft spends on the ground with the main engines shut down (also known as gate occupancy time) and whether there is PCA/ground power at the gate.

If a passenger gate is equipped with PCA and ground power, then the APU operates for a minimum period during the start-up, shutdown processes, and push back of the aircraft. FAA guidance recommends a default operating time of seven minutes of APU use per landing-and-takeoff (LTO) cycle for all aircraft parked at gates that provide PCA and electricity (3.5 minutes for attaching PCA hoses and electrical power cables and 3.5 minutes for disconnecting the equipment and pushing back the aircraft.)

For passenger gates that are not electrified, there would be higher APU operating times. It is assumed that the APU operating time is equivalent to the total gate occupancy time. However for flights that remained

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overnight at non-electrified gates, 90 minutes of APU time was assumed for cleaning and light maintenance activities after the flight, and 30 minutes of APU time was assumed for start-up procedures, loading of provisions, and passenger boarding prior to the next day's flight. This approach was also applied to all aircraft that had extended gate occupancy times (greater than 120 minutes). Therefore the longest duration an APU unit would be operating at a gate was 120 minutes. LeighFisher's proprietary gate modeling software was used to determine gate occupancy times and is described in detail in section 4.5.

4.3.2 Cargo Aircraft

All cargo aircraft operating at the Airport are assumed to have an APU except the Cessna 208 Caravan, which is in the air taxi category and transports mail to and from the Airport. Cargo aircraft do not occupy gates, but park at remote positions where they frequently use their APU during loading and unloading operations. Based on interviews with ground personnel at the Airport, an APU time of 40 minutes per cargo LTO was assigned to aircraft.

Remote parking positions for cargo aircraft can be equipped with PCA and ground power. If remote parking positions are electrified, an APU time of seven minutes is assumed per FAA guidance, similar to electrified passenger gates.

4.3.3 General Aviation Aircraft

General aviation aircraft typically do not occupy passenger gates, but the aircraft may still be equipped with APUs.

When it could not be determined exactly which APU was assigned to a specific aircraft, the GTCP 36-100 APU, the APU with the lowest horsepower rating in EDMS, was assigned. Because the APU operating times could not be determined with accuracy, the EDMS default operating time of 26 minutes was assigned to each general aviation aircraft type.

4.4 AVAILABILITY OF PCA AND GROUND POWER

Passenger gate power was available at varying amounts from 2012 - 2040. Cargo aircraft and general aviation aircraft were assumed to have no access to ground power and/or PCA in this study.

4.4.1 Passenger Gate Power

There were 51 operational passenger gates at the Airport in 2012. Thirteen of the gates were equipped with PCA and ground power in 2012 using a VALE Program grant, while all other gates were not included in the VALE Program project and were modeled to reflect that they were not electrified. PCA units supply heated/cooled air to parked aircraft so that passengers are comfortable as they enplane and deplane, and staff can clean and maintain the aircraft. Ground power provides power to aircraft for internal lighting and to ensure continuous power for navigational instruments. When used simultaneously, PCA and converter units enable parked aircraft to forego the use of APUs, resulting in a reduction of both emissions and the associated fuel consumption.

Based on conversations with Authority staff, it was assumed that aircraft had a 50% utilization rate of the PCA and ground power at the passenger gates. .

It was assumed that all of the 51 passenger gates would be electrified by 2017. Therefore from 2017 onwards, all aircraft that park at a passenger gate would have access to PCA and ground power, but would only utilize the electrification equipment 50% of the time.

4.5 PASSENGER GATE OCCUPANCY AND APU TIMES

The gate occupancy times for 2012 were derived from the 2012 OAG flight schedule for passenger aircraft. LeighFisher's proprietary flight matching software was used to match flights to determine the turnaround time for each aircraft. The flight matching software analyzes the following data:

- Flight number
- Local arrival time
- Local departure time
- Airline
- Aircraft type

If the software is unable to match flight numbers, it pairs flights that are the most realistic combinations, based on other identification criteria. Unmatched arrivals and departures were classified as: first flight of the day, last flight of the day or given the same characteristics as similar operations. As stated previously, APU times were a total of 120 minutes for aircraft that remained overnight: 90 minutes to reflect end of day cleaning and routine maintenance activities, and 30 minutes to account for preparing the aircraft for operation. APU times for flights that had extensive gate times during the day were also assumed to be no longer than 120 minutes. Aircraft that were not in operation in 2012 were assigned an APU time equal to the most similar aircraft operating at the Airport in 2012, as follows:

Aircraft	APU Time Based On
Airbus A320-NEO	Airbus A320-200
Airbus A350	Boeing 787-800
Boeing 717	Boeing MD-90
Boeing 737-MAX	Boeing 737-900
Boeing 787-900	Boeing 787-800

Gate occupancy and APU times were aggregated by aircraft type, and are presented in Appendix B, Table B-1.

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4.6 APU EMISSIONS

Table 4-1 shows the estimated emissions associated with aircraft APU activity at the Airport.

Table 4-1
EMISSIONS ASSOCIATED WITH APU ACTIVITY *(Tons)*

Year	NO_x	VOC	CO	SO_x	PM_{10}	$PM_{2.5}$
2012	57.9	3.9	49.0	7.8	6.7	6.7
2017	45.7	3.0	34.2	6.4	5.2	5.2
2020	49.4	4.6	35.0	8.2	6.9	6.9
2030	58.9	11.8	42.2	15.7	14.2	14.2
2040	68.8	18.3	49.7	22.5	20.7	20.7

Source: LeighFisher, February 2016.

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5 GROUND SUPPORT EQUIPMENT

5.1 INTRODUCTION

Ground support Equipment (GSE) encompasses all motorized equipment that is required to service aircraft on the ground during a normal turnaround. This can include handling baggage and pushing back aircraft. It may also include specialized services (e.g., catering trucks, forklifts, etc.). All of the equipment emissions associated with providing these ground support operations are accounted for in this source group. In addition, the utilization of diesel-powered GPUs for aircraft maintenance activities is also accounted for in this inventory.

Baggage Tractor: passenger baggage and some cargo must be transferred to/from gates and from gate to gate. The baggage tractor is the most recognizable type of GSE at an airport. These vehicles are used to transport luggage, mail, and cargo between an aircraft and an airport terminal and/or processing/sorting facilities.

Belt Loader: the belt loader is used to load and unload baggage and cargo into/from an aircraft.

Catering Truck: provision or catering trucks are used to deliver food, drinks, and other supplies to aircraft while on the ground. These trucks tend to be powered by large diesel engines and have lifts in the back to move the storage compartment to the height of the aircraft. Catering trucks are usually owned by airlines and/or flight kitchens.

Pushback Tractor: although an aircraft's engines are capable of moving an aircraft in reverse, this is not typically done for aircraft with jet engines due to the resulting "jet blast" that would occur on the ramp. For this reason, and others, pushback tractors are used to maneuver aircraft away from/out of gates.

Deicing Trucks: deicing trucks are used to spray hot liquid on to aircraft in inclement weather to remove ice buildup and prevent future accumulation of ice. These trucks typically have (1) an engine on the front that is used to move the truck and run pumps and lifts, and (2) a rear engine that heats the deicing liquid. Deicing trucks typically carry a 2,000-gallon tank of deicing liquid, and a 100- to 110-gallon diesel fuel tank to run for an eight- to 10-hour shift.

Lavatory Truck: lavatory trucks and motorized carts are used by airlines to remove restroom waste from aircraft.

Maintenance Lifts: maintenance lifts are used by airlines to raise equipment or people to elevated work areas.

Potable Water Truck: water trucks are used to deliver potable water to aircraft while on the ground. These trucks tend to be powered by diesel engines and look similar to large pickup trucks.

Airline Support Vehicle: vans and small carts are used by airlines to transport employees in and around the secure side of the airfield. These vans include six-passenger minivans, 15-passenger vans, and maintenance vans with no seating. These support vehicles, which are essentially on-road vehicles, are not modeled in this chapter and are accounted for in Chapter 6, Parking and Roadways.

5.2 METHODOLOGY

Modeling GSE emissions requires knowing a piece of equipment's emission factor and its operating parameters. Once these variables are known, annual emissions were estimated for each equipment type by the following formula:

Emissions *=* HP_{avg} *x Load Factor x Annual Hours x Emissions Factor (g/hp hr)*

The variables in the equation were sourced from:

- **The Authority:** the Authority provided the types and quantity of GSE that were on-site in 2013 and 2014, which was required to calculate how many hours a GSE type was used.
- **EDMS:** the system contains a listing of GSE with default values for each piece of equipment, which includes horsepower, load factor, and operating time (annual hours).
- **CARB 2011 Inventory Model for In-Use Off-Road Equipment (OFFROAD):** this model contains detailed data about California's off-road vehicle fleet by air basin for the airport ground support sector, including age, horsepower, load factor, and annual emissions. This data was used to calculate emission factors in grams per horsepower hour (g/hp hr) for GSE specific to the San Diego Air Basin.

5.2.1 Equipment Population

The Authority provided an inventory of GSE operating on-site in 2013 and 2014, displayed in Table 5-1. In addition to the GSE listed in Table 5-1, there were 94 pieces of electric GSE (eGSE) operating at the Airport in 2013, and 123 pieces in 2014. The Baseline year's (2012) GSE was assumed to be the average of the 2013 and 2014 GSE inventory provided by the Authority. This Baseline GSE count was required to calculate the total hours each piece of GSE was used in a year, which is described in section 5.2.2.

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Table 5-1
AIRPORT GSE INVENTORY

Non eGSE Equipment Type	2013	2014	2013 – 2014 Average
AC Unit	0	5	2.5
Air Start	12	10	11.0
APU	22	6	14.0
Baggage Tug	74	66	70.0
Belt Loader	41	39	40.0
Cabin Service	5	2	3.5
Cargo Belt Loader	17	7	12.0
Cart	0	1	0.5
Catering Truck	16	20	18.0
Container Loader	8	4	6.0
Deicer	1	2	1.5
Forklift	13	12	12.5
Fuel Truck	26	18	22.0
Generator	20	35	27.5
GPU	21	29	25.0
Lavatory Truck	15	12	13.5
Lift	34	25	29.5
Passenger Stand	6	10	8.0
Push Back Tug –N *(a)*	42	38	39.8
Push Back Tug –W *(a)*	1	1	1.2
Sweepers	3	4	3.5
Water Service	1	0	0.5
Non-eGSE Total	378	346	362.0
eGSE	94	123	
Total GSE	472	469	

Note: Numbers may not add due to rounding.

(a) The Airport's "Push Back Tug" count was distributed into two different tug types: narrow body and wide body. 97% were assigned to a narrow body pushback tug, and 3% were assigned to a wide body pushback tug. The ratio at which they were distributed is equal to the ratio of narrow body aircraft operations to wide body aircraft operations at the Airport in 2012.

Source: San Diego International Airport, LeighFisher, February 2016

5.2.2 Emission Equation Variables

5.2.2.1 Equipment Operating Parameters

The equipment operating parameters were sourced from EDMS. Each piece of GSE in EDMS has a default horsepower, load factor, and operating time, described below:

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Operating Time: refers to the annual utilization time of the equipment. Depending on the type of equipment, it can be in annual hours or annual miles travelled.

Horsepower: refers to the power rating of the engine. Generally speaking, as the horsepower increases, so do the emissions.

Load Factor: refers to the time-weighted average of engine utilization relative to full power.

Before identifying the parameters, the equipment types listed in the Airport GSE inventory were mapped using professional judgment to the GSE types in EDMS, since they did not align perfectly. The Airport and EDMS equipment linkages are displayed in Table 5-2.

Table 5-2
AIRPORT GSE MAPPED TO EDMS GSE

Airport Equipment Type	EDMS GSE Equipment Type
AC Unit	Air Conditioner
Air Start	Air Start
APU	Ground Power Unit
Baggage Tug	Baggage Tractor
Belt Loader	Belt Loader
Cabin Service	Cabin Service Truck
Cargo Belt Loader	Cargo Loader
Cart	Cart
Catering Truck	Catering Truck
Container Loader	Cargo Loader
Deicer	Deicer
Forklift	Fork Lift
Fuel Truck	Fuel Truck
Generator	Generator
GPU	Ground Power Unit
Lavatory Truck	Lavatory Truck
Lift	Lift
Passenger Stand	Passenger Stand
Push Back Tug –N	Aircraft Tractor Narrow Body *(a)*
Push Back Tug –W	Aircraft Tractor Wide Body *(b)*
Sweepers	Sweeper
Water Service	Water Service

(a) The Aircraft Tractor selected for narrow body aircraft was rated at 190 HP.
(b) The Aircraft Tractor selected for wide body aircraft was rated at 617 HP.

Source: San Diego International Airport.
Source: LeighFisher, February 2016.

Once the Airport's GSE was accounted for in EDMS, each piece of equipment was assigned the default EDMS parameters for annual operating time (hours), horsepower, and load factor, as listed in Table 5-3. The

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annual operating time was applied to the GSE count listed in Table 5-1 to get the total annual operating hours for each piece of GSE at the Airport in the Baseline Year (2012), listed in Table 5-3. The annual operating time was the only parameter to change over the study timeframe; annual use grew at the same rate as the Airport's operations were forecasted to grow based on the Airport Development Plan. The forecasted growth and forecasted annual hours of use for each piece of GSE are listed in Tables 5-4 and 5-5, respectively. Load factor and horsepower were assumed to remain constant throughout the study.

Table 5-3
EDMS PARAMETERS FOR AIRPORT GSE

EDMS GSE Equipment Type	Horsepower	Load Factor	Operating Time (hours / year)
Air Conditioner	300	0.75	808
Air Start	425	0.90	333
Aircraft Tractor - Narrow Body	190	0.80	628
Aircraft Tractor - Wide Body	617	0.80	641
Baggage Tractor	71	0.55	1,500
Belt Loader	71	0.50	1,300
Cabin Service Truck	71	0.53	1,600
Cargo Loader	80	0.50	1,100
Cart	25	0.50	100
Catering Truck	71	0.53	1,600
Deicer	263	0.95	500
Fork Lift	55	0.30	976
Fuel Truck	300	0.25	564
Generator	158	0.50	1,630
Ground Power Unit	194	0.75	1,700
Lavatory Truck	56	0.25	1,492
Lift	115	0.50	341
Passenger Stand	65	0.57	188
Sweeper	53	0.51	12
Water Service	235	0.20	924

Source: EDMS, LeighFisher, February 2016.

Table 5-4
AIRPORT FLIGHT OPERATIONS GROWTH RATE

	2012 -2017	2017 -2020	2020 – 2030	2030 – 2040
Growth Rate	6.0%	3.8%	12.4%	9.4%

Source LeighFisher, February 2016.
Source: Airport Development Plan.

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Table 5-5
Non eGSE ANNUAL HOURS OF USE

EDMS GSE Equipment Type	2012	2017	2020	2030	2040
Air Conditioner	2,020	2,141	2,223	2,497	2,732
Air Start	3,663	3,882	4,031	4,529	4,954
Aircraft Tractor - Narrow Body	24,976	26,472	27,483	30,877	33,775
Aircraft Tractor - Wide Body	788	836	868	975	1,066
Baggage Tractor	105,000	111,290	115,540	129,809	141,993
Belt Loader	52,000	55,115	57,220	64,287	70,320
Cabin Service Truck	5,600	5,935	6,162	6,923	7,573
Cargo Loader	19,800	20,986	21,787	24,478	26,776
Cart	50	53	55	62	68
Catering Truck	28,800	30,525	31,691	35,605	38,947
Deicer	750	795	825	927	1,014
Fork Lift	12,200	12,931	13,425	15,083	16,498
Fuel Truck	12,408	13,151	13,654	15,340	16,780
Generator	44,825	47,510	49,324	55,416	60,618
Ground Power Unit	66,300	70,271	72,955	81,965	89,659
Lavatory Truck	20,142	21,349	22,164	24,901	27,238
Lift	10,060	10,662	11,069	12,436	13,604
Passenger Stand	1,504	1,594	1,655	1,859	2,034
Sweeper	42	45	46	52	57
Water Service	462	490	508	571	625
Total	411,389	436,032	452,683	508,593	556,328

Note: Numbers may not add due to rounding.

Source: LeighFisher, February 2016.

5.2.2.1 Equipment Emission Factors

GSE emission factors were calculated from the OFFROAD model. The model contains data submitted by off-road equipment users, and has a specific category for "Airport Ground Support." Key pieces of data in this model that improved the emission factors used in this study are age and location of the equipment. Age is important because as the equipment gets older the engine can degrade and emit more pollutants, and tightening emission standards over the years has greatly reduced emissions, and continues to do so. The location data allows for equipment to be filtered by air basin, providing a more accurate age distribution for the equipment operating at the Airport.

To get the emission factors, the model was configured to calculate the annual amount of NO_x, particulate matter, and hydrocarbons by each Aircraft Ground Support vehicle from the San Diego Air Basin in 2012, 2017, 2020, and 2029. 2029 was the furthest into the future the OFFROAD model forecasted emissions. The two maintenance study years used the 2029 OFFROAD forecasted emission factors. The OFFROAD model does not specify what level of PM is measured in the model. Therefore for purposes of this report, PM as reported by OFFROAD is assumed to be TSP.

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The OFFROAD output, displayed in Appendix C Table C-1 lists the total emissions and the operating parameters for each year by equipment type. This level of granular information made it possible to calculate emission factors for GSE that is more likely to be operating at the Airport than the EDMS default emission factors. The following equation was used to calculate the emission factors specific to Airport Ground Support equipment in the San Diego Air Basin in tons per horsepower hour:

$$Emission\ Factor = Pollutant \div Total\ Annual\ Activity \div Load\ Factor \div HP_{avg}$$

The emission factors are presented in grams per horsepower hour, a more standard format than tons per horsepower hour, on the right hand side of Table C-1 in Appendix C. The hydrocarbon emission factor was converted to a VOC emission factor using EPA's suggested conversion factor, 1.053.

The final step to estimate the GSE emissions at the Airport was combining the operational parameters from EDMS with the emission factors from the OFFROAD model for each equipment type. To do so, the EDMS equipment types and OFFROAD equipment types were aligned using professional judgement. Table 5-6 displays the mapping convention used to link the two systems' equipment types. Once the two systems' equipment types were aligned, each equipment type had operational parameters and emission factors that were required to estimate GSE emissions at the Airport. Tables C-3 through C-7 list the operating parameters, emission factors, and total emissions for each piece of equipment throughout the study period.

Table 5-6
CARB EMISSION FACTORS MAPPED TO EDMS GSE TYPE

EDMS GSE Type	OFFROAD GSE Type
Air Conditioner	Bobtail
Air Start	A/C Tug Wide Body
Aircraft Tractor	A/C Tug Narrow Body
Baggage Tractor	Baggage Tug
Belt Loader	Belt Loader
Cabin Service Truck	Passenger Stand
Cargo Loader	Cargo Loader
Cart	Baggage Tug
Catering Truck	Passenger Stand
Deicer	Bobtail
Fork Lift	Forklift (GSE)
Fuel Truck	Passenger Stand
Generator	Bobtail
Ground Power Unit	Bobtail
Lavatory Truck	Passenger Stand
Lift	Lift (GSE)
Passenger Stand	Passenger Stand
Sweeper	Bobtail
Water Service	Passenger Stand

Source: LeighFisher, February 2016.

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5.3 ESTIMATED EMISSIONS

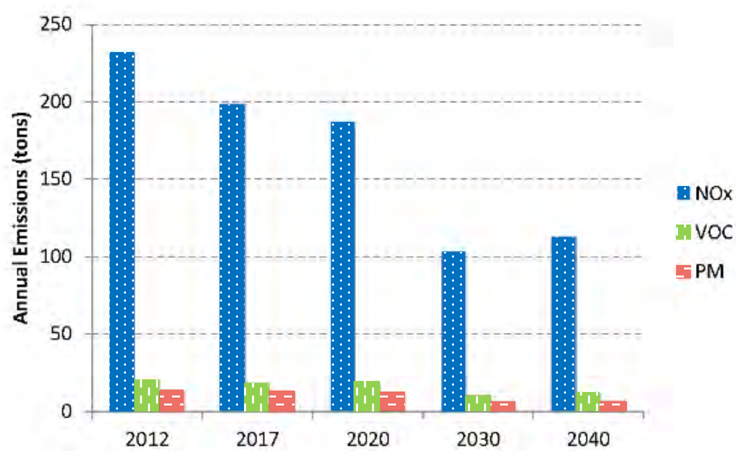
Table 5-7 and Figure 5-1 show the estimated emissions associated with GSE activity at the Airport for all study years. Detailed data for emissions is listed in Appendix C, Tables C-3 through C-7.

Table 5-7
ANNUAL AIRPORT GSE EMISSIONS

Year	NO_x	VOC	TSP
2012	231.5	20.2	13.1
2017	198.7	18.4	12.5
2020	187.4	17.7	11.9
2030	103.3	10.9	6.0
2040	113.0	11.9	6.5

Source: LeighFisher, February 2016.

Figure 5-1
ANNUAL GSE EMISSIONS
San Diego International Airport



Source: LeighFisher, February 2016.

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6 ROADWAYS AND PARKING

6.1 INTRODUCTION

Airport-related, on-road emissions from passenger and commercial vehicles can be categorized as those that take place "on-airport" and those that take place "off-airport". On-airport roadway emissions take place on airport roadways, feeder ramps, curbsides, cargo access roads, and parking facilities that exist on airport property. Airport-related off-airport roadway emissions take place on federal, state, and local roadways that provide origin and destination traffic access to/from some point in the region to/from the Airport. Airport-related, off-airport emissions are produced by passengers and cargo traveling throughout the county with the intent to depart from, or arrive at, the Airport. These emissions represent only a portion of the emissions produced on County roadways. Parking facility emissions refer to emissions from vehicles in Authority-owned parking facilities.

6.2 APPROACH & METHODOLOGY

Emissions from roadways and parking facilities were estimated in accordance with CARB's EMFAC 2014 emissions inventory model. At the time of study, EMFAC 2014 is the most-recently-available estimate of on-road vehicle emissions in California with county-level emissions for 42 classes of vehicles. EMFAC uses emission coefficients for criteria air pollutants and has assumptions regarding the mix of vehicle types, age, fuels, and driving speeds that are specific to the County. It also includes assumptions for combustion, resting loss/evaporation, and particulates from brake and tire degradation. The key steps were:

1. Identify sources of roadway and parking emissions for vehicles using the Airport
2. Estimate vehicle miles traveled (VMT) for each source occurring on on-Airport and off-Airport roadways, and in parking facilities
3. Multiply VMT for each source by pollutant emission factors, measured in tons of pollutant/VMT and derived from EMFAC 2014

By using VMT as the basis for determining Airport-related vehicle emissions, the methodology results in emission estimates using the same mix of vehicle types, ages, fuels, and driving speeds as the County-wide fleet provided in EMFAC 2014.

EMFAC provides an emissions factor for Reactive Organic Gases (ROG), and not for VOCs. Literature suggests that VOCs are often used in place of one another in California emissions modeling, and therefore ROG emissions in this chapter are reported as VOCs[1].

6.3 VEHICLE CATEGORIES

For this inventory, 11 source categories of roadway and parking emissions are considered. The sources were identified based on available data, industry standards, observation, and professional judgement and are defined by type(s) of vehicles, location of emissions, and methods used to estimate emissions. Table 6-1 lists each of the vehicle source categories, with a description, the applicability of the class to either roadways or parking, and the corresponding EMFAC vehicle types.

1 AQMD: Rule 2202 – On-Road Motor Vehicle Mitigation Options Emission Factor Methodology. Page 2.

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Table 6-1
VEHICLE CLASSES USED AT THE AIRPORT

Vehicle Class	Descriptions	Location	EMFAC Vehicle Type
Private Vehicles - Passengers	Privately-owned cars, SUVs, and light trucks that transport passengers to/from the Airport and their points of origin and destination	On-Airport and off-Airport roadways, parking facilities	LDA, LDT1, LDT2, LHD1, MCY
Rental Cars	Rented vehicles that transport passengers to/from the Airport and their points of origin and destination	On-Airport and off-Airport roadways, parking facilities	LDA, LDT1, LDT2, LHD1, MCY
Taxis / Limousines	Livery vehicles that transport passengers to/from the Airport and their points of origin and destination	On-Airport and off-Airport roadways	LDA, LDT1, LDT2, LHD1, MCY
Shared Ride Vans / Charters	Commercially-owned vans and buses that transport passengers to/from the Airport and their points of origin and destination	On-Airport and off-Airport roadways	LDA, LDT1, LDT2, LHD1, MCY
Private Vehicles - Employees	Privately-owned cars, SUVs, and light trucks that transport employees to/from the Airport and their points of origin and destination	On-Airport and off-Airport roadways, parking facilities	LDA, LDT1, LDT2, LHD1, MCY
Public Transit	Public buses owned by San Diego County MTS used by passengers and employees to travel to/from the Airport	On-Airport and off-Airport roadways	UBUS
Authority-Owned Shuttles	Authority-owned buses and modified trucks that provide shuttle service to employees and passengers at the Airport	On-Airport and off-Airport roadways	LDH2, MDV, SBUS, Motor Coach, OBUS, All Other Buses
Off-Airport Shuttles	Private commercial buses and modified trucks that provide shuttle services to Airport passengers	On-Airport and off-Airport roadways	LDH2, MDV, SBUS, Motor Coach, OBUS, All Other Buses
Cargo Vans	Commercial vans used to move cargo between the Airport and regional warehouses	On-Airport and off-Airport roadways	LDH2, MDV, SBUS, Motor Coach, OBUS, All Other Buses
Cargo Trucks	Commercial trucks used to move cargo between the Airport and regional warehouses	On-Airport and off-Airport roadways	T6 Instate Heavy, T6 OOS Heavy, T7 NNOOS, T7 NOOS, T7 Other Port, T7 POLA, T7 Tractor
Maintenance Vehicles and Other	Authority-owned light and medium-duty trucks that perform maintenance at the Airport	On-Airport roadways	LDH2, MDV, SBUS, Motor Coach, OBUS, All Other Buses

Source: LeighFisher, February 2016.

6.4 ROADWAY EMISSIONS – BASELINE YEAR

Total VMT was estimated for each vehicle class as the product of the total number of annual trips and the average trip length.

$$Total\ VMT_{class} = Total\ Trips_{class} \times Average\ Trip\ Length_{class}$$

6.4.1 Vehicle Trips

Total vehicle trips are presented in Table 6-2. These estimates were developed for each vehicle class using sources of data available for that class, including forecasts developed under the 2012 Airport Development Plan, the 2012 Airport Passenger Survey, and professional judgement. The methodology and derivation of estimates are presented in subsequent sections.

Table 6-2
TOTAL VEHICLE TRIPS

Total Trips	2012
Private Vehicles - Passengers	4,853,259
Rental Cars	963,332
Taxis / Limousines	1,479,636
Shared Ride Vans / Charters	171,491
Private Vehicles - Employees	1,756,155
Cargo Trucks	20,402
Cargo Vans	18,158
Public Transit	20,759
Authority-Owned Shuttles	295,000
Off-Airport Shuttles	1,041,000
Maintenance & Other Vehicles	594,000
Total	11,213,193

Note: Numbers may not add due to rounding.

Source: LeighFisher, February 2016.

6.4.1.1 Trips for Private Vehicles, Rental Cars, and On-Demand Passenger Transportation

Vehicle trips for private passenger vehicles, rental cars, and on-demand passenger ground transportation services, including taxis, limousines, shared ride vans, and charter buses, are presented together because each uses the same methodology to estimate vehicle trips. For these vehicle classes, total trips are the product of total originating enplanements from the 2012 Airport Development Plan passenger forecast, the ground transportation mode split provided by the 2012 Airport Passenger Survey, and the estimated vehicle trips per passenger by vehicle class.

$$Total\ Trips_{class} = Originating\ Enplanements \times Survey\ Mode\ Share_{class} \times Vehicle\ Trips\ per\ Enplanement_{class}$$

Total originating enplanements were obtained from the passenger forecast in the 2012 Airport Development Plan. Originating enplanements are passengers with an initial flight leg starting at the Airport,

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implying that they require local ground transportation services. Table 6-3 summarizes the originating enplanements for the inventory years.

Table 6-3
PASSENGER ENPLANEMENTS

	Year				
	2012	2017	2020	2030	2040
Total Enplanements	8,746,134	9,566,731	10,153,866	12,295,686	14,518,374
Domestic Enplanements	8,496,524	9,232,230	9,785,078	11,694,970	13,539,871
Originating	8,268,906	8,984,903	9,522,941	11,381,667	13,177,145
Connecting	227,617	247,327	262,137	313,302	362,726
International Enplanements	249,610	334,501	368,788	600,716	978,503
Originating	242,923	325,540	358,908	584,623	952,290
Connecting	6,687	8,961	9,880	16,093	26,214
Total Originating	8,511,829	9,310,443	9,881,849	11,966,291	14,129,434
Percent of Baseline	100%	109%	116%	141%	166%

Note: Numbers may not add due to rounding.

Source: 2012 Airport Development Plan.

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Table 6-4 summarizes the ground transportation mode choices and traveling party size provided by respondents to the 2012 Airport Passenger Survey. Choices are grouped into four vehicle classes: (1) personal vehicles, (2) rental cars, (3) taxis and limousines, and (4) shared ride vans and charters. Together, these classes account for 96% of all responses and 95% of originating enplanements. The balance of responses are those that reported the use of vehicles such as public transit and circulating shuttles that are considered later.

Table 6-4
2012 PASSENGER SURVEY – 2012 PASSENGER TRAVEL MODE SPLITS

	Responses		Enplanements		Party
Mode	Count	%	Total	%	Size
Private Vehicle					
Private Vehicle (Parking)	922	12%	1,481	11%	1.61
Private Vehicle (Drop-Off)	3,252	43	4,755	37	1.46
Sub-Total	4,174	55%	6,236	48%	1.49
Rental Car	1,474	19%	3,068	24%	2.08
Taxi / Limousine	1,132	15%	1,727	13%	1.53
Shared Ride Van / Charter					
Shared Ride Van	416	5%	901	7%	2.17
Charter	48	1	433	3	9.02
Sub-Total	464	6%	1,334	10%	2.88
Other-Excluded	336	4%	659	5%	
Total	7,580	100%	13,024	100%	

Note: Numbers may not add due to rounding.

Source: LeighFisher, February 2016.

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Table 6-5 summarizes the number of vehicle trips and trips per originating enplanement by vehicle class. Trips per enplanement were estimated based on party size from the 2012 Airport Passenger Survey, observation, and professional judgement.

Table 6-5
2012 VEHICLE TRIPS

Mode	2012 Enplanements	Trips per Enplanement	Total Trips
Private Vehicle			
Private Vehicle (Parking)	967,907	0.62	602,573
Private Vehicle (Drop-Off)	3,107,628	1.37	4,250,686
Sub-Total	**4,075,535**	**1.19**	**4,853,259**
Rental Car	**2,005,090**	**0.48**	**963,332**
Taxi / Limousine	**1,128,680**	**1.31**	**1,479,636**
Shared Ride Van / Charter			
Shared Ride Van	588,848	0.18	108,751
Charter	282,987	0.22	62,741
Sub-Total	**871,835**	**0.20**	**171,491**
Total	**8,081,140**	**0.92**	**7,467,718**

Note: Numbers may not add due to rounding.

Source: LeighFisher, February 2016.

6.4.1.2 Trips for Cargo Vehicles

Airport cargo operators use trucks and vans to transport cargo to/from the Airport and regional distribution centers. Based upon information gathered during Airport tenant interviews, there are 739 vehicles trips per day (391 trucks and 348 vans) and 38,560 trips per year (20,402 trucks and 18,158 vans), summarized in Table 6-6.

Table 6-6
2012 VEHICLE TRIPS—CARGO OPERATIONS

Cargo Vehicles	Trips per Week	Trips per Year
Trucks	391	20,402
Vans	348	18,158
Total	739	38,560

Source: LeighFisher, February 2016.

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6.4.1.3 Other Vehicle Trips

Other vehicles that travel to, from, and around the Airport include private employee vehicles, public transit, Authority-owned circulator and parking shuttles, maintenance vehicles and off-Airport shuttles, such as those for hotels and off-Airport parking companies. Total trips for these vehicle classes, presented in Table 6-7, are derived from published schedules, a forecast developed for the 2012 Airport Development Plan, and professional judgement.

Table 6-7
BASELINE YEAR VEHICLE TRIPS FOR OTHER VEHICLES

Mode	Total Trips
Private Vehicles – Employees	1,756,155
Public Transit	
MTS Public Bus 992	19,990
MTS Public Bus 923	769
Sub-Total	20,759
Authority-Owned Shuttles	
SAN Parking Shuttle	149,000
Employee Shuttle	73,000
Inter-Terminal Bus	73,000
Sub-Total	295,000
Off-Airport Shuttles	
Courtesy Vehicle (Hotel/Motel)	123,000
Rental Car Shuttles	677,000
Off-Airport Parking Shuttle	241,000
Sub-Total	1,041,000
Maintenance & Other Vehicles	594,000
Total	3,706,914

Note: Numbers may not add due to rounding.

Source: LeighFisher, February 2016.

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6.4.2 Trip Length

The average trip length is defined as the total distance that a vehicle is driven per trip. In order to enable comparison to the SIP's regional emission budget for on-road emissions, trip length was separated into the distance driven on Airport property and the distance driven off-Airport. Average trip lengths are presented in Table 6-8.

Table 6-8
TRIP LENGTH

	Trip Length (mi)		
Vehicle Class	On-Airport	Off-Airport	Total
Private Vehicles – Passengers	1.1	39.0	40.2
Rental Cars	–	23.9	23.9
Taxis / Limousines	0.9	16.1	17.1
Shared Ride Vans / Charters	1.0	25.8	26.8
Private Vehicles – Employees	–	36.3	36.3
Public Transit	2.1	2.1	4.2
Authority-Owned Shuttles	2.0	1.4	3.5
Off-Airport Shuttles	1.4	2.8	4.2
Cargo Trucks	1.2	52.1	53.3
Cargo Vans	1.2	43.0	44.2
Maintenance & Other Vehicles	1.3	–	1.3

Source: LeighFisher, February 2016.

6.4.2.1 On-Airport Distance

On-Airport vehicle travel is considered for two areas of the Airport, (1) roadways near the passenger terminals and (2) the roadway adjacent to the North Ramp cargo area.

- **On-Airport roadways near the passenger terminals** consist of the roadways immediately adjacent to Terminal 1, Terminal 2, and the Commuter Terminal and the interlaced network that connects these roadways to North Harbor Drive as depicted in orange on Figure 6-1 and 6-2.
- **Roadways adjacent to the Airport** include North Harbor Drive and most other roadways adjacent to the Airport and airfield, but not on Airport property.

Emissions from roads in on-Airport parking facilities are included in the estimate of parking facility emissions in Section 6-6.

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Figure 6-1
ON-AIRPORT TERMINAL ROADWAYS

Source: LeighFisher, February 2016.

The on-Airport roadway adjacent to the cargo ramp consists of a short distance between the turnoff near the intersection of Wood and West Washington streets and the cargo staging areas along the north ramp.

Figure 6-2
CARGO AREA ON-AIRPORT ROADWAYS

Source: LeighFisher, February 2016.

The on-Airport trip distances shown in Table 6-8 were estimated using a combination of remote sensing, physical observation, and professional judgement for trips on the passenger terminal and cargo area roadways. Factors considered include the number of passenger vehicles that drop off passengers as compared to using a parking facility, observed routes to the three passenger terminals, a weighting of trips to terminals, and anticipated recirculation rates. Rental cars are assumed to have no on-Airport trip distance as all rental car facilities are currently located off-Airport.

6.4.2.2 Off-Airport Distance

For off-Airport travel legs, the trip distance is measured as the round trip route from the point of origin to a destination point at the edge of the Airport property. The points of origin are derived from various sources, depending on the vehicle service class. Route choice is that identified by Google Maps™ for travel on a weekday mid-afternoon. For passenger travel originating outside of San Diego County, the point of origin is set to the County boundary along the given route, so that only the VMT that occur in the County are included. The destination point at the edge of the Airport property is assumed to be the intersection of North Harbor Drive and Harbor Island Drive for vehicles using the passenger terminals and the intersection of West Washington Street and Wood Street for cargo vehicles.

Table 6-9 presents the average trip lengths assumed for private vehicles, rental cars, and on-demand passenger transportation. For these classes, the point of origin was derived from the 2012 Airport Passenger Survey.

Table 6-9
OFF-AIRPORT TRIP LENGTH FOR PASSENGER VEHICLES

Mode	Average Distance (mi)
Private Vehicle	
Private Vehicle (Parking)	52.54
Private Vehicle (Drop-Off)	37.06
Weighted Average	40.85
Rental Car	23.90
Taxi / Limousine	16.06
Shared Ride Van / Charter	
Shared Ride Van	25.58
Charter	25.88
Weighted Average	25.60
Other-Excluded	14.37
Weighted Average	31.72

Source: LeighFisher, February 2016.

For cargo vehicles, points of origin are regional cargo processing centers. Based upon interviews with cargo operators, the average off-Airport trip length was estimated to be 52.1 miles for cargo trucks and 43.0 miles for cargo vans. These estimates were based on distances from regional cargo centers in San Diego, Riverside, and Imperial counties to the intersection of West Washington Street and Wood Street, weighted by the expected number of vehicle trips to each center. As with passenger vehicles, only the portion of travel that occurs inside the County is considered.

For the remaining vehicle classes, the points of origin for vehicle trips were set according to anticipated route destinations and the off-Airport trip length as follows:

- For private employee vehicles, the points of origin were determined using the centroid of the employee home ZIP code. As with passenger and cargo vehicles, only the portion of travel within the air basin is considered.
- For public transit route with the Airport as a terminus, the off-Airport distance was measured using Google Maps™ as the distance from the intersection of North Harbor Drive and Harbor Island Drive to the nearest major stops, which were either North Harbor Drive and Rosecrans Street (3.4 mi.) or Hawthorne Street and the Pacific Highway (2.0 mi.), weighted by the share of trips listed in the 2014 Metropolitan Transit System schedule.
- For Authority-owned shuttles, the off-Airport distance is the distance traveled on the off-Airport road for an expected route.

- For off-Airport shuttles, off-Airport trip length assumes that vehicles travel to downtown or the private parking lots to the east and southwest of the Airport.
- Maintenance vehicles were assigned no off-Airport trip length

6.4.3 Air Pollutant Emissions

Air pollutant emissions are calculated as the product of the VMT for each vehicle class and an emissions coefficient, expressed in tons of pollutant per distance traveled, derived from the EMFAC 2014 inventory for the corresponding vehicle categories, or:

$$Emissions_{pollutant,\, class} = VMT_{class} \times EMFAC\ Emissions_{pollutant,\, class} \div EMFAC\ VMT_{class}$$

EMFAC 2014 reports both VMT and emissions as daily average values, not annual totals. As these two factors are divided against each other in the calculation, the difference is inconsequential.

Appendix D, Tables D1-D5 present the emissions coefficients for each vehicle class. The coefficients were derived from EMFAC 2014 by dividing the total 2012 emissions in EMFAC 2014 for the pollutants included in this study by the corresponding VMT.

Vehicle roadways emissions for Airport-related vehicle trips are presented in detail in Appendix D, Table D-6 through D-10.

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6.5 ROADWAYS EMISSIONS FOR FORECAST YEARS

Emissions estimates for inventory forecast years employ the same methodology as the baseline year.

6.5.1 Vehicle Trips

As with the baseline year, VMT are estimated as the product of vehicle trips and the estimated trip distance. Vehicle trips are shown in Table 6-10 and are estimated to grow in proportion to the originating enplanements forecast as part of the 2012 Airport Development Plan.

Table 6-10
VEHICLE TRIPS

	Year				
Vehicle Class	2012	2017	2020	2030	2040
Private Vehicles - Passengers	4,853,259	5,308,611	5,634,414	6,822,917	8,056,295
Rental Cars	963,332	1,053,716	1,118,385	1,354,293	1,599,108
Taxis / Limousines	1,479,636	1,618,462	1,717,791	2,080,135	2,456,161
Shared Ride Vans / Charters	171,491	187,581	199,094	241,090	284,672
Private Vehicles - Employees	1,756,155	1,920,925	2,038,817	2,468,877	2,915,176
Public Transit	20,759	20,759	20,759	20,759	20,759
Authority-Owned Shuttles	295,000	322,678	342,482	414,724	489,693
Off-Airport Shuttles	1,041,000	1,138,671	1,208,554	1,463,482	1,728,035
Cargo Trucks	20,402	22,316	23,686	28,682	33,867
Cargo Vans	18,158	19,862	21,081	25,527	30,142
Maintenance & Other Vehicles	594,000	649,731	689,607	835,070	986,026
Total	11,213,193	12,263,312	13,014,669	15,755,557	18,599,933

Note: Numbers may not add due to rounding.

Source: LeighFisher, February 2016.

6.5.2 Trip Length

On- and off-Airport trip lengths for the forecast years for most vehicle classes are assumed to be the same as for the baseline year. The exception is for vehicles that are expected to use the new, on-Airport, consolidated rental car center (RCC), which is anticipated to be completed in 2016. When complete, the RCC will be used by various rental car companies that are currently located off-Airport, resulting in new routes for some Airport shuttles and additional, on-Airport travel or rental vehicles.

Figure 6-3 shows the planned location of the RCC, as well as the on-Airport roadways that will be used by vehicles accessing the RCC.

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Figure 6-3
PLANNED RCC FACILITY LOCATION

Source: LeighFisher, February 2016.

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Table 6-11 shows the estimated trip lengths for rental cars and off-Airport shuttles, which are estimated to experience route changes due to the RCC. For all other vehicle classes, the on- and off-Airport trip lengths in the forecast years are assumed to be identical to the baseline year.

Table 6-11
TRIP LENGTHS
(miles)

	Year				
	2012	2017	2020	2030	2040
Rental Cars					
On-Airport	0.0	0.3	0.3	0.3	0.3
Off-Airport	23.9	23.9	23.9	23.9	23.9
Total	23.9	24.2	24.2	24.2	24.2
Off-Airport Shuttles					
On-Airport	1.4	3.7	3.7	3.7	3.7
Off-Airport	2.8	2.1	2.1	2.1	2.1
Total	4.2	5.8	5.8	5.8	5.8

Source: LeighFisher, February 2016.

6.5.3 Emissions Coefficients

Emissions coefficients for the forecast years are estimated using EMFAC in an identical manner to the baseline year. As EMFAC adjusts the inventory for changes in the vehicle fleet over time, the coefficients are different for each year. Tables D-1 through D-5 in Appendix D provide the coefficients for the inventory years.

6.5.4 Air Pollutant Emissions

Tables D-6 through D-10 in Appendix D provide detailed emissions data for roadways for the study timeframe by vehicle class. Table 6-12 presents a summarized emissions total for roadways.

Table 6-12
ROADWAY EMISSIONS SUMMARY

	Emissions (Tons)					
Year	NO_x	VOC	CO	SO_x	PM_{10}	$PM_{2.5}$
2012	152.2	132.1	1,048.9	1.5	18.3	8.3
2017	95.1	87.1	662.0	1.5	19.1	8.2
2020	74.9	72.5	529.8	1.4	20.1	8.6
2030	41.2	57.5	392.8	1.2	23.7	9.9
2040	35.6	51.3	375.6	1.2	27.5	11.3

Source: LeighFisher, February 2016

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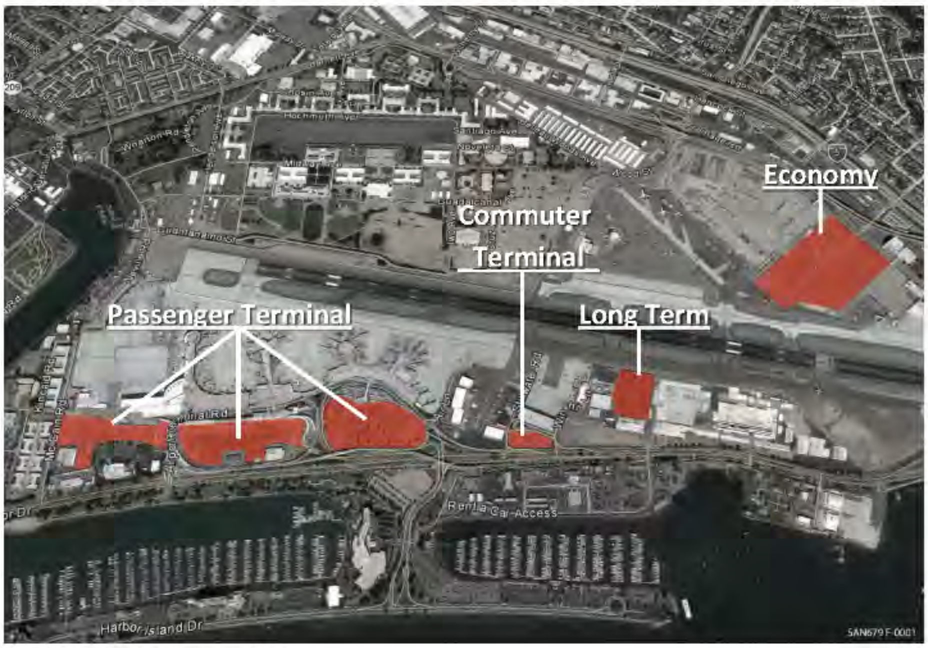
6.6 PARKING FACILITY EMISSIONS – BASELINE YEAR

This inventory includes emissions from vehicles in Authority-owned parking facilities, including parking lots at the passenger terminals, long-term parking lots, and the economy lot. Figure 6-4 shows the location of Airport parking facilities for the baseline year.

Figure 6-4
EXISTING AUTHORITY-OWNED PARKING FACILITIES



Source: LeighFisher, February 2016.

The methodology used to estimate emissions in Airport parking facilities is similar to that for roadways: emissions are calculated as the product of VMT within the parking facilities and emissions coefficients derived from EMFAC 2014. The emissions coefficients for the vehicle classes are identical to those used to determine roadway emissions, as the coefficients are expressed in units of tons per VMT.

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6.6.1 VMT in Parking Facilities

VMT is calculated as the product of the number of vehicles that use the Airport parking lots and the average VMT per use. Of the eleven vehicle classes, only two are considered to use the parking facilities: privately owned vehicles used by either passengers or Airport workers. Emissions from Authority-owned shuttles that serve the parking facilities were included in the on-Airport emissions in section 6.4.

For passenger traffic, the count of vehicles using the parking facilities is based upon estimates developed for the 2012 Airport Development Plan. These estimates are different than those derived from 2012 Airport Passenger Survey for use in roadways and may reflect vehicles that dropped off passengers before subsequently parking. For employee traffic, the count of vehicles using Airport parking lots is estimated based on the number of issued employee parking badges and professional judgement.

The average VMT per use of the parking facilities was estimated using a combination of remote sensing, physical observation, and professional judgement. The VMT for passenger and employee vehicles differ slightly as the parking facility usage distribution is expected to differ between the two types of traffic.

Table 6-13 provides the estimated usage, VMT per use, and total VMT for the parking facilities in the baseline year (2012).

Table 6-13
PARKING FACILITY VMT

	Private Vehicles (Passengers)	Private Vehicles (Employees)	Total
Total Usage	1,932,185	1,756,155	3,688,340
VMT / Use	0.95	0.87	0.91
Total VMT	1,833,751	1,532,601	3,366,352

Source: LeighFisher, February 2016.

6.6.2 Emissions from Parking Facilities

Table 6-14 in the next section provides the baseline emissions from parking facilities in tons of pollutant.

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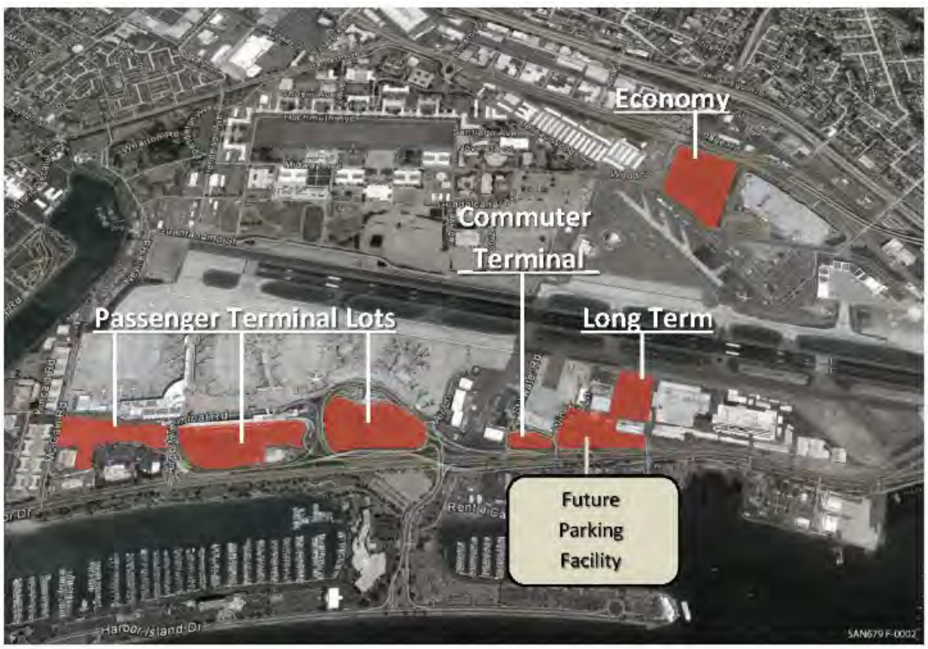
6.7 PARKING FACILITY EMISSIONS – FORECAST YEARS

6.7.1 Parking Facility Emissions – Methodology

Emissions for the forecast years are estimated using a methodology similar to the baseline year. Figure 6-5 illustrates the location of parking facilities assumed for forecast years. Appendix D, Table D-11 and Table D-12 list estimated usage, VMT per use, and total VMT for the parking facilities in all study years.

Figure 6-5
AUTHORITY-OWNED PARKING FACILITIES INCLUDED IN FORECAST YEARS



Source: LeighFisher, February 2016.

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6.7.2 Parking Facility Emissions

The emissions for the study timeframe years are listed in Table 6-14.

Table 6-14
PARKING FACILITY EMISSIONS
Tons

Year	NO_x	VOC	CO	SO_x	PM_{10}	$PM_{2.5}$
2012	1.4	1.4	11.0	>0.0	0.2	0.1
2017	0.9	0.9	6.9	>0.0	0.2	0.1
2020	0.7	0.8	5.5	>0.0	0.2	0.1
2030	0.4	0.6	4.1	>0.0	0.3	0.1
2040	0.3	0.5	3.9	>0.0	0.3	0.1

Source: LeighFisher, February 2016.

6.8 ROADWAY AND PARKING FACILITY EMISSIONS

Table 6-15 presents the total emissions from roadways and parking facilities. Detailed emissions for each year are listed in Appendix D, Table D-13.

Table 6-15
ROADWAYS AND PARKING FACILITY EMISSIONS
Tons

Year	NO_x	VOC	CO	SO_x	PM_{10}	$PM_{2.5}$
2012	153.6	133.4	1,059.9	1.5	18.4	8.4
2017	96.0	88.0	668.8	1.5	19.3	8.3
2020	74.7	73.2	535.3	1.4	20.3	8.7
2030	41.6	58.1	396.9	1.2	24.0	10.0
2040	36.0	51.9	379.6	1.2	27.8	11.4

Source: LeighFisher, February 2016.

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7. CONSTRUCTION ACTIVITIES

7.1 INTRODUCTION

Airport construction projects can be classified as either growth projects, where a major construction or expansion project is undertaken at the Airport (e.g. lengthening a runway or building a new terminal), or as routine, where day-to-day maintenance projects are undertaken (e.g. repaving taxiways and building or demolishing small structures). This emissions inventory includes both future growth projects, recommended in the Airport Development Plan, and routine construction activities that are performed on a day-to-day basis at the Airport.

7.2 METHODOLOGY

Modeling construction emissions required knowing a piece of equipment's operating parameters and emission factors. Once these variables were known, annual emissions were estimated for each equipment type by the following formula:

Emissions = Equipment Population x HP_{avg} x Load Factor x Annual Hours x Emissions Factor (g/HP-Hr)

The variables in the construction emissions equation were sourced from:

- **ACEIT:** ACEIT is a tool that was developed as part of an ACRP project on estimation of airport construction emissions (ACRP Report 102, Guidance for Estimating Airport Construction Emissions, 2014). It contains a listing of construction equipment with key default operating parameters – horsepower, load factor, and operating time (annual hours) – that are specific to airport projects.
- **CARB 2011 Inventory Model for In-Use Off-Road Equipment (OFFROAD):** this model contains detailed data about California's off-road vehicle fleet by air basin for the Construction and Mining sector, including age, horsepower, load factor, and annual emissions. This was used to calculate emission factors for the construction equipment specific to the San Diego Air Basin.

7.2.1 Operating Parameters

7.2.1.1 Baseline Routine Construction Projects

Because routine construction projects can vary from year to year, the most accurate way to capture the full spectrum of projects is to examine an extended time period, with the average of that time period representing a typical year's worth of routine construction projects. Environmental documents filed with the FAA (Categorical Exclusion, Environmental Assessment, etc.) by the Authority provided information on 13 projects listed in Table 7-1 for which environmental documentation was filed over the five-year time period 2010 to 2014.

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Table 7-1
RECENT CONSTRUCTION PROJECTS CONSIDERED ROUTINE

1. Construction of new Airport Park Pacific Highway Lot
2. Reconfiguration and Expansion of the Airport Park Pacific Highway Lot
3. Demolition of Small Storage Building
4. Terminal 2 East Improvements
5. Construction of a Receiving and Distribution Warehouse
6. Reconfiguration and Expansion of the Airport Park Harbor Drive Lot
7. Construction of an Airport Electrical Distribution System
8. Demolition of a Closed Pedestrian Bridge over Pacific Highway
9. Demolition of Existing General Aviation Facility and Construction of New Facility
10. Construction of an Overflow Rental Car Parking and Overflow Valet
11. Relocation of Existing 42-inch Storm Drain
12. Relocation of Runway 9 Displaced Threshold
13. Demolition of World Trade Center Building

Source: San Diego County Regional Airport Authority, 2010 – 2014 environmental filings with Federal Aviation Administration.

The environmental filings provided information on the size and scope of the routine construction at the Airport. This information was then used as input to ACEIT. For each project, ACEIT computed the total operational hours of activity per type of construction equipment. An operational hour is defined as an hour that the piece of construction equipment's engine was running during the project, and therefore responsible for criteria pollutant emissions.

The total hours of activity per type of construction equipment across all routine Airport projects were then summed to aggregate total hours of activity per type of construction equipment, over the five-year period. This provided a five-year total of activity per type of construction equipment. The aggregate total hours of activity per construction equipment were divided by five to determine a five-year average. The five-year total and average operating hours by ACEIT type of construction equipment are provided in Appendix E Table E-1.

Future routine construction emissions were estimated for a forecast year (2017), an anticipated attainment year (2020), and two maintenance years (2030 and 2040). For each milestone year, emissions were calculated assuming that routine construction projects for that year would result in operating hours equal to the five-year average operating hours determined for the baseline year.

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7.2.1.2 Growth Construction Activity Modeling Inputs

The Authority is currently working on an Airport Development Plan. The Airport Development Plan is identifying improvements that will enable the Airport to meet demand through 2035. At the time of this report, the Airport Development Plan Project Team has developed five alternatives that address the need for a replacement to Terminal 1, the need for additional ground transportation facilities and the associated enabling projects. It is expected that the Authority will select a preferred alternative in late 2015. After selection of a preferred concept, a detailed environmental analysis will be conducted. It is expected that the entire planning process will conclude in 2017.

Alternative 4 was selected as a basis for the emissions modeling. The recommended growth construction projects associated with this alternative are listed in Table 7-2. The results of the emissions modeling analysis would not significantly differ if another alternative had been selected as the recommended projects are the same for all five alternatives. There are differences in the size of certain improvements, such as the size of the proposed replacement for Terminal 1, but these differences are small and would not materially impact the emission estimates.

Table 7-2 also provides construction dates for the recommended projects. These dates, used as inputs to ACEIT, were determined based on:

- Facilities required to accommodate future activity levels, as determined in the Airport Development Plan forecasts and facility requirements analyses.
- Phasing constraints and enabling projects.
- Authority priorities–one of the main Authority priorities is the expedited replacement of Terminal 1, which is at the end of its useful life and does not meet the needs of the airlines and the traveling public.

In addition to the Airport Development Plan projects, the emissions related to the runway reconstruction project and the construction of a Terminal 2 parking plaza were calculated. The runway will likely need to be fully reconstructed in the next 15-20 years. During reconstruction, the aircraft would need to operate from a temporary runway. For Taxiway B to serve as this temporary runway, it would need to be strengthened and widened.

The hours associated with construction growth projects are listed in Appendix E Table E-1.

Table 7-2
AIRPORT DEVELOPMENT PLAN RECOMMENDED PROJECTS

Project ID	Project Description	Construction Timeframe
1-8	Construct: Hydrant Fueling System at T2E and T2W	2020
1-10	Construct: Harbor Drive Bypass Road	2024-2027
1-13	Construct: RON Parking Apron (Phase 1)	2024-2025
1-14	Construct: Apron Edge Taxilane (Phase 1 - Eastern End along RON Positions)	2024-2025
1-17	Construct: T1 Parking Plaza	2023-2024
1-21	Construct: T1 Replacement (Eastern Section)	2026-2028
1-24	Demolish: T1	2029
2-3	Construct: T1 Replacement (Central Section)	2029-2031
2-6	Demolish: Commuter Terminal	2031-2032
2-7	Construct: RON Parking Apron (Ultimate Configuration)	2031-2032
2-8	Construct: T1 Replacement Apron (Eastern End of Terminal)	2032-2033
3-1	Construct: T2 West Concourse	2033-2035
3-2	Construct: Belly Cargo Facilities	2035-2036
3-4	Demolish: T2 East	2035
3-5	Construct: T1 Replacement (Western Expansion to Final Configuration)	2036-2037

Note: Some Airport Development Plan projects are considered routine projects and are therefore not included in this list.

Source: LeighFisher, Airport Development Plan, February, 2016.

7.2.2 Emission Factors

Construction equipment emission factors were calculated from the OFFROAD model. The model contains data submitted by off-road equipment users, and has a specific category for "Construction and Mining" equipment. Key pieces of data in this model that improve the emission factor estimate are the age and location of the equipment. Age is important because as the equipment gets older the engine can degrade and emit more pollutants, and tightening emission standards over the years has greatly reduced emissions, and continues to do so. The location data allows for equipment to be filtered by air basin, providing a more accurate age distribution for the equipment operating at the Airport.

To get the emission factors, the model was configured to calculate the annual amount of NO_x, hydrocarbons and PM by each Construction and Mining[2] vehicle type from the San Diego Air Basin in 2012, 2017, 2020, and 2029[3]. The OFFROAD model does not specify what level of PM is measured in the model. Therefore for purposes of this report, PM as reported by OFFROAD is assumed to be TSP.

2 One vehicle type, forklifts, was sourced from the "Industrials" module of the model.
3 The model estimates emissions up until 2029. Therefore, the emission factors for the two maintenance years, 2030 and 2040, used the emission factors from 2029.

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The model results, listed in Appendix E Table E-2, indicate the total emissions and the operating parameters for each year by equipment type. This level of granular information made it possible to calculate emission factors for construction equipment that is more likely to be operating at the Airport than the ACEIT default emission factors. The following equation was used to calculate the emission factors specific to construction equipment in the San Diego Air Basin in tons per horsepower hour:

$$Emission\ Factor\ (T/Hp\ Hr) = Pollutant \div Annual\ Activity \div Population \div Load\ Factor \div HP_{avg}$$

Table E-3 in Appendix E lists the calculated emission factors for each type of OFFROAD equipment over the study timeframe. The factors are presented in grams per horsepower hour, a more standard format than tons per horsepower hour. The hydrocarbon emission factors were converted to volatile organic compounds emission factors using EPA's suggestion conversion factor of 1.053.

The final step to estimate the Airport's construction emissions was combining the operational and usage parameters from ACEIT (horsepower, load factor, and operational hours) with the emission factors from the OFFROAD model. To do so, the ACEIT equipment types and OFFROAD equipment types were aligned using professional judgement. Table E-1 displays the mapping convention used to link the two systems' equipment types. Once the two systems' equipment was aligned, each equipment type had operational parameters and emission factors required to estimate construction emissions at the Airport.

7.3 ESTIMATED EMISSIONS

Table 7-3 and Figure 7-1 show the estimated emissions associated with construction activity at the Airport for the study timeframe.

Table 7-3
ANNUAL CONSTRUCTION EMISSIONS
(Tons)

	Routine Projects			Growth Projects			All Construction Projects		
Pollutant	NO_x	VOC	TSP	NO_x	VOC	TSP	NO_x	VOC	TSP
2012	35.6	2.5	1.48	0.0	0.0	0.00	35.6	2.5	1.48
2017	28.9	2.2	1.19	22.3	1.7	0.94	51.3	3.9	2.14
2020	21.3	1.7	0.84	562.0	44.8	21.9	583.3	46.5	22.8
2030	9.1	1.0	0.29	235.0	25.7	7.2	244.1	26.7	7.5
2040	9.1	1.0	0.29	235.0	25.7	7.2	244.1	26.7	7.5

Source: LeighFisher, February 2016.

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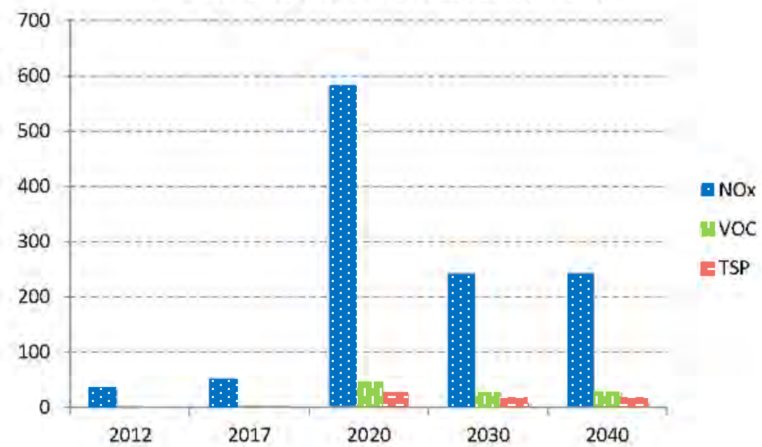
Figure 7-1
ANNUAL CONSTRUCTION EMISSIONS (Tons)



Source: LeighFisher, February 2016.

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8 KEY STATIONARY SOURCES

8.1 INTRODUCTION

This inventory considered only key stationary sources, which include emissions from Authority-owned, or aviation-specific stationary sources on Airport property. Stationary source emissions included in this analysis includes:

- Authority-owned natural gas boilers
- Authority-owned emergency diesel generators,
- Jet A fuel tank storage
- Paint used for airfield marking.

There were additional stationary sources located at the Airport, such as painting booths and training fires, but they were not included in this study due to the lack of readily available data. Additionally, data related to the storage of aviation gasoline and motor gasoline was not collected. It should be noted that, with the exception of Jet A fuel storage tanks, which are owned by Allied Aviation, the key stationary sources are owned and operated by the Authority. This inventory did not collect stationary source data pertaining to Airport tenants. All stationary source emissions on Airport property are also included in the County stationary source budget.

8.2 EMISSIONS ESTIMATION METHODOLOGY

EDMS databases contain emission factors for a large number of combustion and non-combustion stationary source categories typically found at airports. Each of these categories is further divided into sub-categories based on type of fuel consumed, equipment type, or the pollutant emitted. For example, fuel storage tanks have different emission factors for each fuel type (e.g., Jet A) and method of storage (e.g., fixed-roof tank).

Annual emission inventories of key on-Airport stationary sources were estimated based on data obtained from the Authority and modeled in EDMS. Annual emissions were computed based on the product of the actual annual fuel consumption or fuel throughput for a given calendar year. The specific methodologies for computing stationary source emissions vary by source type and are described below.

8.2.1 Boilers

Boilers are powered by natural gas and are used to provide heat during winter months. Emissions from natural gas boilers were calculated using a methodology based on fuel consumption and pollutant emission factors. Pollutant-specific emissions were estimated by multiplying the annual fuel consumption by the emission factor associated with each pollutant. Boiler type, fuel type (natural gas), and annual fuel consumption data for 2010 and 2011 were based on the factors used by Authority staff for annual reporting. Annual natural gas consumption in 2012 was estimated by taking an average of gas consumption in 2010 and 2011. It is assumed that natural gas consumption will remain constant in future years as there are no plans to significantly expand the Airport's heating needs.

8.2.2 Emergency Generators

Emergency generators are powered by diesel fuel and are used as a back-up energy source when electricity is unavailable. Emissions from emergency generators were estimated by EDMS, which calculates emissions based on the capacity rating of generator engines and hours of operation. Logs containing annual generator usage (in hours) and capacity ratings (in horsepower), were provided by Authority staff. Annual generator usage in terms of number of generators and annual operating hours is assumed to remain the same in the future as (1) there are no plans to significantly expand the Airport's emergency generating capacity, and (2) it is not expected that regulations governing the annual testing of generators will change in the future.

8.2.3 Fuel Storage Tanks

Jet A fuel for aircrafts is stored in two fuel storage tanks, owned and operated by Allied Aviation. Emissions associated with fuel storage tanks were based on historical data provided by Authority staff for (1) Jet A fuel dispensed in 2012, and (2) the diameter and height of the storage tanks. It is assumed that EDMS estimates take into account emissions associated with both the dispensing and refilling of the storage tank units. Annual fuel storage throughput volumes for future years were estimated based on the number of aircraft operations expected to occur in each of those years—a 6% increase in operations between 2012 and 2017, a 3.8% increase between 2017 and 2020, a 12.4% increase between 2020 and 2030, and a 9.4% increase between 2030 and 2040.

8.2.4 Paint

Airfield marking paint is weather-resistant paint used for the marking of runways, taxiways and apron areas at the Airport. Emissions from airfield marking paint are based on the volume of paint used annually. No significant increases in aircraft pavement are expected to occur in future years at the Airport, therefore future annual paint usage is assumed to remain unchanged. Emissions may be expressed as the weight of VOCs per volume of material, less water and exempt compounds (AQMD Rule 102). The emissions factors for each type of paint are described in the AQMD VOC Rule 1113, Architectural Coatings.

8.3 STATIONARY SOURCES EMISSION PARAMETERS

Table 8-1 shows the baseline (2012) and future stationary sources usage at the Airport.

Table 8-1
ANNUAL THROUGHPUT PARAMETERS FOR KEY STATIONARY SOURCES

Stationary Source	Unit	2012	2017	2020	2030	2040
Boilers *(a)*	10^3 m^3	841.8	841.8	841.8	841.8	841.8
Emergency Generators *(b)*	Run Hours	178	178	178	178	178
Fuel Storage Tanks *(c)*	Gallons	280,000,000	290,640,000	326,679,360	326,679,360	357,387,220
Paint *(d)*	Gallons	10,490	10,490	10,490	10,490	10,490

(a) Natural gas consumption, in thousand cubic meters per year.
(b) Diesel consumption, in hours of usage per year. HP_{avg} = 407
(c) Jet A fuel consumption, in gallons per year.
(d) Paint consumption, in gallons per year.

Source: Based on information provided by the Authority.

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8.3.1 Boilers

The three boilers at the Airport were modeled in EDMS as "natural gas controlled wall-fired" boilers with an hourly heat energy production of less than 100 million British Thermal Units (MMBTUs), controlled with Low-NO_x Burners and Flue-Gas Recirculation. The volume of natural gas consumed in 2010 and 2011, measured in thousand cubic feet, was obtained from Authority staff and is shown in Tables 8-2 and 8-3. Pursuant to EPA New Source Review requirements, natural gas consumption in 2012 was assumed to be equal to an annual average of the natural gas consumption that occurred in 2010 and 2011. Emission factors for "natural gas controlled wall-fired" boilers were provided by EDMS.

Table 8-2
2010 MONTHLY BOILER READINGS

Reading Date	Boiler 1	Boiler 2	Boiler 3
12/2/2009	24,596	11,610	7,251
1/4/2010	26,894	12,310	7,251
2/1/2010	27,291	13,542	7,251
3/1/2010	28,507	15,121	7,444
4/1/2010	28,675	15,990	9,505
5/3/2010	29,440	16,269	11,072
6/3/2010	30,362	16,726	12,586
7/1/2010	32,432	17,319	12,627
8/1/2010	33,353	17,530	12,637
9/1/2010	33,354	17,710	12,655
10/1/2010	33,354	20,491	13,097
11/1/2010	33,354	21,268	14,641
12/1/2010	34,638	22,277	15,266
Natural Gas Usage (10^3 cf)	10,042	10,667	8,015

Source: Based on information provided by the Authority.

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Table 8-3
2011 MONTHLY BOILER READINGS

Reading Date	Boiler 1	Boiler 2	Boiler 3
12/1/2010	34,638	22,277	15,266
1/18/2011	37,439	24,316	15,266
2/1/2011	38,503	24,873	15,574
3/1/2011	38,561	26,886	16,632
4/4/2011	38,573	29,342	16,928
5/2/2011	38,816	29,744	18,702
6/1/2011	38,940	31,615	19,167
7/1/2011	39,116	32,856	20,088
11/1/2011	39,920	34,246	25,068
12/1/2011	40,223	35,484	27,205
Natural Gas Usage (10^3 cf)	5,585	13,207	11,939

Source: Based on information provided by the Authority.

8.3.2. Emergency Generators

There are 15 diesel-powered emergency generators at the Airport and emissions were determined by the annual hours of usage and horsepower rating of the engines. Engine capacity ratings and usage data from 2014 were obtained from Authority staff and are shown in Table 8-4. Emission factors for each engine type were provided by EDMS.

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Table 8-4
EMERGENCY GENERATOR LOGS

Permit	Location	Allowable Maintenance and Testing Hours	Tank Fuel Gallon Capacity	HP	Actual Run Hours
770	Airside Portable generator "Emergency Use Only" for unplanned emergency use.	50	26.4	55.3	4.3
771	Airside Portable generator "Emergency Use Only" for unplanned emergency use.	50	26.4	55.3	4.2
1418	Green Build Gate 47	50	250 + 1000 secondary fuel storage room	1881	8
951081	Landside East of CT outside	20	190	211	8.1
961289	Airside T1E Gate 18 rooftop enter through baggage area	20	250	519	20
961809	Airside (runway) inside generator yard	30	425	755	5
961834	Airside T2E near Gate 22	20	240	900	15.9
972648	Landside Central Plant	30	120	650	17.6
972682	Airside T2W underneath Gate 36 in Generator Rm	30	240	760	8.3
973586	Airside CT by America West	20	140	277	6.4
978266	Airside behind ARFF Station	50	135	110	24.4
978267	Airside VSR-01 behind jet blast fence	30	78	64	22
978268	Landside near P-18	30	78	64	15.1
978269	Airside by P-25 near ASIG	30	78	64	13.9
986999	Landside West Wing	50	308	250	4.4

Source: Based on information provided by the Authority.

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8.3.3 Fuel Storage Tanks

There are two internal floating roof fuel storage tanks which store Jet A fuel ("Jet Kerosene" in EDMS) at the Airport. Annual fuel consumption in 2012 and fuel tank specifications were obtained from Authority staff and are shown in Table 8-5. Default emission factors in EDMS were used to estimate emissions. Emission factors for storage tanks were provided by EDMS.

Table 8-5
STORAGE FUEL TANK SPECIFICATIONS AND FUEL DISBURSEMENT

Tank Type	Roof Type	Capacity (Gallons/Year)	Tank Height (ft)	Tank Diameter (ft)	Volume Dispensed at Airport (Gallons/Year per tank)
Jet Fuel	Fixed roof with a floating roof inside	1,000,000	28.25	80	140,000,000

Source: Based on information provided by the Authority.

8.3.4 Paint

The annual volumes of airfield marking paint ("Solvent Base," in EDMS) used in 2010, 2011 and 2012 were provided by Authority staff and were reported as the same volume each year—10,490 gallons per year. Future annual paint throughputs are assumed to remain the same. Paint emission factor limit requirements of 100 grams per liter for VOCs were provided by AQMD VOC Rule 1113, but do not account for any additional VOC controls.

8.4 REPORTED EMISSIONS

Each stationary source's respective emission parameters were entered into EDMS to estimate annual emissions in 2012, 2017, 2020, 2030 and 2040. Annual emissions are reported in Tables 8-6. It is important to note that, while emissions from boilers, generators, and paint are expected to remain unchanged in the future, emissions from fuel tank storage increase from 2012 to 2040 because of expected increases in aircraft operations as described in Section 8.2.3.

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Table 8-6
STATIONARY SOURCE EMISSIONS
(Tons)

	NO_x	VOC	CO	SO_x	PM_{10}	$PM_{2.5}$
2012						
Boilers	0.5	0.1	1.2	>0.0	0.1	0.1
Emergency Generators	1.1	0.2	0.2	0.1	0.1	0.01
Fuel Storage Tanks	—	0.4	—	—	—	—
Paint	—	4.4	—	—	—	—
Total	1.5	5.1	1.4	0.1	0.2	0.2
2017						
Boilers	0.5	0.1	1.2	> 0.0	0.1	0.1
Emergency Generators	1.1	0.2	0.2	0.1	0.1	0.1
Fuel Storage Tanks	—	0.4	—	—	—	—
Paint	—	4.4	—	—	—	—
Total	1.5	5.1	1.4	0.1	0.2	0.2
2020						
Boilers	0.5	0.1	1.2	> 0.0	0.1	0.1
Emergency Generators	1.1	0.2	0.2	0.1	0.1	0.1
Fuel Storage Tanks	—	0.4	—	—	—	—
Paint	—	4.4	—	—	—	—
Total	1.5	5.1	1.4	0.1	0.2	0.2
2030						
Boilers	0.5	0.1	1.2	> 0.0	0.1	0.1
Emergency Generators	1.1	0.2	0.2	0.1	0.1	0.1
Fuel Storage Tanks	—	0.4	—	—	—	—
Paint	—	4.4	—	—	—	—
Total	1.5	5.1	1.4	0.1	0.2	0.2
2040						
Boilers	0.5	0.1	1.2	> 0.0	0.1	0.1
Emergency Generators	1.1	0.2	0.2	0.1	0.1	0.1
Fuel Storage Tanks	—	0.4	—	—	—	—
Paint	—	4.4	—	—	—	—
Total	1.5	5.2	1.4	0.1	0.2	0.2

Numbers may not add due to rounding.

Note: Fuel storage tanks and paint are associated with evaporative emissions, not combustion. Therefore, fuel storage tanks and paint only have emissions associated with VOCs and no emissions associated with NO_x CO, SO_x, PM_{10}, or $PM_{2.5}$.

Source: LeighFisher, February 2016.

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9 SUMMARY OF EMISSIONS FOR INCLUSION IN THE CALIFORNIA SIP

This section provides a summary of the following Airport-related emission estimates for the 2012 Baseline Year, the 2017 Forecast Year, the 2020 anticipated attainment year, and two maintenance years, 2030 and 2040:

- **Aircraft engines**—emissions associated with aircraft engines during all phases of movement at or near San Diego International Airport (the Airport)
- **APUs**—emissions associated with the use of aircraft auxiliary power units while parked at passenger gates, cargo stands, or general aviation locations
- **GSE**—emissions associated with motorized equipment used to support aircraft operations at the passenger gate or for maintenance activities
- **Roadways and Parking facilities**—emissions associated with vehicles traveling to, from, and around the Airport, and vehicles utilizing the Airport's parking facilities
- **Construction projects**—emissions associated with routine and growth construction projects
- **Stationary sources**—emissions associated with Authority-owned natural gas boilers and emergency diesel generators, Jet A fuel tank storage, and paint used for airfield marking

9.1 TOTAL EMISSIONS INVENTORY

9.1.1 Total Aircraft Engine Emissions

The estimates for total aircraft engine emissions in 2012, 2017, 2020, 2030 and 2040 are summarized in Table 9-1.

Table 9-1
TOTAL AIRCRAFT ENGINE EMISSIONS
(Tons)

Year	NO_x	VOC	CO	SO_x	PM_{10}	$PM_{2.5}$
2012	787.4	123.3	652.6	77.8	11.6	11.6
2017	900.5	136.0	693.1	85.8	12.6	12.6
2020	975.7	142.4	725.7	91.8	14.1	14.1
2030	1,203.7	162.5	849.9	110.3	19.7	19.7
2040	1,405.5	177.6	973.5	127.2	24.6	24.6

Source: LeighFisher, February 2016.

As discussed in Section 3, aircraft engine emissions will be incorporated into the SIP based on their engine type: jet or piston. Tables 9-2 and 9-3 summarize emissions for jet engine aircraft and piston engine aircraft respectively

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Table 9-2
TOTAL JET AIRCRAFT ENGINE EMISSIONS
(Tons)

Year	NO_x	VOC	CO	SO_x	PM_{10}	$PM_{2.5}$
2012	783.5	120.3	627.4	76.9	11.4	11.4
2017	897.9	132.7	674.4	85.1	12.5	12.5
2020	973.8	139.2	710.6	91.3	14.0	14.0
2030	1,202.8	158.9	839.6	110.0	19.6	19.6
2040	1,405.2	175.2	965.5	127.0	24.6	24.6

Source: LeighFisher, February 2016.

Table 9-3
TOTAL PISTON AIRCRAFT ENGINE EMISSIONS
(Tons)

Year	NO_x	VOC	CO	SO_x	PM_{10}	$PM_{2.5}$
2012	3.8	2.9	25.3	1.0	0.1	0.1
2017	2.6	3.3	18.7	0.7	0.1	0.1
2020	1.9	3.2	15.1	0.5	0.1	0.1
2030	0.9	3.6	10.2	0.3	0.1	0.1
2040	0.3	2.4	8.0	0.1	0.1	0.1

Source: LeighFisher, February 2016.

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9.1.2 Total Aircraft APU Emissions

The estimates for total aircraft APU emissions in 2012, 2017, 2020, 2030 and 2040 are summarized in Table 9-4.

Table 9-4
TOTAL AIRCRAFT APU EMISSIONS
(Tons)

Year	NO_x	VOC	CO	SO_x	PM_{10}	$PM_{2.5}$
2012	57.9	3.9	49.0	7.8	6.7	6.7
2017	45.7	3.0	34.2	6.4	5.2	5.2
2020	49.4	4.6	35.0	8.2	6.9	6.9
2030	58.9	11.8	42.2	15.7	14.2	14.2
2040	68.8	18.3	49.7	22.5	20.7	20.7

Source: LeighFisher, February 2016.

9.1.3 Total GSE Emissions

The estimates for total GSE emissions in 2012, 2017, 2020, 2030 and 2040 are summarized in Table 9-5.

Table 9-5
TOTAL GSE EMISSIONS
(Tons)

Year	NO_x	VOC	TSP
2012	231.5	20.2	13.1
2017	198.7	18.4	12.5
2020	187.4	17.7	11.9
2030	103.3	10.9	6.0
2040	113.0	11.9	6.5

Source: LeighFisher, February 2016.

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9.1.4 Total Roadways and Parking Garage Emissions

The estimates for total roadway and parking garage emissions in 2012, 2017, 2020, 2030, and 2040 are summarized in Table 9-6.

Table 9-6
TOTAL ROADWAY AND PARKING GARAGE EMISSIONS
(Tons)

Year	NO_x	VOC	CO	SO_x	PM_{10}	$PM_{2.5}$
2012	153.6	133.4	1,059.9	1.5	18.4	8.4
2017	96.0	88.0	668.8	1.5	19.3	8.3
2020	74.7	73.2	535.3	1.4	20.3	8.7
2030	41.6	58.1	396.9	1.2	24.0	10.0
2040	36.0	51.9	379.6	1.2	27.8	11.4

Source: LeighFisher, February 2016.

9.1.5 Total Construction Emissions

The estimates for total growth and routine construction emissions in 2012, 2017, 2020, 2030 and 2040 are summarized in Table 9-7.

Table 9-7
TOTAL CONSTRUCTION EMISSIONS
(Tons)

Year	NO_x	VOC	TSP
2012	35.6	2.5	1.5
2017	51.3	3.9	2.1
2020	583.3	46.5	22.8
2030	244.1	26.7	7.5
2040	244.1	26.7	7.5

Source: LeighFisher, February 2016.

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9.1.6 Total Stationary Source Emissions

The total estimated emissions from stationary sources at San Diego International Airport in 2012, 2017, 2020, 2030 and 2040 are summarized in Table 9-8.

Table 9-8
TOTAL STATIONARY SOURCE EMISSIONS
(Tons)

Year	NO_x	VOC	CO	SO_x	PM_{10}	$PM_{2.5}$
2012	1.5	5.1	1.4	0.1	0.2	0.2
2017	1.5	5.1	1.4	0.1	0.2	0.2
2020	1.5	5.1	1.4	0.1	0.2	0.2
2030	1.5	5.1	1.4	0.1	0.2	0.2
2040	1.5	5.2	1.4	0.1	0.2	0.2

Source: LeighFisher, February 2016.

9.1.7 Summary of Emissions

The total estimated emissions at San Diego International Airport in 2012, 2017, 2020, 2030 and 2040 are summarized in Table 9-9.

Table 9-9
TOTAL AIRPORT EMISSIONS
(Tons)

Year	NO_x	VOC	CO	SO_x	PM_{10}	$PM_{2.5}$	TSP
2012	1,267.5	288.4	1,762.9	87.2	36.9	26.9	14.6
2017	1,293.7	254.4	1,397.5	93.8	37.3	26.3	14.6
2020	1,872.0	289.5	1,297.4	101.5	41.5	29.9	34.7
2030	1,653.1	275.1	1,290.4	127.3	58.1	44.1	13.5
2040	1,868.9	291.6	1,404.2	151.0	73.3	56.9	14.0

Note: Due to the specifics of each model used, PM_{10} and $PM_{2.5}$ are reported for Aircraft Operations, APUs, Roadways and Parking, and Stationary Sources. TSP is reported for GSE and Construction emissions.

Source: LeighFisher, February 2016.

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APPENDIX A

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Table A-1
PASSENGER AND CARGO AIRLINES IN THE NMS DATA

Commercial Airlines		Cargo Airlines
Air Canada	Mesa Airlines	ABX Air
Alaska Airlines	Republic Airlines	Atlas Air
Allegiant Air	SkyWest Airlines	Corporate Air
American Airlines	Southwest Airlines	FedEx
American Eagle Airlines	Spirit Airlines	UPS Airlines
British Airways	Sun Country Airlines	
Delta Air Lines	United Airlines	
Frontier Airlines	US Airways	
Hawaiian Airlines	Virgin America	
Horizon Air	Volaris	
JetBlue Airways	WestJet	

Source: LeighFisher, February 2016.

Table A-2
AIR CARRIER AND AIR TAXI AIRCRAFT FRAME TYPES

Air Carrier Aircraft			Air Taxi Aircraft
Airbus A300F4-600	Boeing 737-900	Boeing DC-10-30	Bombardier Challenger 300
Airbus A318-100	Boeing 737-900-ER	Boeing MD-10-1 Freighter	Bombardier Challenger 601
Airbus A319-100	Boeing 747-400 Freighter	Boeing MD-10-30	Bombardier CRJ-100
Airbus A320-200	Boeing 757-200 Freighter	Boeing MD-11 Freighter	Bombardier CRJ-200-ER
Airbus A321-200	Boeing 757-200	Boeing MD-82	Bombardier CRJ-200-LR
Airbus A330-200	Boeing 757-300	Boeing MD-83	Bombardier Global Express
Boeing 737-300	Boeing 767-200 ER	Boeing MD-90	Cessna 208 Caravan
Boeing 737-400	Boeing 767-200 Freighter	Bombardier CRJ-700-ER	Embraer EMB120 Brasilia
Boeing 737-500	Boeing 767-300	Bombardier CRJ-900-ER	Embraer ERJ135-LR
Boeing 737-600	Boeing 767-300 ER	Bombardier Dash 8 Q400	Bombardier Challenger 300
Boeing 737-700	Boeing 767-300	Embraer ERJ190-AR	Bombardier Challenger 601
Boeing 737-800	Boeing 777-200-ER	Embraer ERJ190-LR	
Boeing 737-800 Winglets	Boeing 787-800		

Source: LeighFisher, February 2016.

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Table A-3
PASSENGER AIRCRAFT: BASELINE YEAR FLEET MIX

Aircraft Frame Type	Engine Model	Engine Type	Percent of Baseline Operations
Airbus A318-100 Series	CFM CFM56-5B8/P	Jet	0.1%
Airbus A319-100 Series	CFM CFM56-5A5	Jet	1.1%
Airbus A319-100 Series	CFM CFM56-5B5/P	Jet	1.1%
Airbus A319-100 Series	CFM CFM56-5B6/P	Jet	0.4%
Airbus A319-100 Series	CFM CFM56-5B7/P	Jet	0.1%
Airbus A319-100 Series	IAE V2522-A5	Jet	1.0%
Airbus A319-100 Series	IAE V2524-A5	Jet	1.4%
Airbus A319-100 Series	IAE V2527M-A5	Jet	0.1%
Airbus A320-200 Series	CFM CFM56-5A1	Jet	0.3%
Airbus A320-200 Series	CFM CFM56-5A3	Jet	1.2%
Airbus A320-200 Series	CFM CFM56-5B4	Jet	2.0%
Airbus A320-200 Series	IAE V2500-A1	Jet	0.2%
Airbus A320-200 Series	IAE V2527-A5	Jet	6.1%
Airbus A320-200 Series	IAE V2527E-A5	Jet	>0.0%
Airbus A320-Neo	CFM56-5B4/3	Jet	n/a
Airbus A321-200 Series	CFM CFM56-5B3/P	Jet	0.1%
Airbus A321-200 Series	IAE V2533-A5	Jet	2.5%
Airbus A330-200 Series	Trent 772	Jet	0.2%
Airbus A350 Series	Trent XWB	Jet	n/a
Boeing 717 Series	BR700-715A1-30 IFI	Jet	n/a
Boeing 737-300 Series	CFM CFM56-3B1	Jet	8.8%
Boeing 737-300 Series	CFM CFM56-3B2	Jet	0.6%
Boeing 737-400 Series	CFM CFM56-3C1	Jet	1.5%
Boeing 737-500 Series	CFM CFM56-3B1	Jet	0.8%
Boeing 737-500 Series	CFM CFM56-3C1	Jet	>0.0%
Boeing 737-600 Series	CFM CFM56-7B20	Jet	>0.0%
Boeing 737-700 Series	CFM CFM56-7B20	Jet	0.3%
Boeing 737-700 Series	CFM CFM56-7B22	Jet	27.1%
Boeing 737-700 Series	CFM CFM56-7B24	Jet	0.8%
Boeing 737-800 Series	CFM56-7B26 (8CM051)	Jet	>0.0%
Boeing 737-800 with winglets	CFM CFM56-7B24	Jet	2.2%
Boeing 737-800 with winglets	CFM CFM56-7B27	Jet	1.3%
Boeing 737-800 with winglets	CFM56-7B26 (8CM051)	Jet	7.9%
Boeing 737-900 Series	CFM CFM56-7B24	Jet	0.1%
Boeing 737-900 Series	CFM56-7B26 (8CM051)	Jet	0.3%
Boeing 737-900-ER	CFM CFM56-7B24	Jet	0.2%
Boeing 737-900-ER	CFM56-7B26 (8CM051)	Jet	1.2%
Boeing 737-Max	CFM56-7B24	Jet	n/a

(continued on next page)

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Table A-3 *(continued)*
PASSENGER AIRCRAFT: BASELINE YEAR FLEET MIX

Aircraft Frame Type	Engine Model	Engine Type	Percent of Baseline Operations
Boeing 757-200 Series	PW PW2037	Jet	5.1%
Boeing 757-200 Series	PW PW2040	Jet	>0.0%
Boeing 757-200 Series	RB211-535E4B Phase 5	Jet	0.5%
Boeing 757-300 Series	PW PW2043	Jet	>0.0%
Boeing 757-300 Series	RB211-535E4B Phase 5	Jet	>0.0%
Boeing 767-200 ER	GE CF6-80A2	Jet	>0.0%
Boeing 767-300 ER	GE CF6-80C2B6	Jet	0.4%
Boeing 767-300 ER	PW PW4x52	Jet	>0.0%
Boeing 767-300 ER	PW PW4062	Jet	0.1%
Boeing 767-300 ER	PW4060 Reduced Smoke	Jet	0.2%
Boeing 767-300 Series	GE CF6-80A2	Jet	0.3%
Boeing 767-300 Series	PW4060 Reduced Smoke	Jet	>0.0%
Boeing 777-200-ER	RR Trent 895	Jet	0.4%
Boeing 787-800	GE GEnx-1B64/P1	Jet	>0.0%
Boeing 787-900	GE GEnx-1B64/P1	Jet	n/a
Boeing MD-82	PW JT8D-217	Jet	0.8%
Boeing MD-82	PW JT8D-219	Jet	0.8%
Boeing MD-83	PW JT8D-217	Jet	>0.0%
Boeing MD-83	PW JT8D-219	Jet	1.3%
Boeing MD-90	IAE V2525-D5	Jet	0.2%
Boeing MD-90	IAE V2528-D5	Jet	0.3%
Bombardier CRJ-100	GE CF34-3A1	Jet	0.3%
Bombardier CRJ-200-ER	GE CF34-3B	Jet	0.7%
Bombardier CRJ-200-LR	GE CF34-3B	Jet	2.0%
Bombardier CRJ-700-ER	GE CF34-8C1	Jet	1.0%
Bombardier CRJ-700-ER	GE CF34-8C5A3	Jet	2.1%
Bombardier CRJ-900-ER	CF34-8C5 LEC (8GE110)	Jet	0.2%
Bombardier de Havilland Dash 8 Q400	PWC PW150A	Piston	1.0%
Embraer EMB120 Brasilia	PWC PW118	Piston	6.6%
Embraer ERJ135-LR	RR AE3007-A1/3 Type 1	Jet	4.2%
Embraer ERJ190-AR	CF34-10E5 2253M21	Jet	0.4%
Embraer ERJ190-AR	CF34-10E6 2253M21-PFN	Jet	>0.0%
Embraer ERJ190-LR	CF34-10E5 2253M21	Jet	>0.0%

Source: LeighFisher, February 2016.

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Table A-4
CARGO AIRCRAFT: BASELINE YEAR FLEET MIX

Aircraft Frame Type	Engine Model	Engine Type	Percent of Baseline Operations
Airbus A300F4-600 Series	GE CF6-80C2A5	Jet	12.6%
Airbus A300F4-600 Series	PW PW4158	Jet	5.0%
Boeing 747-400 Freighter	CF6-80C2B1F (1GE024)	Jet	>0.0%
Boeing 757-200 Freighter	PW2040	Jet	0.1%
Boeing 757-200 Freighter	RR RB211-535E4	Jet	0.1%
Boeing 767-200 Freighter	GE CF6-80A2	Jet	4.9%
Boeing 767-200 Freighter	0012 2 PW JT9D-7R4D	Jet	0.5%
Boeing 767-300	GE CF6-80C2B6	Jet	15.0%
Bombardier Challenger 300	HTF7000	Jet	0.1%
Bombardier Challenger 601	GE CF34-3A	Jet	0.1%
Bombardier Global Express	RR BR710A2-20	Jet	0.1%
Cessna 208 Caravan	PWC PT6A-114	Piston	10.0%
Cessna 208 Caravan	PWC PT6A-114A	Piston	17.2%
Boeing DC-10-30 Series	GE CF6-50C2	Jet	0.7%
Boeing MD-10-1 Freighter	GE CF6-6D	Jet	19.4%
Boeing MD-10-30	GE CF6-50C2	Jet	13.9%
Boeing MD-11 Freighter	GE CF6-80C2D1F	Jet	0.2%
Boeing MD-11 Freighter	PW PW4462	Jet	>0.0%

Source: LeighFisher, February 2016.

Table A-5
GENERAL AVIATION AIRCRAFT: BASELINE YEAR FLEET MIX

Aircraft Frame Type	Engine Model	Engine Type	Percent of Baseline Operations
Boeing 757-200 Series	rB211-535E4 Phase 5	Jet	0.2%
Bombardier Challenger 300	HTF7000	Jet	2.8%
Bombardier Challenger 600	CF34-3B	Jet	2.6%
Bombardier Challenger 601	CF34-3A	Jet	0.3%
Bombardier Challenger 604	CF34-3B	Jet	0.5%
Bombardier Learjet 31	TFE731-2-2b	Jet	0.3%
Bombardier Learjet 35A	TFE731-2/2A	Jet	0.2%
Bombardier Learjet 40	TFE731-2-2B	Jet	0.7%
Bombardier Learjet 45	GA TFE731-2-2B	Jet	0.5%
Bombardier Learjet 45-XR	TFE731-2-2B	Jet	2.1%
Bombardier Learjet 60	PW306A	Jet	2.1%
Cessna 172 Skyhawk	IO-360-B	Piston	0.4%
Cessna 525 CitationJet	JT 15D-1	Jet	3.3%
Cessna 550 Citation II	JT15D-4	Jet	0.6%
Cessna 550 Citation II	PW530	Jet	0.4%
Cessna 560 Citation Excel	JT15D-5	Jet	12.4%
Cessna 560 Citation XLS	JT15D-5	Jet	6.4%
Cessna 650 Citation III	TFE731-3	Jet	1.2%
Cessna 680 Citation Sovereign	PW306B	Jet	4.9%
Cessna 750 Citation X	AE3007C Type 2	Jet	4.7%
Dassault Falcon 2000	PW308C	Jet	1.3%
Dassault Falcon 2000-EX	PW308C	Jet	2.9%
Dassault Falcon 50	TFE731-3	Jet	1.4%
Dassault Falcon 900	TFE731-3	Jet	0.7%
Dassault Falcon 900-EX	TFE731-3	Jet	1.6%
Eclipse 500	PW610F	Jet	1.2%
Embraer ERJ135 Legacy Business	AE3007A1E	Jet	0.8%
Falcon 7X	PW307A TALON II (11PW100)	Jet	0.6%
Gulfstream G150	TFE731-3	Jet	1.7%
Gulfstream G200	PW306A	Jet	5.7%
Gulfstream G280	HTF7250G	Jet	0.8%
Gulfstream G450	TAY 611-8C	Jet	1.5%
Gulfstream G550	BR710C4-11	Jet	0.4%
Gulfstream IV-SP	TAY 611-8C	Jet	6.4%
Gulfstream V-SP	BR710C4-11	Jet	4.3%
Piaggio P.180 Avanti	PT6A-66	Piston	5.4%
Pilatus PC-12	PT6A-67B	Piston	1.6%
Piper PA46-TP Meridian	PT6A-42	Piston	0.7%
Raytheon Beechjet 400	JT15D-5	Jet	4.8%
Raytheon Hawker 800	TFE731-3	Jet	3.0%
Raytheon Hawker 900XP	TFE731-2/2A	Jet	3.0%
Raytheon Super King Air 200	PT6A-42	Piston	1.6%
Raytheon Super King Air 300	PT6A-60A	Piston	2.0%

Source: LeighFisher, February 2016.

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Table A-6
PASSENGER AIRCRAFT ANNUAL OPERATIONS

		LTOs				
Aircraft Frame Type	Engine Type	2012	2017	2020	2030	2040
Airbus A318-100 Series	CFM CFM56-5B8/P	44	0	0	0	0
Airbus A319-100 Series	CFM CFM56-5A5	929	667	652	666	325
Airbus A319-100 Series	CFM CFM56-5B5/P	367	264	258	263	128
Airbus A319-100 Series	CFM CFM56-5B6/P	840	603	590	602	294
Airbus A319-100 Series	CFM CFM56-5B7/P	1,234	886	866	885	431
Airbus A319-100 Series	IAE V2522-A5	926	665	650	664	324
Airbus A319-100 Series	IAE V2524-A5	64	46	45	46	23
Airbus A319-100 Series	IAE V2527M-A5	115	83	81	83	40
Airbus A320-200 Series	CFM CFM56-5A1	1,684	1,437	1,234	375	0
Airbus A320-200 Series	CFM CFM56-5A3	228	195	167	51	0
Airbus A320-200 Series	CFM CFM56-5B4	1,015	866	744	226	0
Airbus A320-200 Series	IAE V2500-A1	184	157	135	41	0
Airbus A320-200 Series	IAE V2527-A5	5,241	4,471	3,839	1,166	0
Airbus A320-200 Series	IAE V2527E-A5	2	2	2	1	0
Airbus A320-Neo	CFM56-5B4/3	0	446	1,869	7,347	11,840
Airbus A321-200 Series	CFM CFM56-5B3/P	121	118	125	146	142
Airbus A321-200 Series	IAE V2533-A5	2,183	2,133	2,249	2,622	2,556
Airbus A330-200 Series	Trent 772	168	366	380	427	468
Airbus A350 Series	Trent XWB	0	0	0	0	152
Boeing 717 Series	BR700-715A1-30 IFI	0	902	951	587	0
Boeing 737-300 Series	CFM CFM56-3B1	7,523	4,566	2,552	0	0
Boeing 737-300 Series	CFM CFM56-3B2	485	295	165	0	0
Boeing 737-400 Series	CFM CFM56-3C1	1,282	778	435	0	0
Boeing 737-500 Series	CFM CFM56-3B1	729	0	0	0	0
Boeing 737-500 Series	CFM CFM56-3C1	34	0	0	0	0
Boeing 737-600 Series	CFM CFM56-7B20	1	0	0	0	0
Boeing 737-700 Series	CFM CFM56-7B20	275	337	371	398	373
Boeing 737-700 Series	CFM CFM56-7B22	23,270	28,492	31,389	33,645	31,586
Boeing 737-700 Series	CFM CFM56-7B24	686	840	926	992	931
Boeing 737-800 Series	CFM56-7B26 (8CM051)	5	8	8	10	11
Boeing 737-800 with winglets	CFM CFM56-7B24	1,854	2,791	2,938	3,480	3,981
Boeing 737-800 with winglets	CFM CFM56-7B27	1,119	1,684	1,773	2,101	2,403
Boeing 737-800 with winglets	CFM56-7B26 (8CM051)	6,744	10,150	10,685	12,659	14,481
Boeing 737-900 Series	CFM CFM56-7B24	56	202	230	455	583
Boeing 737-900 Series	CFM56-7B26 (8CM051)	268	965	1,100	2,178	2,790
Boeing 737-900-ER	CFM CFM56-7B24	188	677	771	1,528	1,957
Boeing 737-900-ER	CFM56-7B26 (8CM051)	1,029	3,705	4,221	8,362	10,712
Boeing 737-Max	CFM56-7B24	0	0	1,491	9,441	16,995

(continued on next page)

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Table A-6 *(continued)*
PASSENGER AIRCRAFT ANNUAL OPERATIONS

Aircraft Frame Type	Engine Type	LTOs 2012	2017	2020	2030	2040
Boeing 757-200 Series	PW PW2037	4,363	4,622	4,876	1,366	0
Boeing 757-200 Series	PW PW2040	10	11	11	3	0
Boeing 757-200 Series	RB211-535E4B Phase 5	396	420	443	124	0
Boeing 757-300 Series	RB211-535E4B Phase 5	10	11	11	3	0
Boeing 757-300 Series	PW PW2043	8	9	9	3	0
Boeing 767-200 ER	GE CF6-80A2	4	5	5	6	7
Boeing 767-300 ER	PW PW4062	65	81	84	95	104
Boeing 767-300 ER	GE CF6-80C2B6	318	396	411	462	507
Boeing 767-300 ER	PW4060 Reduced Smoke	158	197	205	230	252
Boeing 767-300 ER	PW PW4x52	1	1	2	2	2
Boeing 767-300 Series	GE CF6-80A2	298	371	386	433	475
Boeing 767-300 Series	PW4060 Reduced Smoke	37	46	48	54	59
Boeing 777-200-ER	RR Trent 895	383	366	290	436	481
Boeing 787-800 Series	GE GEnx-1B64/P1	20	357	832	1,137	2,120
Boeing 787-900 Series	GE GEnx-1B64/P1	0	0	0	521	912
Boeing MD-82	PW JT8D-219	676	104	0	0	0
Boeing MD-82	PW JT8D-217	694	107	0	0	0
Boeing MD-83	PW JT8D-219	1,093	168	0	0	0
Boeing MD-83	PW JT8D-217	12	2	0	0	0
Boeing MD-90	IAE V2525-D5	209	313	330	298	0
Boeing MD-90	IAE V2528-D5	292	437	461	416	0
Bombardier CRJ-100	GE CF34-3A1	253	240	41	0	0
Bombardier CRJ-200-ER	GE CF34-3B	618	587	101	0	0
Bombardier CRJ-200-LR	GE CF34-3B	1,678	3,730	4,441	4,993	4,573
Bombardier CRJ-700-ER	GE CF34-8C1	886	162	193	217	199
Bombardier CRJ-700-ER	GE CF34-8C5A3	1,822	333	397	446	409
Bombardier CRJ-900-ER	CF34-8C5 LEC (8GE110)	206	38	45	51	46
Bombardier Dash 8 Q400	PWC PW150A	842	938	832	965	0
Embraer EMB120 Brasilia	PWC PW118	5,626	3,048	1,917	0	0
Embraer ERJ135-LR	RR AE3007-A1/3 Type 1	3,595	1,955	2,006	18	19
Embraer ERJ190-AR	CF34-10E5 2253M21	316	330	343	386	423
Embraer ERJ190-AR	CF34-10E6 2253M21-PFN	22	23	24	27	30
Embraer ERJ190-LR	CF34-10E5 2253M21	12	13	13	15	16

Source: LeighFisher, February 2016.

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Table A-7
CARGO AIRCRAFT ANNUAL OPERATIONS

Aircraft Frame Type	Engine Type	LTOs 2012	2017	2020	2030	2040
Airbus A300F4-600 Series	GE CF6-80C2A5	44	0	0	0	0
Airbus A300F4-600 Series	PW PW4158	929	667	652	666	325
Boeing 747-400 Freighter	CF6-80C2B1F (1GE024)	367	264	258	263	128
Boeing 757-200 Freighter	PW PW2040	840	603	590	602	294
Boeing 757-200 Freighter	RR RB211-535E4	1,234	886	866	885	431
Boeing 767-200 Freighter	GE CF6-80A2	926	665	650	664	324
Boeing 767-200 Freighter	0012 2 PW JT9D-7R4D	64	46	45	46	23
Boeing 767-300	GE CF6-80C2B6	115	83	81	83	40
Bombardier Challenger 300	HTF7000	1,684	1,437	1,234	375	0
Bombardier Challenger 601	GE CF34-3A	228	195	167	51	0
Bombardier Global Express	RR BR710A2-20	1,015	866	744	226	0
Cessna 208 Caravan	PWC PT6A-114	184	157	135	41	0
Cessna 208 Caravan	PWC PT6A-114A	5,241	4,471	3,839	1,166	0
Boeing DC-10-30 Series	GE CF6-50C2	2	2	2	1	0
Boeing MD-10-1 Freighter	GE CF6-6D	0	446	1,869	7,347	11,840
Boeing MD-10-30	GE CF6-50C2	121	118	125	146	142
Boeing MD-11 Freighter	GE CF6-80C2D1F	2,183	2,133	2,249	2,622	2,556
Boeing MD-11 Freighter	PW PW4460	168	366	380	427	468

Source: LeighFisher, February 2016.

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Table A-8
GENERAL AVIATION AIRCRAFT ANNUAL OPERATIONS (LTOs)

Aircraft	Engine	2012	2017	2020	2030	2040
Boeing 757-200 Series	rB211-535E4 Phase 5	12	14	14	16	17
Bombardier Challenger 300	HTF7000	138	156	161	176	189
Bombardier Challenger 600	CF34-3B	128	145	149	163	176
Bombardier Challenger 601	CF34-3A	17	19	20	22	24
Bombardier Challenger 604	CF34-3B	26	30	31	33	36
Bombardier Learjet 31	TFE731-2-2b	13	15	15	17	18
Bombardier Learjet 35A	TFE731-2/2A	12	14	14	16	17
Bombardier Learjet 40	TFE731-2-2B	35	40	41	45	48
Bombardier Learjet 45	GA TFE731-2-2B	25	29	29	32	35
Bombardier Learjet 45-XR	TFE731-2-2B	106	120	124	135	146
Bombardier Learjet 60	PW306A	104	118	121	133	143
Cessna 172 Skyhawk	IO-360-B	22	25	26	28	30
Cessna 525 CitationJet	JT 15D-1	165	187	192	210	226
Cessna 550 Citation II	JT15D-4	29	33	34	37	40
Cessna 550 Citation II	PW530	19	22	22	24	26
Cessna 560 Citation Excel	JT15D-5	611	690	711	780	837
Cessna 560 Citation XLS	JT15D-5	314	355	366	400	431
Cessna 650 Citation III	TFE731-3	57	65	67	73	78
Cessna 680 Citation Sovereign	PW306B	241	273	281	307	331
Cessna 750 Citation X	AE3007C Type 2	230	260	268	293	315
Dassault Falcon 2000	PW308C	66	75	77	84	91
Dassault Falcon 2000-EX	PW308C	142	161	165	181	195
Dassault Falcon 50	TFE731-3	70	79	82	89	96
Dassault Falcon 900	TFE731-3	33	38	39	42	45
Dassault Falcon 900-EX	TFE731-3	79	90	92	101	109
Eclipse 500	PW610F	59	67	69	75	81
Embraer ERJ135 Legacy Business	AE3007A1E	39	44	46	50	54
Falcon 7X	PW307A TALON II (11PW100)	28	32	33	36	39
Gulfstream G150	TFE731-3	83	94	97	106	114
Gulfstream G200	PW306A	283	320	330	361	388
Gulfstream G280	HTF7250G	41	47	48	52	56
Gulfstream G450	TAY 611-8C	72	82	84	92	99
Gulfstream G550	BR710C4-11	20	23	24	26	28
Gulfstream IV-SP	TAY 611-8C	317	359	369	404	435
Gulfstream V-SP	BR710C4-11	214	242	249	273	294
Piaggio P.180 Avanti	PT6A-66	269	304	313	343	369
Pilatus PC-12	PT6A-67B	77	87	90	98	106
Piper PA46-TP Meridian	PT6A-42	36	41	42	46	50
Raytheon Beechjet 400	JT15D-5	236	267	275	301	324
Raytheon Hawker 800	TFE731-3	149	169	174	190	204
Raytheon Hawker 900XP	TFE731-2/2A	146	165	170	186	200
Raytheon Super King Air 200	PT6A-42	77	87	90	98	106
Raytheon Super King Air 300	PT6A	98	111	114	125	135

Source: LeighFisher, February 2016.

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APPENDIX B

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Table B-1
PASSENGER AIRCRAFT APU AND LTO APU DURATION

AIRCRAFT FRAME TYPE	APU TYPE	LTO APU TIME (minutes) 2012	2017	2020	2030	2040
Airbus A318-100 Series	APU GTCP 36-300 (80HP)	26	18	18	18	18
Airbus A319-100 Series	APU GTCP 36-300 (80HP)	39	26	26	26	26
Airbus A320-200 Series	APU GTCP 36-300 (80HP)	55	37	37	37	37
Airbus A320-NEO	APU GTCP 36-300 (80HP)	55	37	37	37	37
Airbus A321-200 Series	APU GTCP 36-300 (80HP)	73	49	49	49	49
Airbus A330-200 Series	APU GTCP 331-350	89	60	60	60	60
Airbus A350 Series	APU GTCP331-500 (143 HP)	78	53	53	53	53
Boeing 717 Series	APU GTCP 85 (200 HP)	53	36	36	36	36
Boeing 737-300 Series	APU GTCP85-129 (200 HP)	29	20	20	20	20
Boeing 737-400 Series	APU GTCP85-129 (200 HP)	56	38	38	38	38
Boeing 737-500 Series	APU GTCP85-129 (200 HP)	34	23	23	23	23
Boeing 737-600 Series	APU 131-9	45	30	30	30	30
Boeing 737-700 Series	APU 131-9	33	22	22	22	22
Boeing 737-800 Series	APU 131-9	61	41	41	41	41
Boeing 737-800 with winglets	APU 131-9	70	47	47	47	47
Boeing 737-900 Series	APU 131-9	55	37	37	37	37
Boeing 737-900-ER	APU 131-9	55	37	37	37	37
Boeing 737-MAX	APU 131-9	55	37	37	37	37
Boeing 757-200 Series	APU GTCP331-200ER (143 HP)	61	41	41	41	41
Boeing 757-300 Series	APU GTCP331-200ER (143 HP)	61	41	41	41	41
Boeing 767-200 ER	APU GTCP331-200ER (143 HP)	89	60	60	60	60
Boeing 767-300 ER	APU GTCP331-200ER (143 HP)	89	60	60	60	60
Boeing 767-300 Series	APU GTCP331-200ER (143 HP)	89	60	60	60	60
Boeing 777-200-ER	APU GTCP331-500 (143 HP)	82	55	55	55	55
Boeing 787-800 Series	APU GTCP331-500 (143 HP)	78	53	53	53	53
Boeing 787-900 Series	APU GTCP331-500 (143 HP)	78	53	53	53	53
Boeing MD-82	APU GTCP85-98 (200 HP)	61	41	41	41	41
Boeing MD-83	APU GTCP85-98 (200 HP)	61	41	41	41	41
Boeing MD-90	APU 131-9	53	36	36	36	36
Bombardier CRJ-100	APU GTCP 36-150[RR]	26	18	18	18	18
Bombardier CRJ-200-ER	APU GTCP 36-150[RR]	26	18	18	18	18
Bombardier CRJ-200-LR	APU GTCP 36-150[RR]	26	18	18	18	18
Bombardier CRJ-700-ER	APU GTCP 36-150[RR]	58	39	39	39	39
Bombardier CRJ-900-ER	APU GTCP 36-150[RR]	26	18	18	18	18
Bombardier de Havilland Dash 8	APU GTCP 36-150[RR]	24	16	16	16	16
Embraer EMB120 Brasilia	APU GTCP 36-150[]	15	10	10	10	10
Embraer ERJ135-LR	APU GTCP 36-150[]	32	21	21	21	21
Embraer ERJ190-AR	APU GTCP 36-150[]	35	24	24	24	24
Embraer ERJ190-LR	APU GTCP 36-150[]	35	24	24	24	24

Source: LeighFisher, February 2016.

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Table B-2
CARGO AIRCRAFT APU AND LTO APU DURATION

AIRCRAFT FRAME TYPE	APU TYPE	LTO APU TIME (minutes)				
		2012	2017	2020	2030	2040
Bombardier Challenger 601	APU GTCP 36-100	40	40	40	40	40
Bombardier Challenger 300	APU GTCP 36-150[]	40	40	40	40	40
Bombardier Global Express	APU GTCP 85 (200 HP)	40	40	40	40	40
Airbus A300F4-600 Series	APU GTCP331-200ER (143 HP)	40	40	40	40	40
Boeing 757-200 Freighter	APU GTCP331-200ER (143 HP)	40	40	40	40	40
Boeing 767-200 Freighter	APU GTCP331-200ER (143 HP)	40	40	40	40	40
Boeing 767-300	APU GTCP331-200ER (143 HP)	40	40	40	40	40
Boeing 747-400 Freighter	APU PW901A	40	40	40	40	40
Boeing DC-10-30 Series	APU TSCP700-4B (142 HP)	40	40	40	40	40
Boeing MD-10-1 Freighter	APU TSCP700-4B (142 HP)	40	40	40	40	40
Boeing MD-11 Freighter	APU TSCP700-4B (142 HP)	40	40	40	40	40
Cessna 208 Caravan	No APU					

Source: LeighFisher, February 2016.

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Table B-3
GENERAL AVIATION AIRCRAFT APU AND LTO APU DURATION

AIRCRAFT FRAME TYPE	APU TYPE	LTO APU TIME (minutes) 2012	2017	2020	2030	2040
Boeing 757-200 Series	APU GTCP331-200ER (143 HP)	26	26	26	26	26
Bombardier Challenger 300	APU GTCP 36-150[]	26	26	26	26	26
Bombardier Challenger 600	APU GTCP 36-100	26	26	26	26	26
Bombardier Challenger 601	APU GTCP 36-100	26	26	26	26	26
Bombardier Challenger 604	APU GTCP 36-100	26	26	26	26	26
Bombardier Learjet 40	APU GTCP 36-100	26	26	26	26	26
Bombardier Learjet 45	APU GTCP 36-100	26	26	26	26	26
Bombardier Learjet 45-XR	APU GTCP 36-100	26	26	26	26	26
Bombardier Learjet 60	APU GTCP 36-100	26	26	26	26	26
Cessna 525 CitationJet	APU GTCP 36-100	26	26	26	26	26
Cessna 550 Citation II	APU GTCP 36-100	26	26	26	26	26
Cessna 560 Citation Excel	APU GTCP 36-100	26	26	26	26	26
Cessna 560 Citation XLS	APU GTCP 36-100	26	26	26	26	26
Cessna 650 Citation III	APU GTCP 36-100	26	26	26	26	26
Cessna 680 Citation Sovereign	APU GTCP 36-100	26	26	26	26	26
Cessna 750 Citation X	APU GTCP 36-100	26	26	26	26	26
Dassault Falcon 2000	APU GTCP 36-150[]	26	26	26	26	26
Dassault Falcon 2000-EX	APU GTCP 36-150[]	26	26	26	26	26
Dassault Falcon 50	APU GTCP 36-100	26	26	26	26	26
Dassault Falcon 900	APU GTCP 36-150[]	26	26	26	26	26
Dassault Falcon 900-EX	APU GTCP 36-150[]	26	26	26	26	26
Embraer ERJ135 Legacy Business	APU GTCP 36-150[]	26	26	26	26	26
Falcon 7X	APU GTCP 36-150[]	26	26	26	26	26
Gulfstream G150	APU GTCP 36-150[]	26	26	26	26	26
Gulfstream G200	APU GTCP 36-150[]	26	26	26	26	26
Gulfstream G280	APU GTCP 36-150[]	26	26	26	26	26
Gulfstream G450	APU GTCP 36-100	26	26	26	26	26
Gulfstream G550	APU GTCP 36 (80HP)	26	26	26	26	26
Gulfstream IV-SP	APU GTCP 36-100	26	26	26	26	26
Gulfstream V-SP	APU GTCP 36-100	26	26	26	26	26
Raytheon Hawker 800	APU GTCP 36-150[]	26	26	26	26	26
Raytheon Hawker 900XP	APU GTCP 36-150[]	26	26	26	26	26
Raytheon Super King Air 300	APU GTCP 36-150[]	26	26	26	26	26
Bombardier Learjet 31	No APU					
Bombardier Learjet 35A	No APU					
Cessna 172 Skyhawk	No APU					
Eclipse 500	No APU					
Piaggio P.180 Avanti	No APU					
Pilatus PC-12	No APU					
Piper PA46-TP Meridian	No APU					
Raytheon Beechjet 400	No APU					
Raytheon Super King Air 200	No APU					

Source: LeighFisher, February 2016.

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Table B-4
EMISSIONS ASSOCIATED WITH AIRCRAFT APU ACTIVITY BY REPORT CATEGORY *(Tons)*

Passenger	NO_x	VOC	CO	SO_x	PM_{10}	$PM_{2.5}$
2012	55.2	3.7	44.8	7.5	6.4	6.4
2017	42.6	2.8	29.4	6.0	4.9	4.9
2020	46.2	4.4	30.1	7.8	6.5	6.5
2030	55.2	11.5	36.8	15.2	13.8	13.8
2040	64.8	18.0	43.8	22.0	20.3	20.3

Cargo	NO_x	VOC	CO	SO_x	PM_{10}	$PM_{2.5}$
2012	1.94	0.10	0.87	0.22	0.15	0.15
2017	2.25	0.12	1.02	0.26	0.18	0.18
2020	2.35	0.12	1.06	0.27	0.18	0.18
2030	2.73	0.14	1.24	0.31	0.21	0.21
2040	3.01	0.16	1.36	0.35	0.24	0.24

General Aviation	NO_x	VOC	CO	SO_x	PM_{10}	$PM_{2.5}$
2012	0.683	0.088	3.028	0.133	0.123	0.123
2017	0.765	0.1	3.419	0.149	0.138	0.138
2020	0.787	0.102	3.52	0.154	0.143	0.143
2030	0.862	0.112	3.854	0.168	0.156	0.156
2040	0.927	0.121	4.145	0.181	0.168	0.168

Military	NO_x	VOC	CO	SO_x	PM_{10}	$PM_{2.5}$
2012	0.056	0.007	0.328	0.011	0.01	0.01
2017	0.059	0.007	0.344	0.011	0.01	0.01
2020	0.059	0.007	0.344	0.011	0.01	0.01
2030	0.059	0.007	0.344	0.011	0.01	0.01
2040	0.059	0.007	0.344	0.011	0.01	0.01

Total	NO_x	VOC	CO	SO_x	PM_{10}	$PM_{2.5}$
2012	57.9	3.9	49.0	7.8	6.7	6.7
2017	45.7	3.0	34.2	6.4	5.2	5.2
2020	49.4	4.6	35.0	8.2	6.9	6.9
2030	58.9	11.8	42.2	15.7	14.2	14.2
2040	68.8	18.3	49.7	22.5	20.7	20.7

Note: Numbers may not add due to rounding.

Source: LeighFisher, February 2016.

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APPENDIX C

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Table C-1 *(Page 1 of 2)*

OFFROAD RESULTS FOR AIRPORT GROUND SUPPORT EQUIPMENT IN THE SAN DIEGO AIR BASIN

		OFFROAD	Annual Output (Tons)					Avg	Load	Calculated Emission Factor (G/HP Hr)			
Year	Basin	Equipment Type	NOx	PM	HC	Hours	Count	HP	Factor	NOx EF	PM EF	HC EF	VOC EF
2012	SD	A/C Tug Narrow Body	4.05	0.23	0.32	7,345	24.3	132	0.54	7.06	0.40	0.55	0.58
2012	SD	A/C Tug Wide Body	3.23	0.11	0.17	4,179	11.5	248	0.54	5.26	0.18	0.28	0.29
2012	SD	Baggage Tug	4.07	0.32	0.44	11,660	17.3	74	0.37	11.54	0.91	1.25	1.32
2012	SD	Belt Loader	1.85	0.15	0.21	7,035	14.9	75	0.34	9.57	0.78	1.09	1.14
2012	SD	Bobtail	0.46	0.02	0.03	1,244	3.1	144	0.37	6.32	0.25	0.42	0.44
2012	SD	Cargo Loader	3.37	0.21	0.26	14,225	32.8	117	0.34	5.50	0.35	0.42	0.45
2012	SD	Cargo Tractor	4.29	0.32	0.42	13,364	21.8	94	0.36	8.60	0.65	0.84	0.88
2012	SD	Forklift (GSE)	1.54	0.10	0.14	8,279	23.8	107	0.20	7.84	0.50	0.69	0.72
2012	SD	Lift (GSE)	1.02	0.07	0.09	5,427	14.2	95	0.34	5.39	0.38	0.47	0.50
2012	SD	Other GSE	8.14	0.45	0.68	33,855	77.1	108	0.34	6.04	0.33	0.50	0.53
2012	SD	Passenger Stand	0.03	0.00	0.00	212	4.8	70	0.40	4.87	0.31	0.44	0.46
2017	SD	A/C Tug Narrow Body	3.48	0.20	0.27	8,672	27.1	132	0.54	5.13	0.29	0.39	0.42
2017	SD	A/C Tug Wide Body	2.97	0.11	0.17	4,935	12.8	248	0.54	4.10	0.15	0.23	0.25
2017	SD	Baggage Tug	4.85	0.39	0.54	13,767	19.3	74	0.37	11.67	0.94	1.29	1.36
2017	SD	Belt Loader	1.85	0.17	0.22	8,307	16.6	75	0.34	8.08	0.72	0.96	1.01
2017	SD	Bobtail	0.41	0.02	0.03	1,469	3.4	144	0.37	4.71	0.24	0.35	0.37
2017	SD	Cargo Loader	2.58	0.14	0.19	16,795	36.6	117	0.34	3.56	0.20	0.26	0.27
2017	SD	Cargo Tractor	4.17	0.32	0.41	15,779	24.3	94	0.36	7.07	0.55	0.70	0.74
2017	SD	Forklift (GSE)	1.48	0.10	0.13	9,775	26.5	107	0.20	6.35	0.42	0.58	0.61
2017	SD	Lift (GSE)	0.95	0.07	0.08	6,407	15.8	95	0.34	4.24	0.29	0.37	0.39
2017	SD	Other GSE	6.74	0.39	0.61	39,972	86.0	108	0.34	4.24	0.24	0.38	0.40
2017	SD	Passenger Stand	0.03	0.00	0.00	250	5.4	70	0.40	3.48	0.17	0.22	0.23
2020	SD	A/C Tug Narrow Body	3.12	0.18	0.24	9,048	27.9	132	0.54	4.42	0.26	0.34	0.36
2020	SD	A/C Tug Wide Body	2.44	0.09	0.15	5,148	13.2	248	0.54	3.23	0.12	0.20	0.21

Notes: Hydrocarbon emission factor converted to VOC by EPA's suggested factor of 1.053.
Emission factors have been converted from tons/hp hr to g/hp hr by converting to pounds (*2000) and then into grams (*454)

Source: LeighFisher, February 2016, OFFROAD Model.

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Table C-1 *(page 2 of 2)*

OFFROAD RESULTS FOR AIRPORT GROUND SUPPORT EQUIPMENT IN THE SAN DIEGO AIR BASIN

Year	Basin	OFFROAD Equipment Type	Annual Output (Tons) NOx	PM	HC	Hours	Count	Avg HP	Load Factor	Calculated Emission Factor (G/HP Hr) NOx EF	PM EF	HC EF	VOC EF
2020	SD	Baggage Tug	4.89	0.39	0.54	14,363	19.8	74	0.37	11.25	0.90	1.25	1.32
2020	SD	Belt Loader	1.59	0.15	0.19	8,666	17.1	75	0.34	6.65	0.61	0.78	0.82
2020	SD	Bobtail	0.39	0.02	0.03	1,532	3.5	144	0.37	4.35	0.23	0.34	0.35
2020	SD	Cargo Loader	1.75	0.08	0.13	17,522	37.6	117	0.34	2.32	0.11	0.17	0.18
2020	SD	Cargo Tractor	3.37	0.25	0.34	16,462	24.9	94	0.36	5.49	0.41	0.55	0.58
2020	SD	Forklift (GSE)	1.37	0.09	0.13	10,199	27.3	107	0.20	5.64	0.38	0.52	0.54
2020	SD	Lift (GSE)	0.76	0.05	0.06	6,685	16.3	95	0.34	3.25	0.19	0.27	0.28
2020	SD	Other GSE	5.38	0.28	0.48	41,703	88.4	108	0.34	3.24	0.17	0.29	0.31
2020	SD	Passenger Stand	0.03	0.00	0.00	261	5.5	70	0.40	3.31	0.15	0.22	0.23
2029	SD	A/C Tug Narrow Body	1.82	0.10	0.17	10,174	30.0	132	0.54	2.28	0.12	0.21	0.22
2029	SD	A/C Tug Wide Body	1.83	0.08	0.15	5,789	14.2	248	0.54	2.16	0.09	0.17	0.18
2029	SD	Baggage Tug	3.08	0.21	0.34	16,152	21.4	74	0.37	6.30	0.43	0.70	0.74
2029	SD	Belt Loader	1.25	0.10	0.13	9,745	18.4	75	0.34	4.67	0.38	0.49	0.52
2029	SD	Bobtail	0.15	0.01	0.01	1,723	3.8	144	0.37	1.46	0.06	0.14	0.15
2029	SD	Cargo Loader	1.01	0.03	0.09	19,704	40.6	117	0.34	1.19	0.04	0.11	0.11
2029	SD	Cargo Tractor	1.87	0.07	0.17	18,512	26.9	94	0.36	2.71	0.11	0.25	0.26
2029	SD	Forklift (GSE)	1.04	0.07	0.10	11,469	29.4	107	0.20	3.81	0.26	0.38	0.40
2029	SD	Lift (GSE)	0.50	0.03	0.05	7,517	17.6	95	0.34	1.91	0.10	0.18	0.19
2029	SD	Other GSE	2.72	0.09	0.27	46,896	95.3	108	0.34	1.46	0.05	0.15	0.16

Notes: Hydrocarbon emission factor converted to VOC by EPA's suggested factor of 1.053.
Emission factors have been converted from tons/hp hr to g/hp hr by converting to pounds (*2000) and then into grams (*454)

Source: LeighFisher, February 2016, OFFROAD Model.

Emissions Inventory
San Diego International Airport

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LeighFisher

Table C-2
EMISSION FACTORS BY EDMS EQUIPMENT TYPE

Equipment Type	NO_x Emission Factors *(a)*					VOC Emission Factors					PM Emission Factors				
	2012	2017	2020	2030	2040	2012	2017	2020	2030	2040	2012	2017	2020	2030	2040
Air Conditioner	6.32	4.71	4.35	1.46	1.46	0.44	0.37	0.35	0.15	0.15	0.25	0.24	0.23	0.06	0.06
Air Start	5.26	4.10	3.23	2.16	2.16	0.29	0.25	0.21	0.18	0.18	0.18	0.15	0.12	0.09	0.09
Aircraft Tractor – Narrow Body	7.06	5.13	4.42	2.28	2.28	0.58	0.42	0.36	0.22	0.22	0.40	0.29	0.26	0.12	0.12
Aircraft Tractor – Wide Body	5.26	4.10	3.23	2.16	2.16	0.29	0.25	0.21	0.18	0.18	0.18	0.15	0.12	0.09	0.09
Baggage Tractor	11.54	11.67	11.25	6.30	6.30	1.32	1.36	1.32	0.74	0.74	0.91	0.94	0.90	0.43	0.43
Belt Loader	9.57	8.08	6.65	4.67	4.67	1.14	1.01	0.82	0.52	0.52	0.78	0.72	0.61	0.38	0.38
Cabin Service Truck	4.87	3.48	3.31	2.30	2.30	0.46	0.23	0.23	0.18	0.18	0.31	0.17	0.15	0.10	0.10
Cargo Loader	5.50	3.56	2.32	1.19	1.19	0.45	0.27	0.18	0.11	0.11	0.35	0.20	0.11	0.04	0.04
Cart	11.54	11.67	11.25	6.30	6.30	1.32	1.36	1.32	0.74	0.74	0.91	0.94	0.90	0.43	0.43
Catering Truck	4.87	3.48	3.31	2.30	2.30	0.46	0.23	0.23	0.18	0.18	0.31	0.17	0.15	0.10	0.10
Deicer	6.32	4.71	4.35	1.46	1.46	0.44	0.37	0.35	0.15	0.15	0.25	0.24	0.23	0.06	0.06
Fork Lift	7.84	6.35	5.64	3.81	3.81	0.72	0.61	0.54	0.40	0.40	0.50	0.42	0.38	0.26	0.26
Fuel Truck	4.87	3.48	3.31	2.30	2.30	0.46	0.23	0.23	0.18	0.18	0.31	0.17	0.15	0.10	0.10
Generator	6.32	4.71	4.35	1.46	1.46	0.44	0.37	0.35	0.15	0.15	0.25	0.24	0.23	0.06	0.06
Ground Power Unit	6.32	4.71	4.35	1.46	1.46	0.44	0.37	0.35	0.15	0.15	0.25	0.24	0.23	0.06	0.06
Lavatory Truck	4.87	3.48	3.31	2.30	2.30	0.46	0.23	0.23	0.18	0.18	0.31	0.17	0.15	0.10	0.10
Lift	5.39	4.24	3.25	1.91	1.91	0.50	0.39	0.28	0.19	0.19	0.38	0.29	0.19	0.10	0.10
Passenger Stand	4.87	3.48	3.31	2.30	2.30	0.46	0.23	0.23	0.18	0.18	0.31	0.17	0.15	0.10	0.10
Sweeper	6.32	4.71	4.35	1.46	1.46	0.44	0.37	0.35	0.15	0.15	0.25	0.24	0.23	0.06	0.06
Water Service	4.87	3.48	3.31	2.30	2.30	0.46	0.23	0.23	0.18	0.18	0.31	0.17	0.15	0.10	0.10

Source: LeighFisher, February 2016 *OFFROAD*.

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Table C-3

2012 ANNUAL EMISSIONS ESTIMATION – BY EDMS EQUIPMENT TYPE

EDMS GSE Equipment Type	Total Annual Hours	Horse-power	Load Factor	Emission Factors *(a)*			Annual Emissions *(Tons)*		
				NO_x	VOC	PM	NO_x	VOC	TSP
Air Conditioner	2,020	300	0.75	6.3	0.44	0.25	3.2	0.22	0.13
Air Start	3,663	425	0.90	5.3	0.29	0.18	8.1	0.45	0.28
Aircraft Tractor – Narrow Body	24,975.6	190	0.80	7.1	0.58	0.40	29.5	2.42	1.65
Aircraft Tractor – Wide Body	788.4	617	0.80	5.3	0.29	0.18	2.3	0.13	0.08
Baggage Tractor	105,000	71	0.55	11.5	1.32	0.91	52.1	5.96	4.11
Belt Loader	52,000	71	0.50	9.6	1.14	0.78	19.5	2.33	1.58
Cabin Service Truck	5,600	71	0.53	4.9	0.46	0.31	1.1	0.11	0.07
Cargo Loader	19,800	80	0.50	5.5	0.45	0.35	4.8	0.39	0.30
Cart	50	25	0.50	11.5	1.32	0.91	0.0	0.00	0.00
Catering Truck	28,800	71	0.53	4.9	0.46	0.31	5.8	0.55	0.37
Deicer	750	263	0.95	6.3	0.44	0.25	1.3	0.09	0.05
Fork Lift	12,200	55	0.30	7.8	0.72	0.50	1.7	0.16	0.11
Fuel Truck	12,408	300	0.25	4.9	0.46	0.31	5.0	0.47	0.31
Generator	44,825	158	0.50	6.3	0.44	0.25	24.6	1.71	0.99
Ground Power Unit	66,300	194	0.75	6.3	0.44	0.25	67.1	4.67	2.69
Lavatory Truck	20,142	56	0.25	4.9	0.46	0.31	1.5	0.14	0.10
Lift	10,060	115	0.50	5.4	0.50	0.38	3.4	0.32	0.24
Passenger Stand	1,504	65	0.57	4.9	0.46	0.31	0.3	0.03	0.02
Sweeper	42	53	0.51	6.3	0.44	0.25	0.0	0.00	0.00
Water Service	462	235	0.20	4.9	0.46	0.31	0.1	0.01	0.01
Total	411,389						231.5	20.17	13.10

Note: Numbers may not add due to rounding.

(a) Emission Factors in grams per horsepower hour.

Source: LeighFisher, February 2016.

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Table C-4

2017 ANNUAL EMISSIONS ESTIMATION – BY EDMS EQUIPMENT TYPE

EDMS GSE Equipment Type	Total Annual Hours	Horse-power	Load Factor	Emission Factors *(a)* NO_x	Emission Factors *(a)* VOC	Emission Factors *(a)* PM	Annual Emissions *(Tons)* NO_x	Annual Emissions *(Tons)* VOC	Annual Emissions *(Tons)* TSP
Air Conditioner	2,141.0	300	0.75	6.3	0.44	0.25	2.5	0.20	0.13
Air Start	3,882.4	425	0.90	5.3	0.29	0.18	6.7	0.40	0.25
Aircraft Tractor - Narrow Body	26,471.6	190	0.80	7.1	0.58	0.40	22.7	1.84	1.30
Aircraft Tractor - Wide Body	835.7	617	0.80	5.3	0.29	0.18	1.9	0.11	0.07
Baggage Tractor	111,289.6	71	0.55	11.5	1.32	0.91	55.8	6.53	4.50
Belt Loader	55,114.8	71	0.50	9.6	1.14	0.78	17.4	2.17	1.55
Cabin Service Truck	5,935.4	71	0.53	4.9	0.46	0.31	0.9	0.06	0.04
Cargo Loader	20,986.0	80	0.50	5.5	0.45	0.35	3.3	0.25	0.18
Cart	53.0	25	0.50	11.5	1.32	0.91	0.0	0.00	0.00
Catering Truck	30,525.1	71	0.53	4.9	0.46	0.31	4.4	0.30	0.21
Deicer	794.9	263	0.95	6.3	0.44	0.25	1.0	0.08	0.05
Fork Lift	12,930.8	55	0.30	7.8	0.72	0.50	1.5	0.14	0.10
Fuel Truck	13,151.2	300	0.25	4.9	0.46	0.31	3.8	0.26	0.18
Generator	47,510.0	158	0.50	6.3	0.44	0.25	19.5	1.53	0.98
Ground Power Unit	70,271.4	194	0.75	6.3	0.44	0.25	53.0	4.18	2.68
Lavatory Truck	21,348.5	56	0.25	4.9	0.46	0.31	1.1	0.08	0.05
Lift	10,662.1	115	0.50	5.4	0.50	0.38	2.9	0.26	0.20
Passenger Stand	1,594.1	65	0.57	4.9	0.46	0.31	0.2	0.02	0.01
Sweeper	44.5	53	0.51	6.3	0.44	0.25	0.0	0.00	0.00
Water Service	489.7	235	0.20	4.9	0.46	0.31	0.1	0.01	0.00
Total	436,032						198.7	18.4	12.5

Note: Numbers may not add due to rounding.

(a) Emission Factors in grams per horsepower hour.

Source: LeighFisher, February 2016.

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Table C-5

2020 ANNUAL EMISSIONS ESTIMATION – BY EDMS EQUIPMENT TYPE

EDMS GSE Equipment Type	Total Annual Hours	Horse-power	Load Factor	Emission Factors *(a)*			Annual Emissions *(Tons)*		
				NO_x	VOC	PM	NO_x	VOC	TSP
Air Conditioner	2,222.8	300	0.75	6.3	0.44	0.25	2.4	0.20	0.13
Air Start	4,030.7	425	0.90	5.3	0.29	0.18	5.5	0.36	0.21
Aircraft Tractor - Narrow Body	27,482.5	190	0.80	7.1	0.58	0.40	20.3	1.67	1.17
Aircraft Tractor - Wide Body	867.6	617	0.80	5.3	0.29	0.18	1.5	0.10	0.06
Baggage Tractor	115,539.5	71	0.55	11.5	1.32	0.91	55.9	6.53	4.46
Belt Loader	57,219.6	71	0.50	9.6	1.14	0.78	14.9	1.84	1.37
Cabin Service Truck	6,162.1	71	0.53	4.9	0.46	0.31	0.8	0.06	0.04
Cargo Loader	21,787.4	80	0.50	5.5	0.45	0.35	2.2	0.17	0.11
Cart	55.0	25	0.50	11.5	1.32	0.91	0.0	0.00	0.00
Catering Truck	31,690.8	71	0.53	4.9	0.46	0.31	4.3	0.30	0.19
Deicer	825.3	263	0.95	6.3	0.44	0.25	1.0	0.08	0.05
Fork Lift	13,424.6	55	0.30	7.8	0.72	0.50	1.4	0.13	0.09
Fuel Truck	13,653.5	300	0.25	4.9	0.46	0.31	3.7	0.26	0.17
Generator	49,324.4	158	0.50	6.3	0.44	0.25	18.7	1.52	0.98
Ground Power Unit	72,954.9	194	0.75	6.3	0.44	0.25	50.9	4.15	2.67
Lavatory Truck	22,163.8	56	0.25	4.9	0.46	0.31	1.1	0.08	0.05
Lift	11,069.2	115	0.50	5.4	0.50	0.38	2.3	0.20	0.14
Passenger Stand	1,655.0	65	0.57	4.9	0.46	0.31	0.2	0.02	0.01
Sweeper	46.2	53	0.51	6.3	0.44	0.25	0.0	0.00	0.00
Water Service	508.4	235	0.20	4.9	0.46	0.31	0.1	0.01	0.00
Total	452,683						187.4	17.7	11.9

Note: Numbers may not add due to rounding.

(a) Emission Factors in grams per horsepower hour.

Source: LeighFisher, February 2016.

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LeighFisher

Table C-6
2030 ANNUAL EMISSIONS ESTIMATION – BY EDMS EQUIPMENT TYPE

EDMS GSE Equipment Type	Total Annual Hours	Horse-power	Load Factor	Emission Factors *(a)*			Annual Emissions *(Tons)*		
				NO_x	VOC	PM	NO_x	VOC	TSP
Air Conditioner	2,497.3	300	0.75	6.3	0.44	0.25	0.9	0.1	0.04
Air Start	4,528.5	425	0.90	5.3	0.29	0.18	4.1	0.4	0.17
Aircraft Tractor - Narrow Body	30,876.8	190	0.80	7.1	0.58	0.40	11.8	1.1	0.64
Aircraft Tractor - Wide Body	974.7	617	0.80	5.3	0.29	0.18	1.1	0.1	0.05
Baggage Tractor	129,809.4	71	0.55	11.5	1.32	0.91	35.2	4.1	2.42
Belt Loader	64,286.6	71	0.50	9.6	1.14	0.78	11.7	1.3	0.96
Cabin Service Truck	6,923.2	71	0.53	4.9	0.46	0.31	0.7	0.1	0.03
Cargo Loader	24,478.4	80	0.50	5.5	0.45	0.35	1.3	0.1	0.04
Cart	61.8	25	0.50	11.5	1.32	0.91	0.0	0.0	0.00
Catering Truck	35,604.9	71	0.53	4.9	0.46	0.31	3.4	0.3	0.15
Deicer	927.2	263	0.95	6.3	0.44	0.25	0.4	0.0	0.02
Fork Lift	15,082.6	55	0.30	7.8	0.72	0.50	1.0	0.1	0.07
Fuel Truck	15,339.8	300	0.25	4.9	0.46	0.31	2.9	0.2	0.13
Generator	55,416.3	158	0.50	6.3	0.44	0.25	7.0	0.7	0.30
Ground Power Unit	81,965.4	194	0.75	6.3	0.44	0.25	19.1	2.0	0.81
Lavatory Truck	24,901.2	56	0.25	4.9	0.46	0.31	0.9	0.1	0.04
Lift	12,436.4	115	0.50	5.4	0.50	0.38	1.5	0.2	0.08
Passenger Stand	1,859.4	65	0.57	4.9	0.46	0.31	0.2	0.0	0.01
Sweeper	51.9	53	0.51	6.3	0.44	0.25	0.0	0.0	0.00
Water Service	571.2	235	0.20	4.9	0.46	0.31	0.1	0.0	0.00
Total	508,593						103.3	10.9	6.0

Note: Numbers may not add due to rounding.

(a) Emission Factors in grams per horsepower hour

Source: LeighFisher, February 2016.

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Table C-7

2040 ANNUAL EMISSIONS ESTIMATION – BY EDMS EQUIPMENT TYPE

EDMS GSE Equipment Type	Total Annual Hours	Horse-power	Load Factor	Emission Factors *(a)*			Annual Emissions *(Tons)*		
				NO_x	VOC	PM	NO_x	VOC	TSP
Air Conditioner	2,731.7	300	0.75	6.3	0.44	0.25	1.0	0.1	0.04
Air Start	4,953.5	425	0.90	5.3	0.29	0.18	4.5	0.4	0.19
Aircraft Tractor - Narrow Body	33,774.8	190	0.80	7.1	0.58	0.40	12.9	1.3	0.70
Aircraft Tractor - Wide Body	1,066.2	617	0.80	5.3	0.29	0.18	1.3	0.1	0.05
Baggage Tractor	141,993.1	71	0.55	11.5	1.32	0.91	38.5	4.5	2.65
Belt Loader	70,320.4	71	0.50	9.6	1.14	0.78	12.8	1.4	1.05
Cabin Service Truck	7,573.0	71	0.53	4.9	0.46	0.31	0.7	0.1	0.03
Cargo Loader	26,775.8	80	0.50	5.5	0.45	0.35	1.4	0.1	0.04
Cart	67.6	25	0.50	11.5	1.32	0.91	0.0	0.0	0.00
Catering Truck	38,946.7	71	0.53	4.9	0.46	0.31	3.7	0.3	0.17
Deicer	1,014.2	263	0.95	6.3	0.44	0.25	0.4	0.0	0.02
Fork Lift	16,498.2	55	0.30	7.8	0.72	0.50	1.1	0.1	0.08
Fuel Truck	16,779.5	300	0.25	4.9	0.46	0.31	3.2	0.3	0.14
Generator	60,617.5	158	0.50	6.3	0.44	0.25	7.7	0.8	0.32
Ground Power Unit	89,658.5	194	0.75	6.3	0.44	0.25	20.9	2.1	0.88
Lavatory Truck	27,238.3	56	0.25	4.9	0.46	0.31	1.0	0.1	0.04
Lift	13,603.6	115	0.50	5.4	0.50	0.38	1.6	0.2	0.09
Passenger Stand	2,033.9	65	0.57	4.9	0.46	0.31	0.2	0.0	0.01
Sweeper	56.8	53	0.51	6.3	0.44	0.25	0.0	0.0	0.00
Water Service	624.8	235	0.20	4.9	0.46	0.31	0.1	0.0	0.00
Total	556,328						113.0	11.9	6.52

Note: Numbers may not add due to rounding.

(a) Emission Factors in grams per horsepower hour.

Source: LeighFisher, February 2016.

Emissions Inventory
San Diego International Airport
SAN680

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LeighFisher

APPENDIX D
ROADWAYS AND PARKING

Leigh|Fisher

Table D-1
2012 EMISSIONS COEFFICIENTS BY VEHICLE CLASS

Vehicle Class	Emissions Coefficient (Tons / Million Miles)					
	NO_X	VOC	CO	SO_X	PM_{10}	$PM_{2.5}$
Private Vehicles - Passengers	0.422	0.412	3.268	0.005	0.055	0.024
Rental Cars	0.422	0.412	3.268	0.005	0.055	0.024
Taxis / Limousines	0.422	0.412	3.268	0.005	0.055	0.024
Shared Ride Vans / Charters	0.422	0.412	3.268	0.005	0.055	0.024
Private Vehicles - Employees	0.422	0.412	3.268	0.005	0.055	0.024
Public Transit	18.921	1.414	14.710	0.016	1.080	0.622
Authority-Owned Shuttles	0.756	0.371	3.781	0.007	0.065	0.030
Off-Airport Shuttles	0.756	0.371	3.781	0.007	0.065	0.030
Cargo Trucks	12.702	0.901	2.864	0.018	0.516	0.426
Cargo Vans	0.756	0.371	3.781	0.007	0.065	0.030
Maintenance & Other Vehicles	0.756	0.371	3.781	0.007	0.065	0.030

Source: LeighFisher, February 2016.

Table D-2
2017 EMISSIONS COEFFICIENTS

Vehicle Class	Emissions Coefficient (Tons / Million Miles)					
	NO_X	VOC	CO	SO_X	PM_{10}	$PM_{2.5}$
Private Vehicles - Passengers	0.242	0.246	1.862	0.004	0.053	0.023
Rental Cars	0.242	0.246	1.862	0.004	0.053	0.023
Taxis / Limousines	0.242	0.246	1.862	0.004	0.053	0.023
Shared Ride Vans / Charters	0.242	0.246	1.862	0.004	0.053	0.023
Private Vehicles - Employees	0.242	0.246	1.862	0.004	0.053	0.023
Public Transit	13.111	0.995	11.331	0.014	0.914	0.498
Authority-Owned Shuttles	0.512	0.307	2.666	0.007	0.062	0.027
Off-Airport Shuttles	0.512	0.307	2.666	0.007	0.062	0.027
Cargo Trucks	5.524	0.176	0.678	0.017	0.148	0.074
Cargo Vans	0.512	0.307	2.666	0.007	0.062	0.027
Maintenance & Other Vehicles	0.512	0.307	2.666	0.007	0.062	0.027

Source: LeighFisher, February 2016.

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Table D-3
2020 EMISSIONS COEFFICIENTS

Vehicle Class	Emissions Coefficient (Tons / Million Miles)					
	NO_x	VOC	CO	SO_x	PM_{10}	$PM_{2.5}$
Private Vehicles - Passengers	0.175	0.192	1.402	0.004	0.053	0.023
Rental Cars	0.175	0.192	1.402	0.004	0.053	0.023
Taxis / Limousines	0.175	0.192	1.402	0.004	0.053	0.023
Shared Ride Vans / Charters	0.175	0.192	1.402	0.004	0.053	0.023
Private Vehicles - Employees	0.175	0.192	1.402	0.004	0.053	0.023
Public Transit	9.917	0.763	9.637	0.012	0.820	0.429
Authority-Owned Shuttles	0.386	0.264	2.071	0.006	0.063	0.027
Off-Airport Shuttles	0.386	0.264	2.071	0.006	0.063	0.027
Cargo Trucks	4.563	0.144	0.617	0.017	0.135	0.061
Cargo Vans	0.386	0.264	2.071	0.006	0.063	0.027
Maintenance & Other Vehicles	0.386	0.264	2.071	0.006	0.063	0.027

Source: LeighFisher, February 2016.

Table D-4
2030 EMISSIONS COEFFICIENTS

Vehicle Class	Emissions Coefficient (Tons / Million Miles)					
	NO_x	VOC	CO	SO_x	PM_{10}	$PM_{2.5}$
Private Vehicles - Passengers	0.082	0.126	0.867	0.002	0.052	0.022
Rental Cars	0.082	0.126	0.867	0.002	0.052	0.022
Taxis / Limousines	0.082	0.126	0.867	0.002	0.052	0.022
Shared Ride Vans / Charters	0.082	0.126	0.867	0.002	0.052	0.022
Private Vehicles - Employees	0.082	0.126	0.867	0.002	0.052	0.022
Public Transit	3.234	0.280	6.212	0.010	0.631	0.292
Authority-Owned Shuttles	0.145	0.164	0.943	0.004	0.063	0.027
Off-Airport Shuttles	0.145	0.164	0.943	0.004	0.063	0.027
Cargo Trucks	2.101	0.085	0.481	0.015	0.123	0.050
Cargo Vans	0.145	0.164	0.943	0.004	0.063	0.027
Maintenance & Other Vehicles	0.145	0.164	0.943	0.004	0.063	0.027

Source: LeighFisher, February 2016.

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Table D-5
2040 EMISSIONS COEFFICIENTS

Vehicle Class	Emissions Coefficient (Tons / Million Miles)					
	NO_x	VOC	CO	SO_x	PM_{10}	$PM_{2.5}$
Private Vehicles - Passengers	0.059	0.096	0.705	0.002	0.051	0.021
Rental Cars	0.059	0.096	0.705	0.002	0.051	0.021
Taxis / Limousines	0.059	0.096	0.705	0.002	0.051	0.021
Shared Ride Vans / Charters	0.059	0.096	0.705	0.002	0.051	0.021
Private Vehicles - Employees	0.059	0.096	0.705	0.002	0.051	0.021
Public Transit	1.150	0.126	5.091	0.009	0.565	0.244
Authority-Owned Shuttles	0.088	0.112	0.669	0.003	0.062	0.026
Off-Airport Shuttles	0.088	0.112	0.669	0.003	0.062	0.026
Cargo Trucks	1.945	0.082	0.467	0.015	0.123	0.049
Cargo Vans	0.088	0.112	0.669	0.003	0.062	0.026
Maintenance & Other Vehicles	0.088	0.112	0.669	0.003	0.062	0.026

Source: LeighFisher, February 2016.

Table D-6
2012 ROADWAY EMISSIONS

AIRPORT-RELATED EMISSIONS	Annual Emissions (Tons)					
	NO_x	VOC	CO	SO_x	PM_{10}	$PM_{2.5}$
Private Vehicles - Passengers	82.21	80.29	636.87	0.89	10.73	4.72
Rental Cars	9.71	9.48	75.23	0.11	1.27	0.56
Taxis / Limousines	10.66	10.41	82.58	0.12	1.39	0.61
Shared Ride Vans / Charters	1.94	1.89	15.01	0.02	0.25	0.11
Private Vehicles - Employees	26.89	26.26	208.31	0.29	3.51	1.55
Public Transit	1.65	0.12	1.28	0.00	0.09	0.05
Authority-Owned Shuttles	0.77	0.38	3.86	0.01	0.07	0.03
Off-Airport Shuttles	3.34	1.64	16.72	0.03	0.29	0.13
Cargo Trucks	13.81	0.98	3.11	0.02	0.56	0.46
Cargo Vans	0.61	0.30	3.04	0.01	0.05	0.02
Maintenance & Other Vehicles	0.58	0.29	2.92	0.01	0.05	0.02
Total	152.18	132.05	1,048.92	1.50	18.26	8.28

Note: Numbers may not add due to rounding.

Source: LeighFisher, February 2016.

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Table D-7
2017 ROADWAY EMISSIONS

Vehicle Class	Emissions (Tons)					
	NO_x	VOC	CO	SO_x	PM_{10}	$PM_{2.5}$
Private Vehicles - Passengers	51.59	52.44	396.96	0.86	11.38	4.88
Rental Cars	6.17	6.27	47.48	0.10	1.36	0.58
Taxis / Limousines	6.69	6.80	51.47	0.11	1.48	0.63
Shared Ride Vans / Charters	1.22	1.24	9.36	0.02	0.27	0.12
Private Vehicles - Employees	16.88	17.15	129.84	0.28	3.72	1.60
Public Transit	1.14	0.09	0.99	0.00	0.08	0.04
Authority-Owned Shuttles	0.57	0.34	2.98	0.01	0.07	0.03
Off-Airport Shuttles	3.36	2.01	17.49	0.04	0.41	0.18
Cargo Trucks	6.57	0.21	0.81	0.02	0.18	0.09
Cargo Vans	0.45	0.27	2.34	0.01	0.05	0.02
Maintenance & Other Vehicles	0.43	0.26	2.25	0.01	0.05	0.02
Total	95.07	87.09	661.95	1.46	19.05	8.19

Note: Numbers may not add due to rounding.

Source: LeighFisher, February 2016.

Table D-8
2020 ROADWAY EMISSIONS

Vehicle Class	Emissions (Tons)					
	NO_x	VOC	CO	SO_x	PM_{10}	$PM_{2.5}$
Private Vehicles - Passengers	39.68	43.50	317.20	0.82	12.01	5.13
Rental Cars	4.75	5.20	37.94	0.10	1.44	0.61
Taxis / Limousines	5.14	5.64	41.13	0.11	1.56	0.67
Shared Ride Vans / Charters	0.94	1.03	7.48	0.02	0.28	0.12
Private Vehicles - Employees	12.98	14.23	103.75	0.27	3.93	1.68
Public Transit	0.86	0.07	0.84	0.00	0.07	0.04
Authority-Owned Shuttles	0.46	0.31	2.46	0.01	0.07	0.03
Off-Airport Shuttles	2.69	1.84	14.42	0.04	0.44	0.19
Cargo Trucks	5.76	0.18	0.78	0.02	0.17	0.08
Cargo Vans	0.36	0.25	1.93	0.01	0.06	0.03
Maintenance & Other Vehicles	0.35	0.24	1.86	0.01	0.06	0.02
Total	73.96	72.49	529.77	1.40	20.08	8.60

Note: Numbers may not add due to rounding.

Source: LeighFisher, February 2016.

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Table D-9
2030 ROADWAY EMISSIONS

Vehicle Class	Emissions (Tons) NO_x	VOC	CO	SO_x	PM_{10}	$PM_{2.5}$
Private Vehicles - Passengers	22.49	34.60	237.56	0.68	14.20	5.93
Rental Cars	2.69	4.14	28.41	0.08	1.70	0.71
Taxis / Limousines	2.92	4.49	30.80	0.09	1.84	0.77
Shared Ride Vans / Charters	0.53	0.82	5.60	0.02	0.33	0.14
Private Vehicles - Employees	7.36	11.32	77.70	0.22	4.65	1.94
Public Transit	0.28	0.02	0.54	0.00	0.06	0.03
Authority-Owned Shuttles	0.21	0.24	1.35	0.01	0.09	0.04
Off-Airport Shuttles	1.22	1.39	7.95	0.04	0.53	0.22
Cargo Trucks	3.21	0.13	0.74	0.02	0.19	0.08
Cargo Vans	0.16	0.19	1.07	0.00	0.07	0.03
Maintenance & Other Vehicles	0.16	0.18	1.02	0.00	0.07	0.03
Total	41.22	57.50	392.76	1.16	23.72	9.91

Note: Numbers may not add due to rounding.

Source: LeighFisher, February 2016.

Table D-10
2040 ROADWAY EMISSIONS

Vehicle Class	Emissions (Tons) NO_x	VOC	CO	SO_x	PM_{10}	$PM_{2.5}$
Private Vehicles - Passengers	19.23	30.98	228.01	0.69	16.46	6.73
Rental Cars	2.30	3.71	27.27	0.08	1.97	0.80
Taxis / Limousines	2.49	4.02	29.56	0.09	2.13	0.87
Shared Ride Vans / Charters	0.45	0.73	5.38	0.02	0.39	0.16
Private Vehicles - Employees	6.29	10.13	74.58	0.23	5.38	2.20
Public Transit	0.10	0.01	0.44	0.00	0.05	0.02
Authority-Owned Shuttles	0.15	0.19	1.13	0.01	0.11	0.04
Off-Airport Shuttles	0.88	1.12	6.66	0.03	0.62	0.26
Cargo Trucks	3.51	0.15	0.84	0.03	0.22	0.09
Cargo Vans	0.12	0.15	0.89	0.00	0.08	0.03
Maintenance & Other Vehicles	0.11	0.14	0.86	0.00	0.08	0.03
Total	**35.63**	**51.33**	**375.62**	**1.18**	**27.50**	**11.25**

Note: Numbers may not add due to rounding.

Source: LeighFisher, February 2016.

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Table D-11
PARKING FACILITY USAGE

	2012	2017	2020	2030	2040
Private Vehicles - Passengers	1,932,185	2,113,471	2,243,180	2,716,348	3,207,382
Private Vehicles - Employees	1,756,155	1,920,925	2,038,817	2,468,877	2,915,176
Total	**3,688,340**	**4,034,395**	**4,281,996**	**5,185,225**	**6,122,557**

Note: Numbers may not add due to rounding.

Source: LeighFisher, February 2016.

Table D-12
PARKING FACILITY VMT

	2012	2017	2020	2030	2040
Private Vehicles - Passengers	1,833,751	2,005,801	2,128,902	2,577,965	3,043,984
Private Vehicles - Employees	1,532,601	1,676,395	1,779,280	2,154,595	2,544,081
Total	**3,366,352**	**3,682,197**	**3,908,183**	**4,732,561**	**5,588,065**

Note: Numbers may not add due to rounding.

Source: LeighFisher, February 2016.

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Table D-13
PARKING FACILITY EMISSIONS
Tons

	NO_x	VOC	CO	SO_x	PM_{10}	$PM_{2.5}$
2012						
Private Vehicles - Passengers	0.77	0.76	5.99	0.01	0.10	0.04
Private Vehicles - Employees	0.65	0.63	5.01	0.01	0.08	0.04
Total	**1.42**	**1.39**	**11.00**	**0.02**	**0.19**	**0.08**
2017						
Private Vehicles - Passengers	0.49	0.49	3.73	0.01	0.11	0.05
Private Vehicles - Employees	0.41	0.41	3.12	0.01	0.09	0.04
Total	**0.89**	**0.91**	**6.86**	**0.01**	**0.20**	**0.08**
2020						
Private Vehicles - Passengers	0.37	0.41	2.98	0.01	0.11	0.05
Private Vehicles - Employees	0.31	0.34	2.49	0.01	0.09	0.04
Total	**0.69**	**0.75**	**5.48**	**0.01**	**0.21**	**0.09**
2030						
Private Vehicles - Passengers	0.21	0.33	2.24	0.01	0.13	0.06
Private Vehicles - Employees	0.18	0.27	1.87	0.01	0.11	0.05
Total	**0.39**	**0.60**	**4.10**	**0.01**	**0.25**	**0.10**
2040						
Private Vehicles - Passengers	0.18	0.29	2.15	0.01	0.15	0.06
Private Vehicles - Employees	0.15	0.24	1.79	0.01	0.13	0.05
Total	**0.33**	**0.54**	**3.94**	**0.01**	**0.28**	**0.12**

Note: Numbers may not add due to rounding.

Source: LeighFisher, February 2016.

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APPENDIX E

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Table E-1
CONVERSION MAP FOR ACEIT AND OFFROAD CONSTRUCTION EQUIPMENT AND DEFAULT ANNUAL OPERATING PARAMETERS

		ACEIT Defaults			
ACEIT Construction Equipment	OFFROAD Equipment Type	Horse-power	Load Factor	Routine	Growth
40 Ton Crane	Cranes	300	0.43	110	1,032
40 Ton Rough Terrain	Cranes	300	0.43	0	1,158
40 Ton Rough Terrain Crane	Cranes	300	0.43	0	864
90 Ton Crane	Cranes	300	0.43	603	23,430
Air Compressor	Other Construction Equipment	100	0.43	132	1,239
Asphalt Paver	Pavers	175	0.59	100	1,692
Backhoe	Tractors/Loaders/Backhoes	100	0.21	1,005	24,236
Bob Cat	Tractors/Loaders/Backhoes	75	0.21	353	15,502
Caisson Drilling Rig	Bore/Drill Rigs	175	0.43	0	864
Chain Saw	Other Construction Equipment	11	0.70	212	2,395
Chipper/Stump Grinder	Other Construction Equipment	100	0.43	212	2,395
Concrete Boom Pump	Other Construction Equipment	11	0.43	0	2,592
Concrete Pump	Other Construction Equipment	11	0.43	32	1,397
Concrete Ready Mix Trucks	Off-Highway Trucks	600	0.59	248	8,754
Concrete Saws	Other Construction Equipment	40	0.59	14	1,239
Concrete Truck	Off-Highway Trucks	600	0.59	163	7,764
Crane	Cranes	300	0.43	118	0
Curb/Gutter Paver	Pavers	175	0.59	25	163
Distributing Tanker	Off-Highway Trucks	600	0.59	15	904
Dozer	Rubber Tired Dozers	175	0.59	1,606	17,857
Dump Truck	Off-Highway Trucks	600	0.59	1,329	28,076
Dump Truck (12 cy)	Off-Highway Trucks	600	0.59	2,659	28,253
Excavator	Excavators	175	0.59	515	6,881
Excavator with Bucket	Excavators	175	0.59	181	13,251
Excavator with Hoe Ram	Excavators	175	0.59	5	5,500
Flatbed Truck	Off-Highway Trucks	600	0.59	203	18,120
Fork Truck	Off-Highway Trucks	100	0.59	4,270	223,268
Forklift	Forklifts	100	0.59	0	1,728
Front Loader	Rubber Tired Loaders	100	0.21	0	2,005
Front Loader for Subgrade Materials	Rubber Tired Loaders	100	0.21	0	570
Generator	Other Construction Equipment	40	0.43	168	18,720
Generator Sets	Other Construction Equipment	40	0.43	176	7,751
Grader	Graders	300	0.59	82	963
Grout Mixer for Mortar	Other Construction Equipment	600	0.59	254	0
High Lift	Forklifts	100	0.59	1,226	62,192
High Lift Fork Truck	Off-Highway Trucks	100	0.59	424	0
Hydroseeder	Other Construction Equipment	600	0.59	75	867
Loader	Tractors/Loaders/Backhoes	175	0.59	193	3,616
Man Lift	Other Construction Equipment	75	0.21	3,271	192,360
Man Lift (Fascia Construction)	Other Construction Equipment	75	0.21	323	2,014
Masonry Saw	Other Construction Equipment	40	0.59	254	0
Material Deliveries	Off-Highway Trucks	600	0.59	54	3,778
Off-Road Truck	Off-Highway Trucks	600	0.59	75	867
Other General Equipment	Other Construction Equipment	175	0.43	919	30,776
Pickup Truck	Off-Highway Trucks	600	0.59	2,454	69,181

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Table E-1 *(continued)*

CONVERSION MAP FOR ACEIT AND OFFROAD CONSTRUCTION EQUIPMENT AND DEFAULT ANNUAL OPERATING PARAMETERS

		ACEIT Defaults			
ACEIT Construction Equipment	OFFROAD Equipment Type	Horse-power	Load Factor	Routine	Growth
Pressure Washer	Other Construction Equipment	25	0.43	12	0
Pumps	Other Construction Equipment	11	0.43	69	798
Roller	Rollers	100	0.59	944	10,990
Rubber Tired Loader	Rubber Tired Loaders	175	0.59	14	1,239
Scraper	Scrapers	600	0.59	386	3,739
Skid Steer Loader	Skid Steer Loaders	75	0.21	331	4,393
Slip Form Paver	Pavers	175	0.59	14	1,239
Surfacing Equipment (Grooving)	Surfacing Equipment	25	0.59	142	2,675
Survey Crew Trucks	Off-Highway Trucks	600	0.59	31	729
Sweepers/Scrubbers	Other Construction Equipment	175	0.43	12	0
Ten Wheelers- Material Delivery	Off-Highway Trucks	600	0.59	0	432
Tool Truck	Off-Highway Trucks	600	0.59	981	49,916
Tractor Trailer- Material Delivery	Off-Highway Trucks	600	0.59	957	55,438
Tractor Trailer- Steel Deliveries	Off-Highway Trucks	600	0.59	157	4,287
Tractor Trailer- Stone Delivery	Off-Highway Trucks	600	0.59	0	1,434
Tractor Trailer- Truck Delivery	Off-Highway Trucks	600	0.59	64	0
Tractor Trailer with Boom Hoist- Curbs Del & Place	Off-Highway Trucks	600	0.59	0	294
Tractor Trailers Temp Fac.	Off-Highway Trucks	600	0.59	13	295
Tractors/Loader/Backhoe	Tractors/Loaders/Backhoes	100	0.21	407	5,421
Trencher	Trenchers	75	0.59	0.000	864
Trencher for U/G Piping	Trenchers	75	0.59	0	1,434
Trowel Machine	Surfacing Equipment	600	0.59	24	749
Trowel Machines (4) machines	Surfacing Equipment	600	0.59	0	1,728
Truck for Topsoil & Seed Del&Spread	Off-Highway Trucks	600	0.59	0	294
Vibratory Compactor	Surfacing Equipment	6	0.43	51	325
Water Truck	Off-Highway Trucks	600	0.59	1,740	14,400

Notes: Construction growth project hours are applied in 2020, 2030, and 2040, with the construction of the parking plaza in Terminal 2 also being included in 2017.Source: LeighFisher, February 2016, ACEIT.

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Table E-2
OFFROAD RESULTS FOR CONSTRUCTION EQUIPMENT IN THE SAN DIEGO AIR BASIN

Year	Air Basin	OFFROAD Equipment Type	NOx	PM	HC	Hours	Count	Avg HP	Load Factor	NOx EF	PM EF	HC EF	VOC EF
2012	SD	Bore/Drill Rigs	15.5	0.61	0.82	32,876	104.9	206	0.50	4.15	0.16	0.22	0.23
2012	SD	Cranes	72.4	3.44	5.08	129,712	316.0	226	0.29	7.78	0.37	0.55	0.58
2012	SD	Crawler Tractors	148.4	7.06	10.05	234,325	582.1	208	0.43	6.44	0.31	0.44	0.46
2012	SD	Excavators	203.8	8.89	13.14	635,005	1,131.9	163	0.38	4.69	0.20	0.30	0.32
2012	SD	Graders	103.8	4.62	7.06	187,613	366.0	175	0.41	7.03	0.31	0.48	0.51
2012	SD	Off-Highway Tractors	50.9	2.86	4.56	148,750	257.5	123	0.44	5.82	0.33	0.52	0.55
2012	SD	Off-Highway Trucks	325.4	12.70	21.55	316,615	269.5	400	0.38	6.11	0.24	0.40	0.42
2012	SD	Other Construction Equipment	69.7	3.42	4.99	151,316	389.8	172	0.42	5.87	0.29	0.42	0.44
2012	SD	Pavers	16.1	0.89	1.23	47,570	138.4	126	0.42	5.87	0.32	0.45	0.47
2012	SD	Paving Equipment	9.7	0.53	0.72	31,749	78.4	131	0.36	5.97	0.32	0.45	0.47
2012	SD	Rollers	43.8	2.88	4.36	215,557	721.0	81	0.38	6.11	0.40	0.61	0.64
2012	SD	Rough Terrain Forklifts	41.2	2.52	2.82	178,379	727.0	100	0.40	5.19	0.32	0.36	0.38
2012	SD	Rubber Tired Dozers	39.8	2.03	3.07	43,026	64.3	255	0.40	8.31	0.42	0.64	0.67
2012	SD	Rubber Tired Loaders	395.2	18.20	27.70	803,517	942.3	200	0.36	6.18	0.28	0.43	0.45
2012	SD	Scrapers	280.2	11.64	17.75	215,504	529.2	362	0.48	6.77	0.28	0.43	0.45
2012	SD	Skid Steer Loaders	36.4	2.38	2.78	285,401	942.8	65	0.37	4.83	0.32	0.37	0.39
2012	SD	Surfacing Equipment	4.1	0.16	0.23	10,121	43.3	254	0.30	4.80	0.18	0.26	0.27
2012	SD	Tractors/Loaders/Backhoes	340.5	23.63	28.68	1,478,750	2,843.4	98	0.37	5.79	0.40	0.49	0.52
2012	SD	Trenchers	14.1	0.97	1.58	53,857	170.8	81	0.50	5.88	0.40	0.66	0.69
2012	SD	Sweepers/Scrubbers	16.6	1.37	2.15	71,263	116.8	64	0.46	7.24	0.60	0.94	0.99
2012	SD	Forklifts	86.1	6.58	8.53	590,621	896.8	89	0.20	7.36	0.56	0.73	0.77
2017	SD	Bore/Drill Rigs	11.6	0.43	0.70	33,049	98.1	206	0.50	3.08	0.12	0.19	0.20
2017	SD	Cranes	64.8	3.12	4.72	130,395	295.4	226	0.29	6.93	0.33	0.50	0.53
2017	SD	Crawler Tractors	139.3	6.85	9.99	235,559	544.1	208	0.43	6.01	0.30	0.43	0.45
2017	SD	Excavators	145.4	6.44	10.86	638,350	1,058.1	163	0.38	3.33	0.15	0.25	0.26

Notes: Notes: Only select fields and limited results from OFFROAD output displayed.
Hydrocarbon emission factor converted to VOC by EPA's suggested factor of 1.053.
Emission factors have been converted from T/HP Hr to G/HP Hr by converting to pounds (*2000) and then into grams (*454)

Source: LeighFisher, February 2016, OFFROAD Model.

Leigh|Fisher

Table E-3
EMISSION FACTORS BY OFFROAD EQUIPMENT TYPE

Equipment Type	NOx Emission Factors *(a)*					HC Emission Factors					PM Emission Factors				
	2012	2017	2020	2030	2040	2012	2017	2020	2030	2040	2012	2017	2020	2030	2040
Bore/Drill Rigs	4.15	3.08	2.21	1.20	1.20	0.23	0.20	0.16	0.11	0.11	0.16	0.12	0.08	0.04	0.04
Cranes	7.78	6.93	5.92	2.74	2.74	0.58	0.53	0.46	0.25	0.25	0.37	0.33	0.29	0.13	0.13
Crawler Tractors	6.44	6.01	4.97	2.17	2.17	0.46	0.45	0.40	0.22	0.22	0.31	0.30	0.25	0.11	0.11
Excavators	4.69	3.33	2.18	0.85	0.85	0.32	0.26	0.19	0.12	0.12	0.20	0.15	0.09	0.03	0.03
Forklifts	7.36	6.13	4.52	2.02	2.02	0.77	0.64	0.46	0.22	0.22	0.56	0.47	0.32	0.09	0.09
Graders	7.03	6.75	5.96	2.40	2.40	0.51	0.52	0.46	0.25	0.25	0.31	0.31	0.27	0.11	0.11
Off-Highway Tractors	5.82	4.43	3.23	1.42	1.42	0.55	0.46	0.37	0.18	0.18	0.33	0.26	0.19	0.06	0.06
Off-Highway Trucks	6.11	4.89	3.51	1.42	1.42	0.42	0.36	0.27	0.16	0.16	0.24	0.19	0.13	0.04	0.04
Other Construction Equipment	5.87	4.85	3.83	1.79	1.79	0.44	0.39	0.33	0.19	0.19	0.29	0.24	0.19	0.08	0.08
Pavers	5.87	4.73	3.60	1.40	1.40	0.47	0.40	0.32	0.16	0.16	0.32	0.26	0.20	0.07	0.07
Paving Equipment	5.97	4.58	3.31	1.45	1.45	0.47	0.38	0.27	0.15	0.15	0.32	0.25	0.17	0.06	0.06
Rollers	6.11	4.92	3.67	1.95	1.95	0.64	0.54	0.40	0.21	0.21	0.40	0.32	0.23	0.08	0.08
Rough Terrain Forklifts	5.19	3.47	2.52	1.51	1.51	0.38	0.24	0.18	0.11	0.11	0.32	0.18	0.11	0.04	0.04
Rubber Tired Dozers	8.31	7.74	6.88	4.24	4.24	0.67	0.65	0.60	0.42	0.42	0.42	0.40	0.36	0.22	0.22
Rubber Tired Loaders	6.18	5.31	4.02	1.34	1.34	0.45	0.42	0.34	0.18	0.18	0.28	0.25	0.18	0.06	0.06
Scrapers	6.77	6.07	4.88	1.76	1.76	0.45	0.43	0.37	0.19	0.19	0.28	0.26	0.21	0.07	0.07
Skid Steer Loaders	4.83	3.42	2.64	1.82	1.82	0.39	0.26	0.19	0.13	0.13	0.32	0.18	0.11	0.04	0.04
Surfacing Equipment	4.80	3.83	2.75	1.14	1.14	0.27	0.23	0.18	0.11	0.11	0.18	0.15	0.11	0.04	0.04
Sweepers/Scrubbers	7.24	6.33	5.03	2.58	2.58	0.99	0.90	0.68	0.28	0.28	0.60	0.52	0.39	0.10	0.10
Tractors/Loaders/Backhoes	5.79	4.70	3.38	1.69	1.69	0.52	0.42	0.31	0.17	0.17	0.40	0.31	0.20	0.06	0.06
Trenchers	5.88	5.13	4.29	2.89	2.89	0.69	0.62	0.49	0.32	0.32	0.40	0.35	0.28	0.14	0.14

Source: LeighFisher, February 2016, OFFROAD.

Leigh|Fisher

Table E-4
2012 CONSTRUCTION EMISSIONS BY ACEIT EQUIPMENT TYPE *(Tons)*

ACEIT Construction Equipment	Routine Construction Projects			Growth Construction Projects			Total Construction Projects		
	NO_x	VOC	TSP	NO_x	VOC	TSP	NO_x	VOC	TSP
40 Ton Crane	0.12	0.01	0.01	n.a.	n.a.	n.a.	0.12	0.01	0.01
40 Ton Rough Terrain	0.00	0.00	0.00	n.a.	n.a.	n.a.	0.00	0.00	0.00
40 Ton Rough Terrain Crane	0.00	0.00	0.00	n.a.	n.a.	n.a.	0.00	0.00	0.00
90 Ton Crane	0.67	0.05	0.03	n.a.	n.a.	n.a.	0.67	0.05	0.03
Air Compressor	0.04	0.00	0.00	n.a.	n.a.	n.a.	0.04	0.00	0.00
Asphalt Paver	0.07	0.01	0.00	n.a.	n.a.	n.a.	0.07	0.01	0.00
Backhoe	0.13	0.01	0.01	n.a.	n.a.	n.a.	0.13	0.01	0.01
Bob Cat	0.04	0.00	0.00	n.a.	n.a.	n.a.	0.04	0.00	0.00
Caisson Drilling Rig	0.00	0.00	0.00	n.a.	n.a.	n.a.	0.00	0.00	0.00
Chain Saw	0.01	0.00	0.00	n.a.	n.a.	n.a.	0.01	0.00	0.00
Chipper/Stump Grinder	0.06	0.00	0.00	n.a.	n.a.	n.a.	0.06	0.00	0.00
Concrete Boom Pump	0.00	0.00	0.00	n.a.	n.a.	n.a.	0.00	0.00	0.00
Concrete Pump	0.00	0.00	0.00	n.a.	n.a.	n.a.	0.00	0.00	0.00
Concrete Ready Mix Trucks	0.59	0.04	0.02	n.a.	n.a.	n.a.	0.59	0.04	0.02
Concrete Saws	0.00	0.00	0.00	n.a.	n.a.	n.a.	0.00	0.00	0.00
Concrete Truck	0.39	0.03	0.02	n.a.	n.a.	n.a.	0.39	0.03	0.02
Crane	0.13	0.01	0.01	n.a.	n.a.	n.a.	0.13	0.01	0.01
Curb/Gutter Paver	0.02	0.00	0.00	n.a.	n.a.	n.a.	0.02	0.00	0.00
Distributing Tanker	0.04	0.00	0.00	n.a.	n.a.	n.a.	0.04	0.00	0.00
Dozer	1.52	0.12	0.08	n.a.	n.a.	n.a.	1.52	0.12	0.08
Dump Truck	3.16	0.22	0.12	n.a.	n.a.	n.a.	3.16	0.22	0.12
Dump Truck (12 cy)	6.33	0.44	0.25	n.a.	n.a.	n.a.	6.33	0.44	0.25
Excavator	0.27	0.02	0.01	n.a.	n.a.	n.a.	0.27	0.02	0.01
Excavator with Bucket	0.10	0.01	0.00	n.a.	n.a.	n.a.	0.10	0.01	0.00
Excavator with Hoe Ram	0.00	0.00	0.00	n.a.	n.a.	n.a.	0.00	0.00	0.00
Flatbed Truck	0.48	0.03	0.02	n.a.	n.a.	n.a.	0.48	0.03	0.02
Fork Truck	1.69	0.12	0.07	n.a.	n.a.	n.a.	1.69	0.12	0.07
Forklift	0.00	0.00	0.00	n.a.	n.a.	n.a.	0.00	0.00	0.00
Front Loader	0.00	0.00	0.00	n.a.	n.a.	n.a.	0.00	0.00	0.00
Front Loader for Subgrade Materials	0.00	0.00	0.00	n.a.	n.a.	n.a.	0.00	0.00	0.00
Generator	0.02	0.00	0.00	n.a.	n.a.	n.a.	0.02	0.00	0.00
Generator Sets	0.02	0.00	0.00	n.a.	n.a.	n.a.	0.02	0.00	0.00
Grader	0.11	0.01	0.01	n.a.	n.a.	n.a.	0.11	0.01	0.01
Grout Mixer for Mortar	0.58	0.04	0.03	n.a.	n.a.	n.a.	0.58	0.04	0.03
High Lift	0.59	0.06	0.04	n.a.	n.a.	n.a.	0.59	0.06	0.04
High Lift Fork Truck	0.17	0.01	0.01	n.a.	n.a.	n.a.	0.17	0.01	0.01
Hydroseeder	0.17	0.01	0.01	n.a.	n.a.	n.a.	0.17	0.01	0.01

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Table E-4 *(continued)*

2012 CONSTRUCTION EMISSIONS BY ACEIT EQUIPMENT TYPE *(Tons)*

ACEIT Construction Equipment	Routine Construction Projects NO_x	VOC	TSP	Growth Construction Projects NO_x	VOC	TSP	Total Construction Projects NO_x	VOC	TSP
Loader	0.13	0.01	0.01	n.a.	n.a.	n.a.	0.13	0.01	0.01
Man Lift	0.33	0.03	0.02	n.a.	n.a.	n.a.	0.33	0.03	0.02
Man Lift (Fascia Construction)	0.03	0.00	0.00	n.a.	n.a.	n.a.	0.03	0.00	0.00
Masonry Saw	0.04	0.00	0.00	n.a.	n.a.	n.a.	0.04	0.00	0.00
Material Deliveries	0.13	0.01	0.01	n.a.	n.a.	n.a.	0.13	0.01	0.01
Off-Road Truck	0.18	0.01	0.01	n.a.	n.a.	n.a.	0.18	0.01	0.01
Other General Equipment	0.45	0.03	0.02	n.a.	n.a.	n.a.	0.45	0.03	0.02
Pickup Truck	5.84	0.41	0.23	n.a.	n.a.	n.a.	5.84	0.41	0.23
Pressure Washer	0.00	0.00	0.00	n.a.	n.a.	n.a.	0.00	0.00	0.00
Pumps	0.00	0.00	0.00	n.a.	n.a.	n.a.	0.00	0.00	0.00
Roller	0.38	0.04	0.02	n.a.	n.a.	n.a.	0.38	0.04	0.02
Rubber Tired Loader	0.01	0.00	0.00	n.a.	n.a.	n.a.	0.01	0.00	0.00
Scraper	1.02	0.07	0.04	n.a.	n.a.	n.a.	1.02	0.07	0.04
Skid Steer Loader	0.03	0.00	0.00	n.a.	n.a.	n.a.	0.03	0.00	0.00
Slip Form Paver	0.01	0.00	0.00	n.a.	n.a.	n.a.	0.01	0.00	0.00
Surfacing Equipment (Grooving)	0.01	0.00	0.00	n.a.	n.a.	n.a.	0.01	0.00	0.00
Survey Crew Trucks	0.07	0.01	0.00	n.a.	n.a.	n.a.	0.07	0.01	0.00
Sweepers/Scrubbers	0.01	0.00	0.00	n.a.	n.a.	n.a.	0.01	0.00	0.00
Ten Wheelers- Material Delivery	0.00	0.00	0.00	n.a.	n.a.	n.a.	0.00	0.00	0.00
Tool Truck	2.34	0.16	0.09	n.a.	n.a.	n.a.	2.34	0.16	0.09
Tractor Trailer- Material Delivery	2.28	0.16	0.09	n.a.	n.a.	n.a.	2.28	0.16	0.09
Tractor Trailer- Steel Deliveries	0.37	0.03	0.01	n.a.	n.a.	n.a.	0.37	0.03	0.01
Tractor Trailer- Stone Delivery	0.00	0.00	0.00	n.a.	n.a.	n.a.	0.00	0.00	0.00
Tractor Trailer- Truck Delivery	0.15	0.01	0.01	n.a.	n.a.	n.a.	0.15	0.01	0.01
Tractor Trailer with Boom Hoist- Curbs Del & Place	0.00	0.00	0.00	n.a.	n.a.	n.a.	0.00	0.00	0.00
Tractor Trailers Temp Fac.	0.03	0.00	0.00	n.a.	n.a.	n.a.	0.03	0.00	0.00
Tractors/Loader/Backhoe	0.05	0.00	0.00	n.a.	n.a.	n.a.	0.05	0.00	0.00
Trencher	0.00	0.00	0.00	n.a.	n.a.	n.a.	0.00	0.00	0.00
Trencher for U/G Piping	0.00	0.00	0.00	n.a.	n.a.	n.a.	0.00	0.00	0.00
Trowel Machine	0.04	0.00	0.00	n.a.	n.a.	n.a.	0.04	0.00	0.00
Trowel Machines (4) machines	0.00	0.00	0.00	n.a.	n.a.	n.a.	0.00	0.00	0.00
Truck for Topsoil & Seed Del&Spread	0.00	0.00	0.00	n.a.	n.a.	n.a.	0.00	0.00	0.00
Vibratory Compactor	0.00	0.00	0.00	n.a.	n.a.	n.a.	0.00	0.00	0.00
Water Truck	4.14	0.29	0.16	n.a.	n.a.	n.a.	4.14	0.29	0.16
TOTAL	35.59	2.53	1.48				35.59	2.53	1.48

Note: Numbers may not add due to rounding.

Source: LeighFisher, February 2016.

Emissions Inventory
San Diego International Airport
SAN680

E-6

Leigh|Fisher

Table E-5

2017 CONSTRUCTION EMISSIONS BY ACEIT EQUIPMENT TYPE *(Tons)*

ACEIT Construction Equipment	Routine Construction Projects			Growth Construction Projects			Total Construction Projects		
	NO_x	VOC	TSP	NO_x	VOC	TSP	NO_x	VOC	TSP
40 Ton Crane	0.11	0.01	0.01	0.00	0.00	0.00	0.11	0.01	0.01
40 Ton Rough Terrain	0.00	0.00	0.00	0.63	0.05	0.03	0.63	0.05	0.03
40 Ton Rough Terrain Crane	0.00	0.00	0.00	0.47	0.04	0.02	0.47	0.04	0.02
90 Ton Crane	0.59	0.05	0.03	1.89	0.14	0.09	2.48	0.19	0.12
Air Compressor	0.03	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.00
Asphalt Paver	0.05	0.00	0.00	0.17	0.01	0.01	0.22	0.02	0.01
Backhoe	0.11	0.01	0.01	0.17	0.02	0.01	0.28	0.03	0.02
Bob Cat	0.03	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.00
Caisson Drilling Rig	0.00	0.00	0.00	0.12	0.01	0.00	0.12	0.01	0.00
Chain Saw	0.01	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00
Chipper/Stump Grinder	0.05	0.00	0.00	0.00	0.00	0.00	0.05	0.00	0.00
Concrete Boom Pump	0.00	0.00	0.00	0.04	0.00	0.00	0.04	0.00	0.00
Concrete Pump	0.00	0.00	0.00	0.01	0.00	0.00	0.01	0.00	0.00
Concrete Ready Mix Trucks	0.47	0.03	0.02	5.03	0.37	0.19	5.50	0.41	0.21
Concrete Saws	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Concrete Truck	0.31	0.02	0.01	0.00	0.00	0.00	0.31	0.02	0.01
Crane	0.12	0.01	0.01	0.00	0.00	0.00	0.12	0.01	0.01
Curb/Gutter Paver	0.01	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00
Distributing Tanker	0.03	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.00
Dozer	1.41	0.12	0.07	0.00	0.00	0.00	1.41	0.12	0.07
Dump Truck	2.53	0.19	0.10	0.00	0.00	0.00	2.53	0.19	0.10
Dump Truck (12 cy)	5.07	0.37	0.19	0.00	0.00	0.00	5.07	0.37	0.19
Excavator	0.19	0.02	0.01	0.24	0.02	0.01	0.43	0.03	0.02
Excavator with Bucket	0.07	0.01	0.00	0.00	0.00	0.00	0.07	0.01	0.00
Excavator with Hoe Ram	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Flatbed Truck	0.39	0.03	0.01	0.00	0.00	0.00	0.39	0.03	0.01
Fork Truck	1.36	0.10	0.05	0.71	0.05	0.03	2.07	0.15	0.08
Forklift	0.00	0.00	0.00	0.38	0.04	0.03	0.38	0.04	0.03
Front Loader	0.00	0.00	0.00	0.14	0.01	0.01	0.14	0.01	0.01
Front Loader for Subgrade Materials	0.00	0.00	0.00	0.04	0.00	0.00	0.04	0.00	0.00
Generator	0.02	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00
Generator Sets	0.02	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00
Grader	0.11	0.01	0.00	0.00	0.00	0.00	0.11	0.01	0.00
Grout Mixer for Mortar	0.48	0.04	0.02	0.00	0.00	0.00	0.48	0.04	0.02
High Lift	0.49	0.05	0.04	0.64	0.07	0.05	1.13	0.12	0.09
High Lift Fork Truck	0.13	0.01	0.01	0.00	0.00	0.00	0.13	0.01	0.01
Hydroseeder	0.14	0.01	0.01	0.00	0.00	0.00	0.14	0.01	0.01
Loader	0.10	0.01	0.01	0.00	0.00	0.00	0.10	0.01	0.01
Man Lift	0.28	0.02	0.01	0.00	0.00	0.00	0.28	0.02	0.01

Table E-5 *(continued)*

2017 CONSTRUCTION EMISSIONS BY ACEIT EQUIPMENT TYPE *(Tons)*

ACEIT Construction Equipment	Routine Construction Projects			Growth Construction Projects			Total Construction Projects		
	NO_x	VOC	TSP	NO_x	VOC	TSP	NO_x	VOC	TSP
Man Lift (Fascia Construction)	0.03	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.00
Masonry Saw	0.03	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.00
Material Deliveries	0.10	0.01	0.00	0.00	0.00	0.00	0.10	0.01	0.00
Off-Road Truck	0.14	0.01	0.01	0.00	0.00	0.00	0.14	0.01	0.01
Other General Equipment	0.37	0.03	0.02	0.00	0.00	0.00	0.37	0.03	0.02
Pickup Truck	4.68	0.35	0.18	0.00	0.00	0.00	4.68	0.35	0.18
Pressure Washer	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pumps	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Roller	0.30	0.03	0.02	0.00	0.00	0.00	0.30	0.03	0.02
Rubber Tired Loader	0.01	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00
Scraper	0.91	0.06	0.04	0.00	0.00	0.00	0.91	0.06	0.04
Skid Steer Loader	0.02	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00
Slip Form Paver	0.01	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00
Surfacing Equipment (Grooving)	0.01	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00
Survey Crew Trucks	0.06	0.00	0.00	0.07	0.01	0.00	0.13	0.01	0.00
Sweepers/Scrubbers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ten Wheelers- Material Delivery	0.00	0.00	0.00	0.46	0.03	0.02	0.46	0.03	0.02
Tool Truck	1.87	0.14	0.07	2.00	0.15	0.08	3.87	0.29	0.15
Tractor Trailer- Material Delivery	1.83	0.13	0.07	3.35	0.25	0.13	5.18	0.38	0.20
Tractor Trailer- Steel Deliveries	0.30	0.02	0.01	1.83	0.14	0.07	2.13	0.16	0.08
Tractor Trailer- Stone Delivery	0.00	0.00	0.00	1.52	0.11	0.06	1.52	0.11	0.06
Tractor Trailer- Truck Delivery	0.12	0.01	0.00	0.00	0.00	0.00	0.12	0.01	0.00
Tractor Trailer with Boom Hoist- Curbs Del & Place	0.00	0.00	0.00	0.31	0.02	0.01	0.31	0.02	0.01
Tractor Trailers Temp Fac.	0.02	0.00	0.00	0.04	0.00	0.00	0.06	0.00	0.00
Tractors/Loader/Backhoe	0.04	0.00	0.00	0.00	0.00	0.00	0.04	0.00	0.00
Trencher	0.00	0.00	0.00	0.12	0.01	0.01	0.12	0.01	0.01
Trencher for U/G Piping	0.00	0.00	0.00	0.20	0.02	0.01	0.20	0.02	0.01
Trowel Machine	0.04	0.00	0.00	0.00	0.00	0.00	0.04	0.00	0.00
Trowel Machines (4) machines	0.00	0.00	0.00	1.43	0.09	0.05	1.43	0.09	0.05
Truck for Topsoil & Seed Del&Spread	0.00	0.00	0.00	0.31	0.02	0.01	0.31	0.02	0.01
Vibratory Compactor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Water Truck	3.32	0.24	0.13	0.00	0.00	0.00	3.32	0.24	0.13
TOTAL	28.94	2.18	1.19	22.33	1.68	0.94	51.27	3.86	2.14

Note: Numbers may not add due to rounding.

Source: LeighFisher, February 2016.

Leigh|Fisher

Table E-6

2020 CONSTRUCTION EMISSIONS BY ACEIT EQUIPMENT TYPE *(Tons)*

ACEIT Construction Equipment	Routine Construction Projects			Growth Construction Projects			Total Construction Projects		
	NO_x	VOC	TSP	NO_x	VOC	TSP	NO_x	VOC	TSP
40 Ton Crane	0.09	0.01	0.00	0.87	0.07	0.04	0.96	0.08	0.05
40 Ton Rough Terrain	0.00	0.00	0.00	0.97	0.08	0.05	0.97	0.08	0.05
40 Ton Rough Terrain Crane	0.00	0.00	0.00	0.73	0.06	0.03	0.73	0.06	0.03
90 Ton Crane	0.51	0.04	0.02	19.70	1.54	0.95	20.21	1.58	0.97
Air Compressor	0.02	0.00	0.00	0.22	0.02	0.01	0.25	0.02	0.01
Asphalt Paver	0.04	0.00	0.00	0.69	0.06	0.04	0.73	0.06	0.04
Backhoe	0.08	0.01	0.00	1.90	0.17	0.11	1.97	0.18	0.12
Bob Cat	0.02	0.00	0.00	0.91	0.08	0.05	0.93	0.08	0.06
Caisson Drilling Rig	0.00	0.00	0.00	0.16	0.01	0.01	0.16	0.01	0.01
Chain Saw	0.01	0.00	0.00	0.08	0.01	0.00	0.08	0.01	0.00
Chipper/Stump Grinder	0.04	0.00	0.00	0.43	0.04	0.02	0.47	0.04	0.02
Concrete Boom Pump	0.00	0.00	0.00	0.05	0.00	0.00	0.05	0.00	0.00
Concrete Pump	0.00	0.00	0.00	0.03	0.00	0.00	0.03	0.00	0.00
Concrete Ready Mix Trucks	0.34	0.03	0.01	11.99	0.93	0.43	12.33	0.96	0.44
Concrete Saws	0.00	0.00	0.00	0.12	0.01	0.01	0.12	0.01	0.01
Concrete Truck	0.22	0.02	0.01	10.63	0.83	0.38	10.86	0.85	0.39
Crane	0.10	0.01	0.00	0.00	0.00	0.00	0.10	0.01	0.00
Curb/Gutter Paver	0.01	0.00	0.00	0.07	0.01	0.00	0.08	0.01	0.00
Distributing Tanker	0.02	0.00	0.00	1.24	0.10	0.04	1.26	0.10	0.04
Dozer	1.26	0.11	0.07	13.97	1.22	0.73	15.23	1.33	0.79
Dump Truck	1.82	0.14	0.06	38.45	3.00	1.37	40.27	3.14	1.44
Dump Truck (12 cy)	3.64	0.28	0.13	38.70	3.02	1.38	42.34	3.30	1.51
Excavator	0.13	0.01	0.01	1.71	0.15	0.07	1.84	0.16	0.08
Excavator with Bucket	0.04	0.00	0.00	3.29	0.29	0.14	3.33	0.29	0.14
Excavator with Hoe Ram	0.00	0.00	0.00	1.37	0.12	0.06	1.37	0.12	0.06
Flatbed Truck	0.28	0.02	0.01	24.82	1.93	0.89	25.10	1.96	0.90
Fork Truck	0.97	0.08	0.03	50.97	3.97	1.82	51.94	4.05	1.85
Forklift	0.00	0.00	0.00	0.51	0.05	0.04	0.51	0.05	0.04
Front Loader	0.00	0.00	0.00	0.19	0.02	0.01	0.19	0.02	0.01
Front Loader for Subgrade Materials	0.00	0.00	0.00	0.05	0.00	0.00	0.05	0.00	0.00
Generator	0.01	0.00	0.00	1.36	0.12	0.07	1.37	0.12	0.07
Generator Sets	0.01	0.00	0.00	0.56	0.05	0.03	0.57	0.05	0.03
Grader	0.10	0.01	0.00	1.12	0.09	0.05	1.21	0.09	0.05
Grout Mixer for Mortar	0.38	0.03	0.02	0.00	0.00	0.00	0.38	0.03	0.02
High Lift	0.36	0.04	0.03	18.27	1.87	1.30	18.63	1.91	1.33
High Lift Fork Truck	0.10	0.01	0.00	0.00	0.00	0.00	0.10	0.01	0.00
Hydroseeder	0.11	0.01	0.01	1.29	0.11	0.07	1.41	0.12	0.07
Loader	0.07	0.01	0.00	1.39	0.13	0.08	1.46	0.13	0.09
Man Lift	0.22	0.01	0.02	12.77	1.09	0.64	12.99	1.11	0.65

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Table E-6 *(continued)*

2020 CONSTRUCTION EMISSIONS BY ACEIT EQUIPMENT TYPE *(Tons)*

ACEIT Construction Equipment	Routine Construction Projects			Growth Construction Projects			Total Construction Projects		
	NO_x	VOC	TSP	NO_x	VOC	TSP	NO_x	VOC	TSP
Man Lift (Fascia Construction)	0.02	0.00	0.00	0.13	0.01	0.01	0.16	0.01	0.01
Masonry Saw	0.03	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.00
Material Deliveries	0.07	0.01	0.00	5.17	0.40	0.18	5.25	0.41	0.19
Off-Road Truck	0.10	0.01	0.00	1.19	0.09	0.04	1.29	0.10	0.05
Other General Equipment	0.29	0.02	0.01	9.76	0.83	0.49	10.06	0.86	0.51
Pickup Truck	3.36	0.26	0.12	94.75	7.38	3.38	98.11	7.65	3.50
Pressure Washer	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pumps	0.00	0.00	0.00	0.02	0.00	0.00	0.02	0.00	0.00
Roller	0.22	0.02	0.01	2.62	0.29	0.16	2.84	0.31	0.17
Rubber Tired Loader	0.01	0.00	0.00	0.57	0.05	0.03	0.57	0.05	0.03
Scraper	0.73	0.05	0.03	7.12	0.54	0.30	7.85	0.59	0.33
Skid Steer Loader	0.02	0.00	0.00	0.20	0.01	0.01	0.22	0.02	0.01
Slip Form Paver	0.01	0.00	0.00	0.51	0.04	0.03	0.51	0.05	0.03
Surfacing Equipment (Grooving)	0.01	0.00	0.00	0.12	0.01	0.00	0.13	0.01	0.00
Survey Crew Trucks	0.04	0.00	0.00	1.00	0.08	0.04	1.04	0.08	0.04
Sweepers/Scrubbers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ten Wheelers- Material Delivery	0.00	0.00	0.00	0.59	0.05	0.02	0.59	0.05	0.02
Tool Truck	1.34	0.11	0.05	68.37	5.33	2.44	69.71	5.43	2.49
Tractor Trailer- Material Delivery	1.31	0.10	0.05	75.93	5.92	2.71	77.24	6.02	2.75
Tractor Trailer- Steel Deliveries	0.21	0.02	0.01	5.87	0.46	0.21	6.09	0.47	0.22
Tractor Trailer- Stone Delivery	0.00	0.00	0.00	1.96	0.15	0.07	1.96	0.15	0.07
Tractor Trailer- Truck Delivery	0.09	0.01	0.00	0.00	0.00	0.00	0.09	0.01	0.00
Tractor Trailer with Boom Hoist- Curbs Del & Place	0.00	0.00	0.00	0.40	0.03	0.01	0.40	0.03	0.01
Tractor Trailers Temp Fac.	0.02	0.00	0.00	0.40	0.03	0.01	0.42	0.03	0.02
Tractors/Loader/Backhoe	0.03	0.00	0.00	0.42	0.04	0.03	0.46	0.04	0.03
Trencher	0.00	0.00	0.00	0.18	0.02	0.01	0.18	0.02	0.01
Trencher for U/G Piping	0.00	0.00	0.00	0.30	0.03	0.02	0.30	0.03	0.02
Trowel Machine	0.03	0.00	0.00	0.80	0.05	0.03	0.83	0.05	0.03
Trowel Machines (4) machines	0.00	0.00	0.00	1.86	0.12	0.07	1.86	0.12	0.07
Truck for Topsoil & Seed Del&Spread	0.00	0.00	0.00	0.40	0.03	0.01	0.40	0.03	0.01
Vibratory Compactor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Water Truck	2.38	0.19	0.09	19.72	1.54	0.70	22.11	1.72	0.79
TOTAL	21.34	1.70	0.84	561.96	44.76	21.95	583.30	46.47	22.79

Note: Numbers may not add due to rounding.

Source: LeighFisher, February 2016.

Leigh|Fisher

Table E-7
2030 CONSTRUCTION EMISSIONS BY ACEIT EQUIPMENT TYPE *(Tons)*

ACEIT Construction Equipment	Routine Construction Projects			Growth Construction Projects			Total Construction Projects		
	NO_x	VOC	TSP	NO_x	VOC	TSP	NO_x	VOC	TSP
40 Ton Crane	0.04	0.00	0.00	0.40	0.04	0.02	0.45	0.04	0.02
40 Ton Rough Terrain	0.00	0.00	0.00	0.45	0.04	0.02	0.45	0.04	0.02
40 Ton Rough Terrain Crane	0.00	0.00	0.00	0.34	0.03	0.02	0.34	0.03	0.02
90 Ton Crane	0.24	0.02	0.01	9.13	0.84	0.44	9.37	0.86	0.45
Air Compressor	0.01	0.00	0.00	0.10	0.01	0.00	0.12	0.01	0.01
Asphalt Paver	0.02	0.00	0.00	0.27	0.03	0.01	0.29	0.03	0.01
Backhoe	0.04	0.00	0.00	0.95	0.09	0.03	0.99	0.10	0.03
Bob Cat	0.01	0.00	0.00	0.45	0.05	0.02	0.46	0.05	0.02
Caisson Drilling Rig	0.00	0.00	0.00	0.09	0.01	0.00	0.09	0.01	0.00
Chain Saw	0.00	0.00	0.00	0.04	0.00	0.00	0.04	0.00	0.00
Chipper/Stump Grinder	0.02	0.00	0.00	0.20	0.02	0.01	0.22	0.02	0.01
Concrete Boom Pump	0.00	0.00	0.00	0.02	0.00	0.00	0.02	0.00	0.00
Concrete Pump	0.00	0.00	0.00	0.01	0.00	0.00	0.01	0.00	0.00
Concrete Ready Mix Trucks	0.14	0.02	0.00	4.86	0.54	0.13	5.00	0.55	0.13
Concrete Saws	0.00	0.00	0.00	0.06	0.01	0.00	0.06	0.01	0.00
Concrete Truck	0.09	0.01	0.00	4.31	0.48	0.11	4.40	0.49	0.12
Crane	0.05	0.00	0.00	0.00	0.00	0.00	0.05	0.00	0.00
Curb/Gutter Paver	0.00	0.00	0.00	0.03	0.00	0.00	0.03	0.00	0.00
Distributing Tanker	0.01	0.00	0.00	0.50	0.06	0.01	0.51	0.06	0.01
Dozer	0.77	0.08	0.04	8.62	0.86	0.46	9.39	0.93	0.50
Dump Truck	0.74	0.08	0.02	15.59	1.73	0.41	16.33	1.81	0.43
Dump Truck (12 cy)	1.48	0.16	0.04	15.69	1.74	0.41	17.17	1.90	0.45
Excavator	0.05	0.01	0.00	0.67	0.09	0.02	0.72	0.10	0.02
Excavator with Bucket	0.02	0.00	0.00	1.28	0.17	0.04	1.30	0.18	0.04
Excavator with Hoe Ram	0.00	0.00	0.00	0.53	0.07	0.02	0.53	0.07	0.02
Flatbed Truck	0.11	0.01	0.00	10.06	1.12	0.26	10.18	1.13	0.27
Fork Truck	0.40	0.04	0.01	20.66	2.29	0.54	21.06	2.34	0.55
Forklift	0.00	0.00	0.00	0.23	0.02	0.01	0.23	0.02	0.01
Front Loader	0.00	0.00	0.00	0.06	0.01	0.00	0.06	0.01	0.00
Front Loader for Subgrade Materials	0.00	0.00	0.00	0.02	0.00	0.00	0.02	0.00	0.00
Generator	0.01	0.00	0.00	0.63	0.07	0.03	0.64	0.07	0.03
Generator Sets	0.01	0.00	0.00	0.26	0.03	0.01	0.27	0.03	0.01
Grader	0.04	0.00	0.00	0.45	0.05	0.02	0.49	0.05	0.02
Grout Mixer for Mortar	0.18	0.02	0.01	0.00	0.00	0.00	0.18	0.02	0.01
High Lift	0.16	0.02	0.01	8.17	0.89	0.35	8.33	0.91	0.36
High Lift Fork Truck	0.04	0.00	0.00	0.00	0.00	0.00	0.04	0.00	0.00
Hydroseeder	0.05	0.01	0.00	0.60	0.06	0.03	0.66	0.07	0.03
Loader	0.04	0.00	0.00	0.69	0.07	0.02	0.73	0.07	0.03
Man Lift	0.10	0.01	0.00	5.96	0.63	0.28	6.06	0.64	0.28

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Table E-7 *(continued)*
2030 CONSTRUCTION EMISSIONS BY ACEIT EQUIPMENT TYPE *(Tons)*

ACEIT Construction Equipment	Routine Construction Projects			Growth Construction Projects			Total Construction Projects		
	NO_x	VOC	TSP	NO_x	VOC	TSP	NO_x	VOC	TSP
Man Lift (Fascia Construction)	0.01	0.00	0.00	0.06	0.01	0.00	0.07	0.01	0.00
Masonry Saw	0.01	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00
Material Deliveries	0.03	0.00	0.00	2.10	0.23	0.06	2.13	0.24	0.06
Off-Road Truck	0.04	0.00	0.00	0.48	0.05	0.01	0.52	0.06	0.01
Other General Equipment	0.14	0.01	0.01	4.56	0.48	0.21	4.69	0.50	0.22
Pickup Truck	1.36	0.15	0.04	38.42	4.26	1.01	39.78	4.41	1.04
Pressure Washer	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pumps	0.00	0.00	0.00	0.01	0.00	0.00	0.01	0.00	0.00
Roller	0.12	0.01	0.00	1.39	0.15	0.06	1.51	0.16	0.06
Rubber Tired Loader	0.00	0.00	0.00	0.19	0.03	0.01	0.19	0.03	0.01
Scraper	0.26	0.03	0.01	2.56	0.28	0.11	2.83	0.30	0.12
Skid Steer Loader	0.01	0.00	0.00	0.14	0.01	0.00	0.15	0.01	0.00
Slip Form Paver	0.00	0.00	0.00	0.20	0.02	0.01	0.20	0.02	0.01
Surfacing Equipment (Grooving)	0.00	0.00	0.00	0.05	0.00	0.00	0.05	0.00	0.00
Survey Crew Trucks	0.02	0.00	0.00	0.40	0.04	0.01	0.42	0.05	0.01
Sweepers/Scrubbers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ten Wheelers- Material Delivery	0.00	0.00	0.00	0.24	0.03	0.01	0.24	0.03	0.01
Tool Truck	0.54	0.06	0.01	27.72	3.07	0.73	28.26	3.13	0.74
Tractor Trailer- Material Delivery	0.53	0.06	0.01	30.79	3.41	0.81	31.32	3.47	0.82
Tractor Trailer- Steel Deliveries	0.09	0.01	0.00	2.38	0.26	0.06	2.47	0.27	0.06
Tractor Trailer- Stone Delivery	0.00	0.00	0.00	0.80	0.09	0.02	0.80	0.09	0.02
Tractor Trailer- Truck Delivery	0.04	0.00	0.00	0.00	0.00	0.00	0.04	0.00	0.00
Tractor Trailer with Boom Hoist- Curbs	0.00	0.00	0.00						
Del & Place				0.16	0.02	0.00	0.16	0.02	0.00
Tractor Trailers Temp Fac.	0.01	0.00	0.00	0.16	0.02	0.00	0.17	0.02	0.00
Tractors/Loader/Backhoe	0.02	0.00	0.00	0.21	0.02	0.01	0.23	0.02	0.01
Trencher	0.00	0.00	0.00	0.12	0.01	0.01	0.12	0.01	0.01
Trencher for U/G Piping	0.00	0.00	0.00	0.20	0.02	0.01	0.20	0.02	0.01
Trowel Machine	0.01	0.00	0.00	0.33	0.03	0.01	0.34	0.03	0.01
Trowel Machines (4) machines	0.00	0.00	0.00	0.77	0.07	0.03	0.77	0.07	0.03
Truck for Topsoil & Seed Del&Spread	0.00	0.00	0.00	0.16	0.02	0.00	0.16	0.02	0.00
Vibratory Compactor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Water Truck	0.97	0.11	0.03	8.00	0.89	0.21	8.96	0.99	0.24
TOTAL	9.06	0.99	0.29	235.02	25.69	7.16	244.08	26.68	7.45

Note: Numbers may not add due to rounding.

Source: LeighFisher, February 2016.

Leigh|Fisher

Table E-8

2040 CONSTRUCTION EMISSIONS BY ACEIT EQUIPMENT TYPE *(Tons)*

ACEIT Construction Equipment	Routine Construction Projects			Growth Construction Projects			Total Construction Projects		
	NO_x	VOC	TSP	NO_x	VOC	TSP	NO_x	VOC	TSP
40 Ton Crane	0.04	0.00	0.00	0.40	0.04	0.02	0.45	0.04	0.02
40 Ton Rough Terrain	0.00	0.00	0.00	0.45	0.04	0.02	0.45	0.04	0.02
40 Ton Rough Terrain Crane	0.00	0.00	0.00	0.34	0.03	0.02	0.34	0.03	0.02
90 Ton Crane	0.24	0.02	0.01	9.13	0.84	0.44	9.37	0.86	0.45
Air Compressor	0.01	0.00	0.00	0.10	0.01	0.00	0.12	0.01	0.01
Asphalt Paver	0.02	0.00	0.00	0.27	0.03	0.01	0.29	0.03	0.01
Backhoe	0.04	0.00	0.00	0.95	0.09	0.03	0.99	0.10	0.03
Bob Cat	0.01	0.00	0.00	0.45	0.05	0.02	0.46	0.05	0.02
Caisson Drilling Rig	0.00	0.00	0.00	0.09	0.01	0.00	0.09	0.01	0.00
Chain Saw	0.00	0.00	0.00	0.04	0.00	0.00	0.04	0.00	0.00
Chipper/Stump Grinder	0.02	0.00	0.00	0.20	0.02	0.01	0.22	0.02	0.01
Concrete Boom Pump	0.00	0.00	0.00	0.02	0.00	0.00	0.02	0.00	0.00
Concrete Pump	0.00	0.00	0.00	0.01	0.00	0.00	0.01	0.00	0.00
Concrete Ready Mix Trucks	0.14	0.02	0.00	4.86	0.54	0.13	5.00	0.55	0.13
Concrete Saws	0.00	0.00	0.00	0.06	0.01	0.00	0.06	0.01	0.00
Concrete Truck	0.09	0.01	0.00	4.31	0.48	0.11	4.40	0.49	0.12
Crane	0.05	0.00	0.00	0.00	0.00	0.00	0.05	0.00	0.00
Curb/Gutter Paver	0.00	0.00	0.00	0.03	0.00	0.00	0.03	0.00	0.00
Distributing Tanker	0.01	0.00	0.00	0.50	0.06	0.01	0.51	0.06	0.01
Dozer	0.77	0.08	0.04	8.62	0.86	0.46	9.39	0.93	0.50
Dump Truck	0.74	0.08	0.02	15.59	1.73	0.41	16.33	1.81	0.43
Dump Truck (12 cy)	1.48	0.16	0.04	15.69	1.74	0.41	17.17	1.90	0.45
Excavator	0.05	0.01	0.00	0.67	0.09	0.02	0.72	0.10	0.02
Excavator with Bucket	0.02	0.00	0.00	1.28	0.17	0.04	1.30	0.18	0.04
Excavator with Hoe Ram	0.00	0.00	0.00	0.53	0.07	0.02	0.53	0.07	0.02
Flatbed Truck	0.11	0.01	0.00	10.06	1.12	0.26	10.18	1.13	0.27
Fork Truck	0.40	0.04	0.01	20.66	2.29	0.54	21.06	2.34	0.55
Forklift	0.00	0.00	0.00	0.23	0.02	0.01	0.23	0.02	0.01
Front Loader	0.00	0.00	0.00	0.06	0.01	0.00	0.06	0.01	0.00
Front Loader for Subgrade Materials	0.00	0.00	0.00	0.02	0.00	0.00	0.02	0.00	0.00
Generator	0.01	0.00	0.00	0.63	0.07	0.03	0.64	0.07	0.03
Generator Sets	0.01	0.00	0.00	0.26	0.03	0.01	0.27	0.03	0.01
Grader	0.04	0.00	0.00	0.45	0.05	0.02	0.49	0.05	0.02
Grout Mixer for Mortar	0.18	0.02	0.01	0.00	0.00	0.00	0.18	0.02	0.01
High Lift	0.16	0.02	0.01	8.17	0.89	0.35	8.33	0.91	0.36
High Lift Fork Truck	0.04	0.00	0.00	0.00	0.00	0.00	0.04	0.00	0.00
Hydroseeder	0.05	0.01	0.00	0.60	0.06	0.03	0.66	0.07	0.03
Loader	0.04	0.00	0.00	0.69	0.07	0.02	0.73	0.07	0.03
Man Lift	0.10	0.01	0.00	5.96	0.63	0.28	6.06	0.64	0.28

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Table E-8 *(continued)*

2040 CONSTRUCTION EMISSIONS BY ACEIT EQUIPMENT TYPE *(Tons)*

ACEIT Construction Equipment	Routine Construction Projects			Growth Construction Projects			Total Construction Projects		
	NO_x	VOC	TSP	NO_x	VOC	TSP	NO_x	VOC	TSP
Man Lift (Fascia Construction)	0.01	0.00	0.00	0.06	0.01	0.00	0.07	0.01	0.00
Masonry Saw	0.01	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00
Material Deliveries	0.03	0.00	0.00	2.10	0.23	0.06	2.13	0.24	0.06
Off Road Truck	0.04	0.00	0.00	0.48	0.05	0.01	0.52	0.06	0.01
Other General Equipment	0.14	0.01	0.01	4.56	0.48	0.21	4.69	0.50	0.22
Pickup Truck	1.36	0.15	0.04	38.42	4.26	1.01	39.78	4.41	1.04
Pressure Washer	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pumps	0.00	0.00	0.00	0.01	0.00	0.00	0.01	0.00	0.00
Roller	0.12	0.01	0.00	1.39	0.15	0.06	1.51	0.16	0.06
Rubber Tired Loader	0.00	0.00	0.00	0.19	0.03	0.01	0.19	0.03	0.01
Scraper	0.26	0.03	0.01	2.56	0.28	0.11	2.83	0.30	0.12
Skid Steer Loader	0.01	0.00	0.00	0.14	0.01	0.00	0.15	0.01	0.00
Slip Form Paver	0.00	0.00	0.00	0.20	0.02	0.01	0.20	0.02	0.01
Surfacing Equipment (Grooving)	0.00	0.00	0.00	0.05	0.00	0.00	0.05	0.00	0.00
Survey Crew Trucks	0.02	0.00	0.00	0.40	0.04	0.01	0.42	0.05	0.01
Sweepers/Scrubbers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ten Wheelers- Material Delivery	0.00	0.00	0.00	0.24	0.03	0.01	0.24	0.03	0.01
Tool Truck	0.54	0.06	0.01	27.72	3.07	0.73	28.26	3.13	0.74
Tractor Trailer- Material Delivery	0.53	0.06	0.01	30.79	3.41	0.81	31.32	3.47	0.82
Tractor Trailer Steel Deliveries	0.09	0.01	0.00	2.38	0.26	0.06	2.47	0.27	0.06
Tractor Trailer Stone Delivery	0.00	0.00	0.00	0.80	0.09	0.02	0.80	0.09	0.02
Tractor Trailer- Truck Delivery	0.04	0.00	0.00	0.00	0.00	0.00	0.04	0.00	0.00
Tractor Trailer with Boom Hoist Curbs Del & Place	0.00	0.00	0.00	0.16	0.02	0.00	0.16	0.02	0.00
Tractor Trailers Temp Fac.	0.01	0.00	0.00	0.16	0.02	0.00	0.17	0.02	0.00
Tractors/Loader/Backhoe	0.02	0.00	0.00	0.21	0.02	0.01	0.23	0.02	0.01
Trencher	0.00	0.00	0.00	0.12	0.01	0.01	0.12	0.01	0.01
Trencher for U/G Piping	0.00	0.00	0.00	0.20	0.02	0.01	0.20	0.02	0.01
Trowel Machine	0.01	0.00	0.00	0.33	0.03	0.01	0.34	0.03	0.01
Trowel Machines (4) machines	0.00	0.00	0.00	0.77	0.07	0.03	0.77	0.07	0.03
Truck for Topsoil & Seed Del&Spread	0.00	0.00	0.00	0.16	0.02	0.00	0.16	0.02	0.00
Vibratory Compactor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Water Truck	0.97	0.11	0.03	8.00	0.89	0.21	8.96	0.99	0.24
TOTAL	9.06	0.99	0.29	235.02	25.69	7.16	244.08	26.68	7.45

Note: Numbers may not add due to rounding.

Source: LeighFisher, February 2016.

ATTACHMENT D
CARB Control Measures, 1985 to 2019

Prepared by
California Air Resources Board
San Diego County Air Pollution Control District

March 2020

CARB Board Action (Board)	Hearing Date
Public Meeting to Consider San Joaquin Valley Agricultural Equipment Incentive Measure: The Board adopted the San Joaquin Valley Agricultural Equipment Incentive Measure for submission to the United States Environmental Protection Agency as a revision to the California State Implementation Plan (SIP). The measure achieves SIP creditable emission reductions from agricultural equipment incentive projects.	12/13/19
Public Hearing to Consider Proposed Amendments to the Regulation for Limiting Ozone Emissions from Indoor Air Cleaning Devices: The Board adopted amendments to the air cleaner regulation, which limits ozone emissions from air cleaning devices.	12/12/19
Public Hearing to Consider Proposed Control Measure for Ocean-Going Vessels At Berth: The Board adopted the Control Measure for Ocean-Going Vessels At Berth. The Proposed Regulation would take effect in 2021 and is designed to achieve further emissions from vessels at berth to reduce adverse health impacts to communities surrounding ports and terminals throughout California. These benefits would be achieved by including new vessel categories (such as vehicle carriers and tanker vessels), new ports, and independent marine terminals.	12/5/19
Public Hearing to Consider Proposed Amendments to the Low Carbon Fuel Standard: The Board adopted amendments to the Low Carbon Fuel Standard (LCFS) Regulation, focusing on strengthening the program's cost containment provisions and ensuring that LCFS residential charging credit revenue value benefits disadvantaged and low-income communities.	11/21/19
Public Hearing to Consider the Proposed Zero-Emission Airport Shuttle Regulation: The Board adopted the Zero-Emission Airport Shuttle Regulation. The regulation will transition combustion powered airport shuttles to zero-emission vehicles and will apply to private and public fixed destination shuttles that serve California's commercial airports. The Board certified the Final Environmental Analysis, approving the written response to any environmental comments received, approving findings and statement of overriding considerations, and adopting the regulation at this meeting.	6/27/19

CARB Board Action (Board)	Hearing Date
Public Meeting to Consider Proposed Updates to the Architectural Coatings Suggested Control Measure: The Board adopted updates to the Suggested Control Measure (SCM) for Architectural Coatings. The updates to the SCM would reduce volatile organic compound (VOC) limits for several coating categories, create two new coatings categories, and set limits for colorants (tints) added to architectural coatings at the point of sale. The updated SCM would serve as a model rule and assist air districts in their efforts to further reduce VOC emissions to meet ambient air quality standards for ozone.	5/23/19
Public Hearing to Consider Proposed Amendments to the Regulation for the Certification of Vapor Recovery Systems for Cargo Tanks: The Board adopted amendments to the Certification of Vapor Recovery Systems on Cargo Tanks Regulation that establish a regulatory mechanism to periodically evaluate program costs and subsequently adjust the certification fee to recover these costs, per the authority under the Health and Safety Code Section 41962. In addition, the amendments will establish: (1) a requirement for a public meeting prior to adjusting fees, (2) an effective date of January 1 following a fee revision, (3) the cost of replacement decals, and (4) procedures to request a certification fee refund.	4/25/19
Public Hearing to Consider Proposed Amendments to the Red Sticker Program for Off-Highway Recreational Vehicles: The Board adopted amendments to the Red Sticker Program for Off-Highway Recreation Vehicles (OHRV). OHRV are primarily used in public State parks and federally designated lands, as well as on private tracks. The goal of the amendments is to end the current red sticker program which allows for CARB certification of OHRV that do not meet emissions standards. The amendments include provisions that end the certification of new red sticker vehicles, end riding restrictions on public lands for existing red sticker vehicles, establish new OHRV emissions standards, and increase incentives for fleet emissions averaging and zero emission OHRV. The amendments are intended to cause emissions reductions from OHRV in California while ensuring availability for California dealers and riders.	4/25/19

CARB Board Action (Board)	Hearing Date
Public Hearing to Consider the Proposed Amendments to the On-Road Heavy-Duty Diesel-Fueled Residential and Commercial Solid Waste Collection Vehicles Regulation to Include Heavy Cranes: The Board adopted amendments to the On-Road Heavy-Duty Diesel-Fueled Residential and Commercial Solid Waste Collection Vehicles (SWCV) regulation. The amendments include two distinct changes to the regulation, (1) to ensure that compliant SWCVs do not experience registration delays at the California Department of Motor Vehicles due to recent changes in California law; (2) to provide a more cost-effective compliance option for specialized heavy cranes.	1/24/19
Public Hearing to Consider the Proposed Innovative Clean Transit Regulation, a Replacement of the Fleet Rule for Transit Agencies: The Board adopted the Innovative Clean Transit (ICT) Regulation that requires California transit agencies to gradually transition their buses to zero-emission technologies. The ICT regulation is structured to allow transit agencies to take advantage of incentive programs by acting early and in a manner to implement plans that are best suited for their own situations. This is the second of two Board hearings on this item; the Board certified the Final Environmental Analysis, approving the written response to comments received on the Draft Environmental Analysis, and adopting the amendments at this meeting.	12/14/18
Public Hearing to Consider California Cap on Greenhouse Gas Emissions and Market-Based Compliance Mechanisms Regulation: The Cap-and-Trade Regulation amendments are intended to conform with the requirements in AB 398, respond to Board direction in Resolution 17-21, and enhance program implementation and oversight. The amendments include changes to provisions relating to free allocation for minimizing leakage and transition assistance, offsets usage limits and criteria related to direct environmental benefits in the State, and cost containment.	12/13/18
Public Hearing to Consider Proposed Amendments to the Regulation for the Mandatory Reporting of Greenhouse Gas Emissions: The Mandatory Reporting of Greenhouse Gas Emissions amendments are targeted revisions to clarify the existing regulation related to how entities report their greenhouse gas emissions to support the Cap-and-Trade Program, and to ensure the data that are collected for CARB's climate change programs are complete and accurate.	12/13/18

CARB Board Action (Board)	Hearing Date
Public Hearing to Consider Proposed Revisions to On Board Diagnostic System Requirements, Including the Introduction of Real Emissions Assessment Logging, for Heavy Duty Engines, Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles and Engine: The Board adopted amendments to the heavy-duty (HD) On Board Diagnostic (OBD) and medium-duty OBD II requirements to update the monitoring requirements for gasoline and diesel vehicles, to require more data parameters to be tracked and reported by the engine/vehicle, and to clarify and improve the regulation where necessary. Staff also updated the associated HD OBD enforcement regulation to align with the proposed changes to the HD OBD regulation and to modify the manufacturer self-testing requirements.	11/15/18
Public Hearing to Consider Proposed California Certification Procedures for Light-Duty Engine Packages for Use in New Light-Duty Specially-Produced Motor Vehicles for 2019 and Subsequent Model Years: The Board adopted the California Regulation and Certification Procedures for Light-Duty Engine Packages for Use In New Light-Duty Specially-Produced Motor Vehicles for 2019 And Subsequent Model Years. Staff presented regulations and certification procedures for manufacturers of light-duty engine packages for use in new light-duty specially constructed vehicles which resemble heritage vehicles originally produced at least 25 years ago	10/25/18
Public Meeting to Consider Proposed Amendments to California Specifications for Fill Pipes and Openings of Motor Vehicle Fuel Tanks: The Board adopted amendments to Vehicle Fill Pipe Specifications to help ensure new motor vehicle fill pipes are compatible and form a good seal with Phase II recovery nozzles that are certified for use at California gasoline stations as a means to reduce overpressure.	10/25/18
Public Hearing to Consider Proposed Amendments to Enhanced Vapor Recovery Regulations to Standardize Gas Station Nozzle Spout Dimensions to Help Address Storage Tank Overpressure: The Board adopted amendments to Enhanced Vapor Recovery Regulations to standardize gas station nozzle spout dimensions to improve compatibility with newer motor vehicle fill pipes. This compatibility is necessary to reduce air ingestion at the nozzle, which will help reduce storage tank overpressure conditions.	10/25/18

CARB Board Action (Board)	Hearing Date
Public Meeting to Consider the Proposed Submission of California's Greenhouse Gas Emission Standards for Crude Oil and Natural Gas Facilities into the California State Implementation Plan: The Board adopted a resolution directing staff to submit California's Greenhouse Gas Emission Standards for Crude Oil and Natural Gas Facilities into the California State Implementation Plan (Oil and Gas SIP Submittal). California Air Resources Board submitted the Oil and Gas SIP Submittal to the United States Environmental Protection Agency as a revision to the California State Implementation Plan.	10/25/18
Public Hearing to Consider Proposed Amendments to the Low-Emission Vehicle III Greenhouse Gas Emission Regulation: The Board adopted amendments to the Low-Emission Vehicle III greenhouse gas emission regulation to clarify that the "deemed to comply" option for model years 2021 through 2025 is applicable only if the currently adopted federal regulations remain in effect.	9/27/18
Public Hearing to Consider Proposed Amendments to the Low Carbon Fuel Standard Regulation and to the Regulation on Commercialization of Alternative Diesel Fuels: The Board adopted amendments designed to strengthen the Low Carbon Fuel Standard (LCFS) regulation through 2030 in line with the Senate Bill 32 greenhouse gas reduction goals. The amendments would enhance LCFS credit for zero-emission vehicle fueling infrastructure per Governor Brown's Executive Order B-48-18, adopt a protocol to enable credit generation for carbon capture and sequestration projects, expand fuel types and vehicle applications to which the LCFS regulation applies (including adding alternative jet fuel), improve crediting for innovative actions at petroleum refineries, and establish an independent third-party verification and verifier accreditation system to ensure accuracy of LCFS reported data. The amendments also include several technical changes to improve, simplify, streamline, and clarify the regulation. As part of this rulemaking, the Board will comply with a California court order by considering supplemental environmental analysis related to oxides of nitrogen (NOx) emissions from biodiesel, and a proposed amendment to the Alternative Diesel Fuels regulation based on that analysis. This is the first of two Board hearings on this item; the Board will not vote on the amendments at this meeting.	9/27/18

CARB Board Action (Board)	Hearing Date
Public Hearing to Consider Proposed Amendments to California Emission Control System Warranty Regulations and Maintenance Provisions for 2022 and Subsequent Model Year On-Road Heavy-Duty Diesel Vehicles with Gross Vehicle Weight Rating Greater Than 14,000 Pounds and Heavy-Duty Diesel Engines in Such Vehicles: The Board adopted amendments to the California warranty and maintenance provisions for on-road heavy-duty (HD) diesel vehicles, and the engines used in such vehicles. Currently, because the warranty mileage period is disproportionate to the actual service lives of many modern HD vehicles and engines, vehicle owners have no incentive to pay for repairs of emissions-related problems that do not adversely affect fuel economy or performance, which results in additional emissions. Accordingly, staff presented to lengthen both the existing warranty periods and minimum maintenance intervals so as to reduce emissions by incentivizing vehicle owners to perform required maintenance and to seek more timely repairs, and to encourage manufacturers to design and produce more durable parts. Staff also clarified that the warranty coverage extends to any part that causes the illumination of the HD on-board diagnostic system malfunction indicator light.	6/28/18
Public Meeting to Consider Submission of the 2013 Amendments to the Cargo Tank Vapor Recovery Regulation into the California State Implementation Plan: The Board adopted a resolution directing staff to submit the 2013 Amendments to the Cargo Tank Vapor Recovery Regulations into the California State Implementation Plan (Cargo Tank SIP Submittal). CARB submitted the Cargo Tank SIP Submittal to the United States Environmental Protection Agency as a revision to the California State Implementation Plan.	6/28/18
Public Hearing to Consider Proposed Amendments to the Heavy-Duty Vehicle Inspection Program and Periodic Smoke Inspection Program: The amendments lower the allowable opacity limit for HD vehicles operating in California for both the HDVIP and PSIP, establish reporting requirements for the PSIP and smoke tester training requirements, and allow 2013 model year and newer engines to report on-board diagnostic data in lieu of performing the annual PSIP smoke test.	5/25/18
Public Hearing to Consider Proposed Amendments to the Consumer Products Regulation and Method 310: The adopted amendments to the consumer products regulation established an alternate compliance option for multi-purpose lubricant (MPL) products.	5/25/18

CARB Board Action (Board)	Hearing Date
Public Hearing to Consider the Proposed Regulation for Prohibitions on Use of Certain Hydrofluorocarbons in Stationary Refrigeration and Foam End-Uses: The adopted regulation will provide prohibitions on the use of certain high-global warming potential hydrofluorocarbons (HFC) in stationary refrigeration and foam end-uses. The objective is to preserve HFC emissions reductions expected from the federal Significant New Alternatives Policy (SNAP) Rules for certain end-uses for which compliance dates have either already passed or are imminent.	3/23/18
Public Meeting to Consider Funding Agricultural Replacement Measures for Emission Reductions Program Guidelines: The Guidelines outline the California Air Resources Board's plans for expending these funds in a manner consistent with the legislative direction from two bills, existing statutes, and regulations. The Guidelines describe district funding allocations, eligible project categories and criteria, program implementation details, and the justification for these investments.	3/23/18
Public Hearing to Consider Proposed California Greenhouse Gas Emissions Standards for Medium- and Heavy-Duty Engines and Vehicles, and Proposed Amendments to the Tractor-Trailer Greenhouse Gas Regulation: The adoption creates new, more stringent California Phase 2 GHG emission standards that largely harmonize with the federal Phase 2 standards, and proposed amendments to the Tractor-Trailer GHG regulation to harmonize California's Tractor-Trailer GHG regulation with the proposed Phase 2 trailer standards. The proposed California Phase 2 GHG standards are needed to meet the mandates of both AB 32 and of SB 32, and the California HSC.	2/8/18
Public Hearing to Consider Proposed Amendments to the Airborne Toxic Control Measure For Diesel Particulate Matter from Portable Engines Rated at 50 Horsepower and Greater – and to the Statewide Portable Equipment Registration Program Regulation: The amendments will provide more time for cleaner engine replacement while preserving the expected emission reductions, and make other improvements to the ATCM. PERP will have corresponding amendments and make other improvements to the program.	11/16/17
Public Hearing to Consider the Proposed Amendments to California's Evaluation Procedures for New Aftermarket Catalytic Converters: The amendments are for procedures used to evaluate and approve aftermarket catalytic converters designed for use on California passenger cars and trucks to allow them to be used for Low Emission Vehicle III emission standards.	9/28/17

CARB Board Action (Board)	Hearing Date
Public Hearing to Consider Proposed Amendments to the Market-Based Compliance Mechanism Regulation (Cap-and-Trade Regulation): The amendments to the Cap-and-Trade Program extend major provisions of the Program beyond 2020, to broaden the Program through linkage with Ontario, Canada, to prevent emissions leakage in the most cost-effective manner through appropriate allocation to entities, to clarify compliance obligations for certain sectors, and to enhance ARB's ability to implement and oversee the Cap-and-Trade Program.	7/27/17
Public Hearing to Consider Proposed Amendments to the Regulation for the Mandatory Reporting of Greenhouse Gas Emissions: The amendments to the Regulation for the Mandatory Reporting of Greenhouse Gas Emissions are to ensure the reported GHG data are accurate and fully support the California Cap-and-Trade Regulation.	6/29/17
Public Meeting to Consider Proposed Revisions to the Carl Moyer Memorial Air Quality Standards Attainment Program Guidelines: The updated Carl Moyer Memorial Air Quality Standards Attainment Program 2017 Guidelines implement changes directed by Senate Bill 513 and redesign the Program to meet California's need to transition to the very low and zero-emission technologies of the future.	4/27/17
Public Meeting to Consider the Proposed Amendments to the Evaporative Emission Requirements for Small Off-Road Engines: The amendments will address to non-compliance of small off-road engines (SORE) with existing evaporative emission standards, as well as amendments to streamline the certification process by harmonizing where feasible with federal requirements.	11/17/16
Notice of Public Hearing to Consider Proposed Regulation to Provide Certification Flexibility for Innovative Heavy-Duty Engine and California Certification and Installation Procedures for Medium and Heavy-Duty Vehicle Hybrid Conversion Systems: This regulation's certification flexibility is tailored to encourage development and market launch of heavy-duty engines meeting California's optional low oxides of oxides of nitrogen emission standards, robust heavy-duty hybrid engines, and high-efficiency heavy-duty engines.	10/20/16

CARB Board Action (Board)	Hearing Date
Notice of Public Hearing to Consider Amendments to the California Cap on Greenhouse Gas Emissions and Market-Based Compliance Mechanisms Regulations: The amendments would extend major provisions of the Regulation beyond 2020; link the Regulation with Ontario, Canada; continue cost-effective prevention of emission leakage through allowance allocations to entities; and enhance Program implementation and oversight.	9/22/16
Notice of Public Hearing to Consider Proposed Amendments to the Mandatory Reporting of Greenhouse Gas Emissions: The amendments are to ensure reported GHG data are accurate and fully support the California Cap on Greenhouse Gas Emissions and Market Based Compliance Mechanisms and comply with the U.S. EPA Clean Power Plan.	9/22/16
Public Hearing to Consider Proposed Amendments to the Large Spark-Ignition Engine Fleet Requirements Regulation: The amendment will establish new reporting and labeling requirements and extend existing recordkeeping requirements. The regulatory amendments are expected to improve the reliability of the emission reductions projected for the existing LSI Fleet Regulation by increasing enforcement effectiveness and compliance rates.	7/21/16
Public Hearing to Consider Proposed Evaluation Procedure for New Aftermarket Diesel Particulate Filters Intended as Modified Parts for 2007 through 2009 Model Year On-Road Heavy-Duty Diesel Engines: The amendment would establish a path for exempting aftermarket modified part DPFs intended for 2007 through 2009 on-road heavy-duty diesel engines from the prohibitions of the current vehicle code. Staff is also proposing to incorporate a new procedure for the evaluation of such DPFs.	4/22/16
Public Hearing to Consider Proposed Amendments to the Regulation for Small Containers of Automotive Refrigerant: The amendments to the Regulation for Small Containers of Automotive Refrigerant to clarify any existing requirement that retailers must transfer the unclaimed consumer deposits to the manufacturers, clarify how the manufacturers spend the money, set the refundable consumer deposit at $10, and require additional language on the container label.	4/22/16
Amendments to the Portable Fuel Container Regulation Amendments to the Portable Fuel Container (PFC) regulation, which include requiring certification fuel to contain 10 percent ethanol, harmonizing aspects of the Board's PFC certification and test procedures with those of the U.S. EPA, revising the ARB's certification process, and streamlining, clarifying, and increasing the robustness of ARB's certification and test procedures.	2/18/16

CARB Board Action (Board)	Hearing Date
Technical Status and Proposed Revisions to On-Board Diagnostic System Requirements and Associated Enforcement Provisions for Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles and Engines (OBD II) Amendments to the OBD II regulations that update requirements to account for LEV III applications and monitoring requirements for gasoline and diesel vehicles, and clarify and improve the regulation; also, updates to the associated OBD II enforcement regulation to align it with the proposed amendments to the OBD II regulations and a minor amendment to the definition of "emissions-related part" in title 13, CCR section 1900.	9/25/15
2015 Low Carbon Fuel Standard (LCFS) Amendments (2 of 2) Re-adoption of the Low Carbon Fuel Standard, which includes updates and revisions to the regulation now in effect. The proposed regulation was first presented to the Board at its February 2015 public hearing, at which the Board directed staff to make modifications to the proposal.	9/24/15
Proposed Regulation on the Commercialization of Alternative Diesel Fuels (2 of 2) Regulation governing the introduction of alternative diesel fuels into the California commercial market, including special provisions for biodiesel.	9/24/15
CA Cap on GHG Emissions and Market-Based Compliance Mechanisms (2 of 2) Amendments to the Cap and Trade Regulation to include a new Rice Cultivation Compliance Offset Protocol and an update to the United States Forest Compliance Offset Protocol that would include project eligibility in parts of Alaska.	6/25/15
Intermediate Volume Manufacturer Amendments to the Zero Emission Vehicle Regulation (2 of 2) Amendments regarding intermediate volume manufacturer compliance obligations under the Zero Emission Vehicle regulation.	5/21/15
2015 Amendments to Certification Procedures for Vapor Recovery Systems at Gasoline Dispensing Facilities—Aboveground Storage Tanks and Enhanced Conventional Nozzles Amendments would establish new performance standards and specifications for nozzles used at fleet facilities that exclusively refuel vehicles equipped with onboard vapor recovery systems, would provide regulatory relief for owners of certain existing aboveground storage tanks, and would ensure that mass-produced vapor recovery equipment matches the specifications of equipment evaluated during the ARB certification process.	4/23/15

CARB Board Action (Board)	Hearing Date
Proposed Regulation for the Commercialization of Alternative Diesel Fuels (1 of 2) Regulation governing the introduction of alternative diesel fuels into the California commercial market, including special provisions for biodiesel. This is the first of two hearings on the item, and the Board will not take action to approve the proposed regulation.	2/19/15
Evaporative Emission Control Requirements for Spark-Ignition Marine Watercraft Regulation for controlling evaporative emissions from spark-ignition marine watercraft. The proposed regulation will harmonize, to the extent feasible, with similar federal requirements, while adding specific provisions needed to support California's air quality needs.	2/19/15
2015 Low Carbon Fuel Standard (LCFS) Amendments (1 of 2) Regulation for a Low Carbon Fuel Standard that includes re- adoption of the existing Low Carbon Fuel Standard with updates and revisions. This is the first of two hearings on the item, and the Board will not take action to approve the proposed regulation.	2/19/15
CA Cap on GHG Emissions and Market-Based Compliance Mechanisms to Add the Rice Cultivation Projects and Updated U.S. Forest Projects Protocols (1 of 2) Updates to the Cap and Trade Regulation to include a new Rice Cultivation Compliance Offset Protocol and an update to the United States Forest Compliance Offset Protocol that would include project eligibility in parts of Alaska.	12/18/14
2014 Amendments to ZEV Regulation Additional compliance flexibility to ZEV manufacturers working to bring advanced technologies to market.	10/23/14
LEV III Criteria Pollutant Requirements for Light- and Medium-Duty Vehicles the Hybrid Electric Vehicle Test Procedures, and the HD Otto-Cycle and HD Diesel Test Procedures Applies to the 2017 and subsequent model years.	10/23/14
Amendments to Mandatory Reporting Regulation for Greenhouse Gases Further align reporting methods with U.S. EPA methods and factors, and modify reporting requirements to fully support implementation of California's Cap and Trade program.	9/19/14
Amendments to the California Cap on Greenhouse Gas Emissions and Market Based Compliance Mechanisms Technical revisions to Mandatory Reporting of Greenhouse Gas Emissions Regulation to further align reporting methods with U.S.EPA update methods and factors, and modify reporting requirements to fully support implementation of California's Cap and Trade program.	9/18/14

CARB Board Action (Board)	Hearing Date
Amendments to the AB 32 Cost of Implementation Fee Regulation Amendments to the regulation to make it consistent with the revised mandatory reporting regulation, to add potential reporting requirements, and to incorporate requirements within the mandatory reporting regulation to streamline reporting.	9/18/14
Low Carbon Fuel Standard 2014 Update As a result of a California Court of Appeal decision, ARB will revisit the LCFS rulemaking process to meet certain procedural requirements of the APA and CEQA. Following incorporation of any modifications to the regulation, the Board will consider the proposed regulation for adoption at a second hearing held in the spring of 2015.	7/24/14
Revisions to the Carl Moyer Memorial Air Quality Standards Attainment Program Guidelines for On-Road Heavy-Duty Trucks Revisions to 1) reduce surplus emission reduction period, 2) reduce minimum CA usage requirement, 3) prioritize on-road funding to small fleets, 4) include light HD vehicles 14000-19500 libs, and 5) clarify program specifications.	7/24/14
Amendments to Enhanced Fleet Modernization (Car Scrap) Program Amendments consistent with SB 459 which requires ARB to increase benefits for low-income California residents, promote cleaner replacement vehicles, and enhance emissions reductions.	6/26/14
Proposed Approval of Amendments to CA Cap on GHG Emissions and Market-Based Compliance Mechanisms Second hearing of two, continued from October 2013.	4/24/14
Truck and Bus Rule Update Amendments to the Regulation to Reduce Emissions of Diesel Particulate Matter, Oxides of Nitrogen, and Other Criteria Pollutants From In-Use On-Road Diesel-Fueled Vehicles: increasing low-use vehicle thresholds, allowing owners to newly opt-in to existing flexibility provisions, adjusting “NOx exempt” vehicle provisions, and granting additional time for fleets in certain areas to meet PM filter requirements.	4/24/14
Heavy-Duty GHG Phase I: On-Road Heavy-Duty GHG Emissions Rule, Tractor-Trailer Rule, Commercial Motor Vehicle Idling Rule, Optional Reduced Emission Standards, Heavy-Duty Hybrid-Electric Vehicles Certification Procedure: New GHG standards for MD and HD engines and vehicles identical to those adopted by the U.S. EPA in 2011 for MYs 2014-18.	12/12/13

CARB Board Action (Board)	Hearing Date
Agricultural equipment SIP credit rule Incentive-funded projects must be implemented using Carl Moyer Program Guidelines; must be surplus, quantifiable, enforceable, and permanent, and result in emission reductions that are eligible for SIP credit.	10/25/13
Mandatory Report of Greenhouse Gas Emissions Approved a regulation that establishes detailed specifications for emissions calculations, reporting, and verification of GHG emission estimates from significant sources.	10/25/13
CA Cap on Greenhouse Gas Emissions and Market-Based Compliance Mechanisms Technical revisions to the Mandatory Reporting of Greenhouse Gas Emissions Regulation to further align reporting methods with U.S.EPA, update factors, and modify definitions to maintain consistency with the Cap and Trade program.	10/25/13
Zero emission vehicle test procedures Existing certification test procedures for plug-in hybrid vehicles need to be updated to reflect technology developments. The ZEV regulation will require minor modifications to address clarity and implementation issues.	10/24/13
Consumer Products: Antiperspirants, Deodorants, Test Method 310, Aerosol Coatings, Proposed Repeal of Hairspray Credit) Amendments to require various consumer products to reformulate to reduce VOC or reactivity content to meet specified limits, and to clarify various regulatory provisions, improve enforcement, and add analytical procedures.	9/26/13
Alternative fuel certification procedures Amendments to current alternative fuel conversion certification procedures for motor vehicles and engines that will allow small volume conversion manufacturers to reduce the upfront demonstration requirements and allow systems to be sold sooner with lower certification costs than with the current process, beginning with MY 2018.	9/26/13
Vapor Recovery for Gasoline Dispensing Facilities Amendments to certification and test procedures for vapor recovery equipment used on cargo tanks and at gasoline dispensing facilities.	7/25/13
Off-highway recreational vehicle evaporative emission control Staff proposes to set evaporative emission standards to control hydrocarbon emissions from Off-Highway Recreational Vehicles. The running loss, hot soak, and diurnal performance standards can be met by using proven automobile type control technology.	7/25/13

CARB Board Action (Board)	Hearing Date
Gasoline and diesel fuel test standards Adopted amendments to add test standards for the measurement of prohibited oxygenates at trace levels specified in existing regulations.	1/25/13
LEV III and ZEV Programs for Federal Compliance Option Adopted amendments to deem compliance with national GHG new vehicle standards in 2017-2025 as compliance with California GHG standards for the same model years.	11/15/12 12/6/12 EO
Consumer products (automotive windshield washing fluid) Adopted amendments to add portions of 14 California counties to the list of areas with freezing temperatures where 25% VOC content windshield washing fluid could be sold.	10/18/2012 EO 03/15/13
GHG mandatory reporting, Fee Regulation, and Cap and Trade 2012 Adopted amendments to eliminate emission verification for facilities emitting less than 25,000 MTCO2e and make minor changes in definitions and requirements.	9/20/12 11/2/12 EO
Amendments to Verification Procedure, Warranty and In-Use Compliance Requirements for In-Use Strategies to Control Emissions from Diesel Engines Approved amendments to the verification procedure used to evaluate diesel retrofits through emissions, durability, and field testing. Amendments will lower costs associated with required in-use compliance testing, streamline the in-use compliance process, and will extend time allowed to complete verifications.	8/23/2012 EO 07/02/13
Amendments to On-Board Diagnostics (OBD I and II) Regulations Approved amendments to the light- and medium-duty vehicle and heavy-duty engine OBD regulations.	8/23/2012 EO 06/26/13
Cap and Trade: Amendments to CA Cap on GHG Emissions and Market-Based Compliance Mechanisms, and Amendments Allowing Use of Compliance Instruments Issued by Linked Jurisdictions Amends Cap-and-Trade and compliance mechanisms to add security to the market system and to aid staff in implementation. Amendments include first auction rules, offset registry, market monitoring provisions, and information gathering necessary for the financial services operator.	6/28/12 7/31/12 EO
Vapor recovery defect list Adopted amendments to add defects and verification procedures for equipment approved since 2004, and make minor changes to provide clarity	6/11/12 EO

CARB Board Action (Board)	Hearing Date
Tractor-Trailer GHG Regulation: Emergency Amendment Adopted emergency amendment to correct a drafting error and delay the registration date for participation in the phased compliance option	2/29/2012 2/29/12 EO
Advanced Clean Cars (ACC) Regulation: Low-Emission Vehicles and GHG Adopted more stringent criteria emission standards for MY 2015-2025 light and medium duty vehicles (LEV III), amended GHG emission standards for model year 2017-2025 light and medium duty vehicles (LEV GHG), amended ZEV Regulation to ensure the successful market penetration of ZEVs in commercial volumes, amended hydrogen fueling infrastructure mandate of the Clean Fuels Outlet regulation, and amended cert fuel for light duty vehicles from an MTBE-containing fuel to an E10 certification fuel.	1/26/12
Zero Emission Vehicle (ZEV) Adopted amendments to increase compliance flexibility, add two new vehicle categories for use in creating credits, increase credits for 300 mile FCVs, increase requirements for ZEVs and TZEVs, eliminate credit for PZEVs and AT PZEVs, expand applicability to smaller manufacturers, base ZEV credits on range, and make other minor changes in credit requirements	1/26/12
Amendments to Low Carbon Fuel Standard Regulation The amendments address several aspects of the regulation, including reporting requirements, credit trading, regulated parties, opt-in and opt-out provisions, definitions, and other clarifying language.	12/16/11 10/10/12 EO
Amendments to Small Off-Road Engine and Tier 4 Off-Road Compression-Ignition Engine Regulations And Test Procedures; also “Recreational Marine” Spark-Ignition Marine Engine Amendments (Recreational Boats) adopted. Aligns California test procedures with U.S. EPA test procedures and requires off-road CI engine manufacturers to conduct in-use testing of their entire product lines to confirm compliance with previously established Not-To-Exceed emission thresholds.	12/16/2011 10/25/12 EO
Regulations and Certification Procedures for Engine Packages used in Light-Duty Specially Constructed Vehicles (Kit Cars) Ensures that certified engine packages, when placed into any Kit Car, would meet new vehicle emission standards, and be able to meet Smog Check requirements.	11/17/11 9/21/12 EO
Amendments to the California Reformulated Gasoline Regulations Corrects drafting errors in the predictive model, deletes outdated regulatory provisions, updates the notification requirements, and changes the restrictions on blending CARBOB with other liquids.	10/21/11 8/24/12 EO

CARB Board Action (Board)	Hearing Date
Amendments to the In-Use Diesel Transport Refrigeration Units (TRU) ATCM Mechanisms to improve compliance rates and enforceability.	10/21/11 8/31/12 EO
Amendments to the AB 32 Cost of Implementation Fee Regulation Clarifies requirements and regulatory language, revises definitions.	10/20/11 8/21/12 EO
Cap on Greenhouse Gas Emissions and Market-Based Compliance Mechanisms Regulation, Including Compliance Offset Protocols Greenhouse Gas Emissions Cap-and-Trade Program, including compliance offset protocols and multiple pathways for compliance.	10/21/11 8/21/12 EO
Amendments to the Regulation for Cargo Handling Equipment (CHE) at Ports and Intermodal Rail Yards (Port Yard Trucks Regulation) Provides additional compliance flexibility and maintains anticipated emissions reductions. As applicable to yard trucks and two-engine sweepers.	9/22/11 8/2/12 EO
Amendments to the Enhanced Vapor Recovery Regulation for Gasoline Dispensing Facilities New requirement for low permeation hoses at gasoline dispensing facilities.	9/22/11 7/26/12 EO
Amendments to Cleaner Main Ship Engines and Fuel for Ocean-Going Vessels Adjusts the offshore regulatory boundary. Aligns very low sulfur fuel implementation deadlines with new federal requirements.	6/23/11 9/13/12 EO
Particulate Matter Emissions Measurement Allowance For Heavy-Duty Diesel In-Use Compliance Regulation Emission measurement allowances provide for variability associated with the field testing required in the regulation.	6/23/11
Low Carbon Fuel Standard Carbon Intensity Lookup Table Amendments Adds new pathways for vegetation-based fuels	2/24/11
Amendments to Cleaner In-Use Heavy-Duty On-Road Diesel Trucks and LSI Fleets Regulations Amends five regulations to provide relief to fleets adversely affected by the economy and take into account the fact that emissions are lower than previously predicted.	12/16/10 9/19/11 EO
Tractor-Trailer GHG Regulation Amendment Enacts administrative changes to increase compliance flexibility and reduce costs	12/16/10

CARB Board Action (Board)	Hearing Date
Amendments to Cleaner In-Use Off-Road Diesel-Fueled Fleets Regulation Amendments provide relief to fleets adversely affected by the economy and take into account the fact that emissions are lower than previously predicted.	12/16/10 10/28/11 EO
In-Use On-Road Diesel-Fueled Heavy-Duty Drayage Trucks at Ports and Rail Yard Facilities Amendments add flexibility to fleets' compliance schedules, mitigate the use of noncompliant trucks outside port and rail properties, and provide transition to the Truck and Bus regulation.	12/16/10 9/19/11 EO
Amendments to the Regulation for Mandatory Reporting of Greenhouse Gas Emissions Changes requirements to align with federal greenhouse gas reporting requirements adopted by US EPA.	12/16/10 10/28/11 EO
Cap on Greenhouse Gas Emissions and Market-Based Compliance Mechanisms Regulation Establishes framework and requirements for Greenhouse Gas Emissions Cap-and-Trade Program, including compliance offset protocols.	12/16/10 10/26/11 EO
Amendments to the Consumer Products Regulation Amendments set new or lower VOC limits for some categories, prohibit certain toxic air contaminants, high GWP compounds, and surfactants toxic to aquatic species. Also changes Method 310, used to determine aromatic content of certain products.	11/18/10 9/29/11 EO
Amendment of the ATCM for Diesel Transportation Refrigeration Units (TRU) Amendments expand the compliance options and clarify the operational life of various types of TRUs.	11/18/10 2/2/11 EO
Amendments to the ATCM for Stationary Compression Ignition Engines Approved amendments to closely align the emission limits for new emergency standby engines in the ATCM with the emission standards required by the federal Standards of Performance.	10/21/10 3/25/11 EO
Diesel Vehicle Periodic Smoke Inspection Program Adopted amendments to exempt medium duty diesel vehicles from smoke inspection requirements if complying with Smog Check requirements.	10/21/10 8/23/11 EO
Renewable Electricity Standard Regulation Approved a regulation that will require electricity providers to obtain at least 33% of their retail electricity sales from renewable energy resources by 2020.	9/23/10

CARB Board Action (Board)	Hearing Date
Energy Efficiency at Industrial Facilities Adopted standards for the reporting of GHG emissions and the feasibility of emissions controls by the largest GHG-emitting stationary sources.	7/22/10 5/9/11 EO
Amendments to Commercial Harbor Craft Regulation Approved amendments to require the use of cleaner engines in diesel-fueled crew and supply, barge, and dredge vessels.	6/24/10 4/11/11 EO
Accelerated Introduction of Cleaner Line-Haul Locomotives Agreement with railroads sets prescribed reductions in diesel risk and target years through 2020 at four major railyards.	6/24/10
Amendments to New Passenger Motor Vehicle Greenhouse Gas Emission Standards Approved amendments deeming compliance with EPA's GHG standards as compliance with California's standards in 2012 through 2016 model years.	2/25/2010 03/29/10
Sulfur Hexafluoride (SF6) Regulation Regulation to reduce emissions of sulfur hexafluoride (SF6), a high-GWP GHG, from high-voltage gas-insulated electrical switchgear.	2/25/10 12/15/10 EO
Amendments to the Statewide Portable Equipment Registration Regulation and Portable Engine ATCM Approved amendments that extend the deadline for removal of certain uncertified portable engines for one year.	1/28/10 8/27/10 EO 12/8/10 EO
Diesel Engine Retrofit Control Verification, Warranty, and Compliance Regulation Amendments Approved amendments to require per-installation compatibility assessment, performance data collection, and reporting of additional information, and enhance enforceability.	1/28/10 12/6/10 EO
Stationary Equipment High-GWP Refrigerant Regulation Approved a regulation to reduce emissions of high-GWP refrigerants from stationary non-residential equipment.	12/1/09 9/14/10 EO
Amendments to Limit Ozone Emissions from Indoor Air Cleaning Devices Adopted amendments to delay the labeling compliance deadlines by one to two years and to make minor changes in testing protocols.	12/9/09
Emission Warranty Information Reporting Regulation Amendments Repealed the 2007 regulation and readopted the 1988 regulation with amendments to implement adverse court decision.	11/19/09 9/27/10 EO
Amendments to Maximum Incremental Reactivity Tables Added many new compounds and modified reactivity values for many existing compounds in the tables to reflect new research data.	11/3/09 7/23/10 EO

CARB Board Action (Board)	Hearing Date
AB 32 Cost of Implementation Fee Regulation AB 32 authorizes ARB to adopt by regulation a schedule of fees to be paid by sources of greenhouse gas emissions regulated pursuant to AB 32. ARB staff will propose a fee regulation to support the administrative costs of AB 32 implementation.	9/24/2009 05/06/10 EO
Passenger Motor Vehicle Greenhouse Gas Limits Amendments Approved amendments granting credits to manufacturers for compliant vehicles sold in other states that have adopted California regulations.	9/24/09 2/22/10 EO
Consumer Products Amendments Approved amendments that set new VOC limits for multi-purpose solvent and paint thinner products and lower the existing VOC limit for double phase aerosol air fresheners.	9/24/09 8/6/10 EO
Amendments to In-Use Off-Road Diesel-Fueled Fleets Regulation Approved amendments to implement legislatively directed changes and provide additional incentives for early action.	7/23/09 12/2/09 EO 6/3/10 EO
Methane Emissions from Municipal Solid Waste Landfills Approved a regulation to require smaller and other uncontrolled landfills to install gas collection and control systems, and requires existing and newly installed systems to operate optimally.	6/25/09 5/5/10 EO
Cool Car Standards Approved a regulation requiring the use of solar management window glass in vehicles up to 10,000 lb. GVWR.	6/25/09
Enhanced Fleet Modernization (Car Scrap) Approved guidelines for a program to scrap up to 15,000 light duty vehicles statewide.	6/25/09 7/30/10 EO
Amendments to Heavy-Duty On-Board Diagnostics Regulations Approved amendments to the light and medium-duty vehicle and heavy-duty engine OBD regulations.	5/28/2009 4/6/10 EO
Smog Check Improvements BAR adopted amendments to implement changes in State law and SIP commitments adopted by ARB between 1996 and 2007.	5/7/09 by BAR 6/9/09 EO
AB 118 Air Quality Improvement Program Guidelines The Air Quality Improvement Program provides for up to $50 million per year for seven years beginning in 2009-10 for vehicle and equipment projects that reduce criteria pollutants, air quality research, and advanced technology workforce training. The AQIP Guidelines describe minimum administrative, reporting, and oversight requirements for the program, and provide general criteria for how the program shall be implemented.	04/23/09 08/28/09 EO

CARB Board Action (Board)	Hearing Date
Pesticide Element Reduce volatile organic compound (VOC) emissions from the application of agricultural field fumigants in the South Coast, Southeast Desert, Ventura County, San Joaquin Valley, and Sacramento Metro federal ozone nonattainment areas.	4/20/09 10/12/09 EO (2) 8/2/11 EO
Low Carbon Fuel Standard Approved new standards to lower the carbon content of fuels.	4/20/09 11/25/09 EO
Pesticide Element for San Joaquin Valley DPR Director approved pesticide ROG emission limit of 18.1 tpd and committed to implement restrictions on non-fumigant pesticide use by 2014 in the San Joaquin Valley.	4/7/09 DPR
Tire Pressure Inflation Regulation Approved a regulation requiring automotive service providers to perform tire pressure checks as part of every service.	3/26/09 2/4/10 EO
Sulfur Hexafluoride from Non-Utility and Non-Semiconductor Applications Approved a regulation to phase out use of Sulfur Hexafluoride over the next several years.	2/26/09 11/12/09 EO
Semiconductor Operations Approved a regulation to set standards to reduce fluorinated gas emissions from the semiconductor and related devices industry.	2/26/09 10/23/09 EO
Plug-In Hybrid Electric Vehicles Test Procedure Amendments Amends test procedures to address plug-in-hybrid electric vehicles.	1/23/09 12/2/09 EO
In-Use Off-Road Diesel-Fueled Fleets Amendments Makes administrative changes to recognize delays in the supply of retrofit control devices.	1/22/09
Small Containers of Automotive Refrigerant Approved a regulation to reduce leakage from small containers, adopt a container deposit and return program, and require additional container labeling and consumer education requirements.	1/22/09 1/5/10 EO
Aftermarket Critical Emission Parts on Highway Motorcycles Allows for the sale of certified critical emission parts by aftermarket manufacturers.	1/22/09 6/19/09 EO
Heavy-Duty Tractor-Trailer Greenhouse Gas (GHG) Reduction Approved a regulation to reduce greenhouse gas emissions by improving long haul tractor and trailer efficiency through use of aerodynamic fairings and low rolling resistance tires.	12/11/08 10/23/09 EO

CARB Board Action (Board)	Hearing Date
Cleaner In-Use Heavy-Duty Diesel Trucks (Truck and Bus Regulation) Approved a regulation to reduce diesel particulate matter and oxides of nitrogen through fleet modernization and exhaust retrofits. Makes enforceability changes to public fleet, off-road equipment, and portable equipment regulations.	12/11/08 10/19/09 EO 10/23/09 EO
Large Spark-Ignition Engine Amendments Approved amendments to reduce evaporative, permeation, and exhaust emissions from large spark-ignition (LSI) engines equal to or below 1 liter in displacement.	11/1/08 3/12/09 EO
Small Off-Road Engine (SORE) Amendments Approved amendments to address the excessive accumulation of emission credits.	11/21/08 2/24/10 EO
Proposed AB 118 Air Quality Guidelines for the Air Quality Improvement Program and the Alternative and Renewable Fuel and Vehicle and Technology Program. The California Alternative and Renewable Fuel, Vehicle Technology, Clean Air, and Carbon Reduction Act of 2007 (AB 118) requires ARB to develop guidelines for both the Alternative and Renewable Fuel and Vehicle Technology Program and the Air Quality Improvement Program to ensure that both programs do not adversely impact air quality.	09/25/08 EO 05/20/09
Portable Outboard Marine Tanks and Components (part of Additional Evaporative Emission Standards) Approved a regulation that establishes permeation and emission standards for new portable outboard marine tanks and components.	9/25/08 7/20/09 EO
Cleaner Fuel in Ocean Going Vessels Approved a regulation that requires use of low sulfur fuel in ocean-going ship main engines, and auxiliary engines and boilers.	7/24/08 4/16/09 EO
Spark-Ignition Marine Engine and Boat Amendments Provides optional compliance path for > 500 hp sterndrive/inboard marine engines.	7/24/08 6/5/09 EO
Consumer Products Amendments Approved amendments that add volatile organic compound (VOC) limits for seven additional categories and lower limits for twelve previously regulated categories.	6/26/08 5/5/09 EO

CARB Board Action (Board)	Hearing Date
Zero emission vehicles Updated California's ZEV requirements to provide greater flexibility with respect to fuels, technologies, and simplifying compliance pathways. Amendments give manufacturers increased flexibility to comply with ZEV requirements by giving credit to plug-in hybrid electric vehicles and establishing additional ZEV categories in recognition of new developments in fuel cell vehicles and battery electric vehicles.	3/27/08 12/17/08 EO
Amendments to the Verification Procedure, Warranty, and In-Use Compliance Requirements for In-Use Strategies to Control Emissions from Diesel Engines Adds verification requirements for control technologies that only reduce NOx emissions, new reduction classifications for NOx reducing technologies, new testing requirements, and conditional extensions for verified technologies.	1/24/08 12/4/08 EO
Mandatory Report of Greenhouse Gas Emissions Approved a regulation that establishes detailed specifications for emissions calculations, reporting, and verification of GHG emission estimates from significant sources.	12/6/07 10/12/08 EO
Gaseous Pollutant Measurement Allowances for In-Use Heavy-Duty Diesel Compliance Measurement accuracy margins are to be determined through an ongoing comprehensive testing program performed by an independent contractor. Amendments include these measurement accuracy margins into the regulation.	12/6/07 10/14/08 EO
Ocean-Going Vessels While at Berth (aka Ship Hoteling) - Auxiliary Engine Cold Ironing and Clean Technology Approved a regulation that reduces emissions from auxiliary engines on ocean-going ships while at-berth.	12/6/07 10/16/08 EO
In-Use On-Road Diesel-Fueled Heavy-Duty Drayage Trucks at Ports and Rail Yard Facilities Approved a regulation that establishes emission standards for in-use, heavy-duty diesel-fueled vehicles that transport cargo to and from California's ports and intermodal rail facilities.	12/6/07 10/12/08 EO
Commercial Harbor Craft Approved a regulation that establishes in-use and new engine emission limits for both auxiliary and propulsion diesel engines on ferries, excursion vessels, tugboats, and towboats.	11/15/07 9/2/08 EO
Suggested Control Measure for Architectural Coatings Amendments Approved amendments to reduce the recommended VOC content of 19 categories of architectural coatings.	10/26/07

CARB Board Action (Board)	Hearing Date
Aftermarket Catalytic Converter Requirements Approved amendments that establish more stringent emission performance and durability requirements for used and new aftermarket catalytic converters offered for sale in California.	10/25/07 2/21/08 NOD
Limiting Ozone Emissions from Indoor Air Cleaning Devices Approved ozone emission limit of 0.050 ppm for portable indoor air cleaning devices in response to requirements of AB 2276 (2006).	9/27/07 8/7/08 EO
Pesticide Commitment for Ventura County in 1994 SIP Approved substitution of excess ROG emission reductions from State motor vehicle program for 1994 SIP reduction commitment from pesticide application in Ventura County.	9/27/07 11/30/07 EO
In-Use Off-Road Diesel Equipment Approved a regulation that requires off-road diesel fleet owners to modernize their fleets and install exhaust retrofits.	7/26/07 4/4/08 EO
Emission Control and Environmental Performance Label Regulations Approved amendments to add a Global Index Label and modify the formal of the Smog Index Label on new cars.	6/21/07 5/2/08 EO
Vapor Recovery from Aboveground Storage Tanks Approved a regulation to establish new performance standards and specifications for the vapor recovery systems and components used with aboveground storage tanks.	6/21/07 5/2/08 EO
CaRFG Phase 3 amendments Approved amendments to mitigate the increases in evaporative emissions from on-road motor vehicles resulting from the addition of ethanol to gasoline.	6/14/07 4/25/08 EO 8/7/08 EO
Formaldehyde from Composite Wood Products Approved an ATCM to limit formaldehyde emissions from hardwood plywood, particleboard, and medium density fiberboard to the maximum amount feasible.	4/26/07 3/5/08 EO
Portable equipment registration program (PERP) and airborne toxic control measure for diesel-fueled portable engines Approved amendments to allow permitting of Tier 0 portable equipment engines used in emergency or low use duty and to extend permitting of certain Tier 1 and 2 "resident" engines to 1/1/10.	3/22/07 7/31/07 EO
Perchloroethylene Control Measure Amendments Approved amendments to the Perchloroethylene ATCM to prohibit new Perc dry cleaning machines beginning 2008 and phase out all Perc machines by 2023.	1/25/07 11/7/07 EO

CARB Board Action (Board)	Hearing Date
Amendments to Emission Warranty Information Reporting & Recall Regulations Approved amendments that tighten the provisions for recalling vehicles for emissions-related failures, helping ensure that corrective action is taken to vehicles with defective emission control devices or systems.	12/7/06 3/22/07 10/17/07 EO
Voluntary accelerated vehicle retirement regulations Approved amendments that authorize the use of remote sensing to identify light-duty high emitters and that establish protocols for quantifying emissions reductions from high emitters proposed for retirement.	12/7/06
Emergency regulation for portable equipment registration program (PERP), airborne toxic control measures for portable and stationary diesel-fueled engines	12/7/06
Amendments to the Hexavalent Chromium ATCM Approved amendments that require use of best available control technology on all chrome plating and anodizing facilities.	12/7/06
Consumer Products Regulation Amendments Approved amendments that set lower emission limits in 15 product categories.	11/17/06 9/25/07 EO
Requirements for Stationary Diesel In-Use Agricultural Engines Approved amendments to the stationary diesel engine ATCM which set emissions standards for in-use diesel agricultural engines.	11/16/06 7/3/07 NOD
Ships - Onboard Incineration Approved amendments to cruise ship incineration ATCM to include all oceangoing ships of 300 gross registered tons or more.	11/16/06 9/11/07 EO
Zero Emission Bus Approved amendments postponing the 15 percent purchase requirement three years for transit agencies in the diesel path and one to two years for transit agencies in the alternative fuel path, in order to keep pace with developments in zero emission bus technology, and adding an Advanced Demonstration requirement to offset emission losses.	10/19/06 8/27/07 EO
Distributed generation certification Approved amendments improving the emissions durability and testing requirements, adding waste gas emission standards, and eliminating a redundant PM standard in the current 2007 emission standards.	10/19/06 5/17/07 NOD

CARB Board Action (Board)	Hearing Date
Heavy-Duty Diesel In-Use Compliance Regulation Approved amendments to the heavy-duty diesel engine regulations and test procedures to create a new in-use compliance program conducted by engine manufacturers. The amendments would help ensure compliance with applicable certification standards throughout an engine's useful life.	9/28/06 7/19/07 NOD
Revisions to OBD II and the Emission Warranty Regulations Approved amendments to the OBD II regulation to provide for improved emission control monitoring including air-fuel cylinder imbalance monitoring, oxygen sensor monitoring, catalyst monitoring, permanent fault codes for gasoline vehicles and new thresholds for diesel vehicles.	9/28/06 8/9/07 EO
Off-Highway Recreational Vehicle Amendments Approved amendments to the Off-Highway Recreational Vehicle Regulations including harmonizing evaporative emission standards with federal regulations, expanding the definition of ATVs, modifying labeling requirements, and adjusting riding seasons.	7/20/06 6/1/07 EO
Portable Equipment Registration Program (PERP) Amendments Approved amendments to the Statewide Portable Equipment Registration program that include installation of hour meters on equipment, and revisions to recordkeeping, reporting, and fees.	6/22/06 11/13/06 NOD
Heavy Duty Vehicle Service Information Approved amendments to the Service Information Rule to require manufacturers to make available diagnostic equipment and information for sale to the aftermarket.	6/22/06 5/3/07 EO
LEV II technical amendments Approved amendments to evaporative emission test procedures, four-wheel drive dynamometer provisions, and vehicle label requirements.	6/22/06 9/27/06 NOD
Dry Cleaning ATCM Amendments Approved amendments to the Dry Cleaning ATCM to limit siting of new dry cleaners, phase out use of Perc at co-residential facilities, phase out higher emitting Perc sources at other facilities, and require enhanced ventilation at existing and new Perc facilities.	5/25/06
Forklifts and other Large Spark Ignition (LSI) Equipment Adopted a regulation to reduce emissions from forklifts and other off-road spark-ignition equipment by establishing more stringent standards for new equipment and requiring retrofits or engine replacement on existing equipment. Adopts EPA's standards for 2007; adopts more stringent standards for 2010.	5/25/06 3/2/07 EO
Enhanced Vapor Recovery Amendments Approved amendments to the vapor recovery system regulation and adopted revised test procedures.	5/25/06

CARB Board Action (Board)	Hearing Date
Diesel Retrofit Technology Verification Procedure Approved amendments to the Diesel Emission In-use Control Strategy Verification Procedure to substitute a 30% increase limit in NOx concentration for an 80% reduction requirement from PM retrofit devices.	3/23/06 12/21/06 NOD
Heavy duty vehicle smoke inspection program amendments Approved amendments to impose a fine on trucks not displaying a current compliance certification sticker.	1/26/06 12/4/06 EO
Ocean-going Ship Auxiliary Engine Fuel Approved a regulation to require ships to use cleaner marine gas oil or diesel to power auxiliary engines within 24 nautical miles of the California coast.	12/8/05 10/20/06 EO
Diesel Cargo Handling Equipment Approved a regulation to require new and in-use cargo handling equipment at ports and intermodal rail yards to reduce emissions by utilizing best available control technology.	12/8/05 6/2/06 EO
Public and Utility Diesel Truck Fleets Approved a regulation to reduce diesel particulate matter emissions from heavy duty diesel trucks in government and private utility fleets.	12/8/05 10/4/06 EO
Cruise ships – Onboard Incineration Adopted an Air Toxic Control Measure to prohibit cruise ships from conducting onboard incineration within three nautical miles of the California coast.	11/17/05 2/1/06 NOD
Inboard Marine Engine Rule Amendments Approved amendments to the 2001 regulation to include additional compliance options for manufacturers.	11/17/05 9/26/06 EO
Heavy-Duty Diesel Truck Idling Technology Approved a regulation to limit sleeper truck idling to 5 minutes. Allows alternate technologies to provide cab heating/cooling and power.	10/20/05 9/1/06 EO
Automotive Coating Suggested Control Measure Approved an SCM for automotive coatings for adoption by air districts. The measure will reduce the VOC content of 11 categories of surface protective coatings.	10/20/05
2007-09 Model-year heavy duty urban bus engines and the fleet rule for transit agencies Adopted amendments to align urban bus emission limits with on-road heavy duty truck emission limits and allow for the purchase of non-complying buses under the condition that bus turnover increase to offset NOx increases.	10/20/05 10/27/05 7/28/06 EO
Portable fuel containers (part 2 of 2) Approved amendments to revise spout and automatic shutoff design.	9/15/05 7/28/06 EO

CARB Board Action (Board)	Hearing Date
Portable Fuel Containers (part 1 of 2) Approved amendments to include kerosene containers in the definition of portable fuel containers.	9/15/05 11/9/05 NOD
2007-09 Model-year heavy duty urban bus engines and the fleet rule for transit agencies Adopted amendments to require all transit agencies in SCAQMD to purchase only alternate fuel versions of new buses.	9/15/05 Superseded by 10/20/05
Reid vapor pressure limit emergency rule Approved amendments to relax Reid vapor pressure limit to accelerate fuel production for Hurricane Katrina victims.	9/8/05 Operative for September and October 2005 only
Heavy-Duty Truck OBD Approved a regulation to require on-board diagnostic (OBD) systems for new gas and diesel trucks, similar to the systems on passenger cars.	7/21/05 12/28/05 EO
Definition of Large Confined Animal Facility Adopted a regulation to define the size of a large CAF for the purposes of air quality permitting and reduction of ROG emissions to the extent feasible.	6/23/05 4/13/06 EO
ATCM for stationary compression ignition engines Approved emergency amendments (3/17/05) and permanent amendments (5/26/05) to relax the diesel PM emission limits on new stationary diesel engines to current off-road engine standards to respond to the lack of availability of engines meeting the original ATCM standard.	3/17/05 5/26/05 7/29/05 EO
Transit Fleet Rule Approved amendments to add emission limits for non-urban bus transit agency vehicles, require lower bus and truck fleet-average NOx and PM emission limits, and clarify emission limits for CO, NMHC, and formaldehyde.	2/24/05 10/19/05 NOD
Thermal Spraying ATCM Approved a regulation to reduce emissions of hexavalent chromium and nickel from thermal spraying operations.	12/9/04 7/20/05 EO
Tier 4 Standards for Small Off-Road Diesel Engines (SORE) Approved new emission standards for off-road diesel engines to be phased in between 2008 and 2015.	12/9/04 10/21/05 EO

CARB Board Action (Board)	Hearing Date
Emergency Regulatory Amendment Delaying the January 1, 2005 Implementation Date for the Diesel Fuel Lubricity Standard Adopted an emergency regulation delaying the lubricity standard compliance deadline by five months to respond to fuel pipeline contamination problems.	11/24/04 12/10/04 EO
Enhanced vapor recovery compliance extension Approved amendments to the EVR regulation to extend the compliance date for onboard refueling vapor recovery compatibility to the date of EVR compliance.	11/18/04 2/11/05 EO
CaRFG Phase 3 amendments Approved amendments correcting errors and streamlining requirements for compliance and enforcement of CaRFG Phase 3 regulations adopted in 1999.	11/18/04
Clean diesel fuel for harbor craft and intrastate locomotives Approved a regulation that required harbor craft and locomotives operating solely within California to use clean diesel fuel.	11/18/04 3/16/05 EO
Nonvehicular Source, Consumer Product, and Architectural Coating Fee Regulation Amendment Approved amendments to fee regulations to collect supplemental fees when authorized by the Legislature.	11/18/04
Greenhouse gas limits for motor vehicles Approved a regulation that sets the first ever greenhouse gas emission standards on light and medium duty vehicles starting with the 2009 model year.	9/24/04 8/4/05 EO
Gasoline vapor recovery system equipment defects list Approved the addition of defects to the VRED list for use by compliance inspectors.	8/24/04 6/22/05 EO
Unihose gasoline vapor recovery systems Approved an emergency regulation and an amendment to delay the compliance date for unihose installation to the date of dispenser replacement.	7/22/04 11/24/04 EO
General Idling Limits for Diesel Trucks Approved a regulation that limits idling of heavy-duty diesel trucks operating in California to five minutes, with exceptions for sleeper cabs.	7/22/04
Consumer Products Approved a regulation to reduce ROG emissions from 15 consumer products categories, prohibit the use of 3 toxic compounds in consumer products, ban the use of PDCB in certain products, allow for the use of Alternative Control Plans, and revise Test Method 310.	6/24/04 5/6/05 EO

CARB Board Action (Board)	Hearing Date
Urban bus engines/fleet rule for transit agencies Approved amendments to allow for the purchase of hybrid diesel buses and revise the zero-emission bus demonstration and purchase timelines.	6/24/04
Engine Manufacturer Diagnostics Approved a regulation that would require model year 2007 and later heavy-duty truck engines to be equipped with engine diagnostic systems to detect malfunctions of the emission control system.	5/20/04
Chip Reflash Approved a voluntary program and a backstop regulation to reduce heavy duty truck NOx emissions through the installation of new software in the engine's electronic control module.	3/25/04 3/21/05 EO
Portable equipment registration program (PERP) Approved amendments to allow uncertified engines to be registered until December 31, 2005, to increase fees, and to modify administrative requirements.	2/26/04 1/7/05 EO 6/21/05 EO
Portable Diesel Engine ATCM Adopted a regulation to reduce diesel PM emissions from portable engines through a series of emission standards that increase in stringency through 2020.	2/26/04 1/4/05 EO
California motor vehicle service information rule Adopted amendments to allow for the purchase of heavy-duty engine emission-related service information and diagnostic tools by independent service facilities and aftermarket parts manufacturers.	1/22/04 5/20/04
Transportation Refrigeration Unit ATCM Adopted a regulation to reduce diesel PM emissions from transport refrigeration units by establishing emission standards and facility reporting requirements to streamline inspections.	12/11/03 2/26/04 11/10/04 EO
Diesel engine verification procedures Approved amendments that reduced warranty coverage to the engine only, delayed the NOx reduction compliance date to 2007, added requirements for proof-of-concept testing for new technology, and harmonized durability requirements with those of U.S. EPA.	12/11/03 2/26/04 10/17/04
Chip Reflash Approved a voluntary program and a backstop regulation to reduce heavy duty truck NOx emissions through the installation of new software in the engine's electronic control module.	12/11/03 3/27/04 3/21/05 EO
Revised tables of maximum incremental reactivity values Approved the addition of 102 more chemicals with associated maximum incremental reactivity values to existing regulation allowing these chemicals to be used in aerosol coating formulations.	12/3/03

CARB Board Action (Board)	Hearing Date
Stationary Diesel Engines ATCM Adopted a regulation to reduce diesel PM emissions from stationary diesel engines through the use of clean fuel, lower emission standards, operational practices.	11/20/03 12/11/03 2/26/2004 9/27/04 EO
Solid waste collection vehicles Adopted a regulation to reduce toxic diesel particulate emissions from solid waste collection vehicles by over 80 percent by 2010. This measure is part of ARB's plan to reduce the risk from a wide range of diesel engines throughout California.	9/25/03 5/17/04 EO
Small off-road engines (SORE) Adopted more stringent emission standards for the engines used in lawn and garden and industrial equipment, such as string trimmers, leaf blowers, walk-behind lawn mowers, generators, and lawn tractors.	9/25/03 7/26/04 EO
Off-highway recreational vehicles Changes to riding season restrictions.	7/24/03
Clean diesel fuel Adopted a regulation to reduce sulfur levels and set a minimum lubricity standard in diesel fuel used in vehicles and off-road equipment in California, beginning in 2006.	7/24/03 5/28/04 EO
Ozone Transport Mitigation Amendments Adopted amendments to require upwind districts to (1) have the same no-net-increase permitting thresholds as downwind districts, and (2) Adopt "all feasible measures."	5/22/03 10/2/03 NOD
Zero emission vehicles Updated California's ZEV requirements to support the fuel cell car development and expand sales of advanced technology partial ZEVs (like gasoline-electric hybrids) in the near-term, while retaining a role for battery electric vehicles.	3/27/03 12/19/03 EO
Heavy duty gasoline truck standards Aligned its existing rules with new, lower federal emission standards for gasoline-powered heavy-duty vehicles starting in 2008.	12/12/02 9/23/03 EO
Low emission vehicles II Minor administrative changes.	12/12/02 9/24/03 EO
Gasoline vapor recovery systems test procedures Approved amendments to add advanced vapor recovery technology certification and testing standards.	12/12/02 7/1/03 EO 10/21/03 EO
CaRFG Phase 3 amendments Approved amendments to allow for small residual levels of MTBE in gasoline while MTBE is being phased out and replaced by ethanol.	12/12/02 3/20/03 EO

CARB Board Action (Board)	Hearing Date
School bus Idling Adopted a measure requiring school bus drivers to turn off the bus or vehicle engine upon arriving at a school and restart it no more than 30 seconds before departure in order to limit children's exposure to toxic diesel particulate exhaust.	12/12/02 5/15/03 EO
California Interim Certification Procedures for 2004 and Subsequent Model Year Hybrid-Electric Vehicles in the Urban Transit Bus and Heavy-Duty Vehicle Classes Regulation Amendment Adopted amendments to allow diesel-path transit agencies to purchase alternate fuel buses with higher NOx limits, establish certification procedures for hybrid buses, and require lower fleet-average PM emission limits.	10/24/02 9/2/03 EO
CaRFG Phase 3 amendments Approved amendments delaying removal of MTBE from gasoline by one year to 12/31/03.	7/25/02 11/8/02 EO
Diesel retrofit verification procedures, warranty, and in-use compliance requirements Adopted regulations to specify test procedures, warranty, and in-use compliance of diesel engine PM retrofit control devices.	5/16/02 3/28/03 EO
On-board diagnostics for cars Adopted changes to the On-Board Diagnostic Systems (OBD II) regulation to improve the effectiveness of OBD II systems in detecting motor vehicle emission-related problems.	4/25/02 3/7/03 EO
Voluntary accelerated light duty vehicle retirement regulations Establishes standards for a voluntary accelerated retirement program.	2/21/02 11/18/02 EO
Residential burning Adopted a measure to reduce emissions of toxic air contaminants from outdoor residential waste burning by eliminating the use of burn barrels and the outdoor burning of residential waste materials other than natural vegetation.	2/21/02 12/18/02 EO
California motor vehicle service information rule Adopted regulations to require light- and medium-duty vehicle manufacturers to offer for sale emission-related service information and diagnostic tools to independent service facilities and aftermarket parts manufacturers.	12/13/01 7/31/02 EO
Vapor recovery regulation amendments Adopted amendments to expand the list of specified defects requiring equipment to be removed from service.	11/15/01 9/27/02 EO

CARB Board Action (Board)	Hearing Date
Distributed generation guidelines and regulations Adopted regulations requiring the permitting by ARB of distributed generation sources that are exempt from air district permitting and approved guidelines for use by air districts in permitting non-exempt units.	11/15/01 7/23/02 EO
Low emission vehicle regulations (LEV II) Approved amendments to apply PM emission limits to all new gasoline vehicles, extend gasoline PZEV emission limits to all fuel types, and streamline the manufacturer certification process.	11/15/01 8/6/02 EO
Gasoline vapor recovery systems test methods and compliance procedures Adopted amendments to add test methods for new technology components and streamline test methods for liquid removal equipment.	10/25/01 7/9/02 EO
Heavy-duty diesel trucks Adopted amendments to emissions standards to harmonize with EPA regulations for 2007 and subsequent model year new heavy-duty diesel engines.	10/25/01
Automotive coatings Adopted Air Toxic Control Measure which prohibits the sale and use in California of automotive coatings that contain hexavalent chromium or cadmium.	9/20/01 9/2/02 EO
Inboard and sterndrive marine engines Lower emission standards for 2003 and subsequent model year inboard and sterndrive gasoline-powered engines in recreational marine vessels.	7/26/01 6/6/02 EO
Asbestos from construction, grading, quarrying, and surface mining Adopted an Airborne Toxic Control Measure for construction, grading, quarrying, and surface mining operations requiring dust mitigation for construction and grading operations, road construction and maintenance activities, and quarries and surface mines to minimize emissions of asbestos-laden dust.	7/26/01 6/7/02 EO
Zero emission vehicle infrastructure and standardization of electric vehicle charging equipment Adopted amendments to the ZEV regulation to alter the method of quantifying production volumes at joint-owned facilities and to add specifications for standardized charging equipment.	6/28/01 5/10/02 EO
Pollutant transport designation Adopted amendments to add two transport couples to the list of air basins in which upwind areas are required to adopt permitting thresholds no less stringent than those adopted in downwind areas.	4/26/01

CARB Board Action (Board)	Hearing Date
Zero emission vehicle regulation amendments Adopted amendments to reduce the numbers of ZEVs required in future years, add a PZEV category and grant partial ZEV credit, modify the ZEV range credit, allow hybrid-electric vehicles partial ZEV credit, grant ZEV credit to advanced technology vehicles, and grant partial ZEV credit for several other minor new programs.	1/25/01 12/7/01 EO 4/12/02 EO
Heavy duty diesel engines supplemental test procedures Approved amendments to extend "Not-To-Exceed" and EURO III supplemental test procedure requirements through 2007 when federal requirements will include these tests.	12/7/00
Light and medium duty low emission vehicle alignment with federal standards Approved amendments that require light and medium duty vehicles sold in California to meet the more restrictive of State or federal emission standards.	12/7/00 12/27/00 EO
Exhaust emission standards for heavy duty gas engines Adopted amendments that establish 2005 emission limits for heavy duty gas engines that are equivalent to federal limits.	12/7/00 12/27/00 EO
CaRFG Phase 3 amendments Approved amendments to regulate the replacement of MTBE in gasoline with ethanol.	11/16/00 4/25/01 EO
CaRFG Phase 3 test methods Approved amendments to gasoline test procedures to quantify the olefin content and gasoline distillation temperatures.	11/16/00 7/11/01 EO 8/28/01 EO
Antiperspirant and deodorant regulations Adopted amendments to relax a 0% VOC limit to 40% VOC limit for aerosol antiperspirants.	10/26/00
Diesel risk reduction plan Adopted plan to reduce toxic particulate from diesel engines through retrofits on existing engines, tighter standards for new engines, and cleaner diesel fuel.	9/28/00
Conditional rice straw burning regulations Adopted regulations to limit rice straw burning to fields with demonstrated disease rates reducing production by more than 5 percent.	9/28/00
Asbestos from unpaved roads Tightened an existing Air Toxic Control Measure to prohibit the use of rock containing more than 0.25% asbestos on unsurfaced roads.	7/20/00

CARB Board Action (Board)	Hearing Date
Aerosol Coatings Approved amendments to replace mass-based VOC limits with reactivity-based limits, add a table of Maximum Incremental Reactivity values, add limits for polyolefin adhesion promoters, prohibit use of certain toxic solvents, and make other minor changes.	6/22/00 5/1/01 EO
Consumer products aerosol adhesives Adopted amendments to delete a 25% VOC limit by 2002, add new VOC limits for six categories of adhesives, prohibit the use of toxic solvents, and add new labeling and reporting requirements.	5/25/00 3/14/01 EO
Automotive care products Approved an Air Toxic Control Measure to eliminate use of perchloroethylene, methylene chloride, and trichloroethylene in automotive products such as brake cleaners and degreasers.	4/27/00 2/28/01 EO
Enhanced vapor recovery emergency regulation Adopted a four-year term for equipment certifications.	5/22/01 EO
Enhanced vapor recovery Adopted amendments to require the addition of components to reduce spills and leakage, adapt to onboard vapor recovery systems, and continuously monitor system operation and report equipment leaks immediately.	3/23/00 7/25/01 EO
Agricultural burning smoke management Adopted amendments to add marginal burn day designations, require day-specific burn authorizations by districts, and smoke management plans for larger prescribed burn projects.	3/23/00 1/22/01 EO
Urban transit buses Adopted a public transit bus fleet rule and emissions standards for new urban buses that mandates a lower fleet-average NOx emission limit, PM retrofits, lower sulfur fuel use, and purchase of specified percentages of zero emission buses in future years.	1/27/00 2/24/00 11/22/00 EO 5/29/01 EO
Small Off-Road (diesel) Equipment (SORE) Adopted amendments to conform with new federal requirements for lower and engine power-specific emission limits, and for the averaging, banking, and trading of emissions among SORE manufacturers.	1/28/00
CaRFG Phase 3 MTBE phase out Adopted regulations to enable refiners to produce gasoline without MTBE while preserving the emissions benefits of Phase 2 cleaner burning gasoline.	12/9/99 6/16/00 EO
Consumer products – mid-term measures II Adopted a regulation which adds emission limits for 2 new categories and tightens emission limits for 15 categories of consumer products.	10/28/99

CARB Board Action (Board)	Hearing Date
Portable fuel cans Adopted a regulation requiring that new portable fuel containers, used to refuel lawn and garden equipment, motorcycles, and watercraft, be spill-proof beginning in 2001.	9/23/99 7/6/00 EO
Clean fuels at service stations Adopted amendments rescinding requirements applicable to SCAB in 1994-1995, modifying the formula for triggering requirements, and allowing the Executive Officer to make adjustments to the numbers of service stations required to provide clean fuels.	7/22/99
Gasoline vapor recovery Adopted amendments to certification and test methods.	6/24/99
Reformulated gasoline oxygenate Adopted amendments rescinding the requirement for wintertime oxygenate in gasoline sold in the Lake Tahoe Air Basin and requiring the statewide labeling of pumps dispensing gasoline containing MTBE.	6/24/99
Marine pleasure craft Adopted regulations to control emissions from spark-ignition marine engines, specifically, outboard marine engines and personal watercraft.	12/11/98 2/17/00 EO 6/14/00 EO
Voluntary accelerated light duty vehicle retirement Adopted regulation setting standards for voluntary accelerated retirement program.	12/10/98 10/22/99 EO
Off-highway recreational vehicles and engines Approved amendments to allow non-complying vehicles to operate in certain seasons and in certain ORV-designated areas.	12/10/98 10/22/99 EO
On-road motorcycles Amended on-road motorcycle regulations, to lower the tailpipe emission standards for ROG and NOx.	12/10/98
Portable equipment registration program (PERP) Approved amendments to exclude non-dredging equipment operating in OCS areas and equipment emitting hazardous pollutants, include NSPS Part OOO rock crushers, require SCR emission limits and onshore emission offsets from dredging equipment operating in OCS areas, set catalyst emission limits for gasoline engines, and relieve certain retrofitted engines from periodic source testing.	12/10/98
Liquid petroleum gas motor fuel specifications Approved amendment rescinding 5% propene limit and extending 10% limit indefinitely.	12/11/98

CARB Board Action (Board)	Hearing Date
Reformulated gasoline Approved amendments to rescind the RVP exemption for fuel with 10% ethanol and allow for oxygen contents up to 3.7% if the Predictive Model weighted emissions to not exceed original standards.	12/11/98
Consumer products Adopted amendments to add new VOC test methods, to modify Method 310 to quantify low vapor pressure VOC (LVP-VOC) constituents, and to exempt LVP-VOC from VOC content limits	11/19/98
Consumer products Approved amendments to extend the 1999 VOC compliance deadline for several aerosol coatings, antiperspirants and deodorants, and other consumer products categories to 2002, to exempt methyl acetate from the VOC definition, and make other minor changes.	11/19/98
Low-emission vehicle program (LEV II) Adopted regulations adding exhaust emission standards for most sport utility vehicles, pick-up trucks and mini-vans, lowering tailpipe standards for cars, further reducing evaporative emission standards, and providing additional means for generating zero-emission vehicle credits.	11/5/98 9/17/99 EO
Off-road engine aftermarket parts Approved implementation of a new program to test and certify aftermarket parts in gasoline and diesel, light-duty through heavy duty, engines used in off-road vehicles and equipment.	11/19/98 10/1/99 EO 7/18/00 EO
Off-road spark ignition engines Adopted new emission standards for small and large spark ignition engines for off-road equipment, a new engine certification program, an in-use compliance testing program, and a three-year phase-in for large LSI.	10/22/98
Gasoline deposit control additives Adopted amendments to decertify pre-RFG additives, tighten the inlet valve deposit limits, add a combustion chamber deposit limit, and modify the test procedures to align with the characteristics of reformulated gasoline formulations.	9/24/98 4/5/99 EO
Stationary source test methods Adopted amendments to stationary source test methods to align better with federal methods.	8/27/98 7/2/99 EO
Locomotive MOA for South Coast Memorandum of agreement (MOA) signed by ARB, U.S. EPA and major railroads to concentrate cleaner locomotives in the South Coast by 2010 and fulfill 1994 ozone SIP commitment.	7/2/98

CARB Board Action (Board)	Hearing Date
Gasoline vapor recovery Adopted amendments to certification and test methods to add methods for onboard refueling vapor recovery, airport refuelers, and underground tank interconnections, and make minor changes to existing methods.	5/21/98 8/27/98
Reformulated gasoline Approved amendments to rescind the wintertime oxygenate requirement, allow for sulfur content averaging, and make other minor technical amendments.	8/27/98
Ethylene oxide sterilizers Adopted amendments to the ATCM to streamline source testing requirements, add EtO limits in water effluent from control devices, and make other minor changes.	5/21/98
Chrome platers Adopted amendments to ATCM to harmonize with requirements of federal NESHAP standards for chrome plating and chromic acid anodizing facilities.	5/21/98
On-road heavy-duty vehicles Approved amendments to align on-road heavy duty vehicle engine emission standards with EPA's 2004 standards and align certification, testing, maintenance, and durability requirements with those of U.S. EPA.	4/23/98 2/26/99 EO
Small off-road engines (SORE) Approved amendments to grant a one-year delay in implementation, relaxation of emissions standards for non-handheld engines, emissions durability requirements, averaging/banking/trading, harmonization with the federal diesel engine regulation, and modifications to the production line testing requirements.	3/26/98
Heavy duty vehicle smoke inspection program Adopted amendments to require annual smoke testing, set opacity limits, and exempt new vehicles from testing for the first four years.	12/11/97 3/2/98 EO
Consumer products (hairspray credit program) Adopted standards for the granting of tradable emission reduction credits achieved by sales of hairspray products having VOC contents less than required limits.	11/13/97
Light-duty vehicle off-cycle emissions Adopted standards to control excess emissions from aggressive driving and air conditioner use in light duty vehicles and added two light duty vehicle test methods for certification of new vehicles under these standards.	7/24/97 3/19/98 EO

CARB Board Action (Board)	Hearing Date
Consumer products Adopted amendments to add VOC limits to 18 categories of consumer products used in residential and industrial cleaning, automobile maintenance, and commercial poisons.	7/24/97
Enhanced evaporative emissions standards Adopted amendments extending the compliance date for ultra-small volume vehicle manufacturers by one year.	5/22/97
Emission reduction credit program Adopted standards for District establishment of ERC programs including certification, banking, use limitation, and reporting requirements.	5/22/97
Lead as a toxic air contaminant Adopted an amendment to designate inorganic lead as a toxic air contaminant.	4/24/97
Consumer products (hair spray) Adopted amendments to (1) delay a January 1, 1998, compliance deadline to June 1, 1999, (2) require progress plans from manufacturers, and (3) authorize the Executive Officer to require VOC mitigation when granting variances from the June 1, 1999 deadline.	3/27/97
Portable engine registration program (PERP) Adopted standards for (1) the permitting of portable engines by ARB and (2) District recognition and enforcement of permits.	3/27/97
Liquefied petroleum gas Adopted amendments to extend the compliance deadline from January 1, 1997, to January 1, 1999, for the 5% propene limit in liquefied petroleum gas used in motor vehicles.	3/27/97
Onboard diagnostics, phase II Adopted amendments to extend the phase-in of enhanced catalyst monitoring, modify misfire detection requirements, add PVC system and thermostat monitoring requirements, and require manufacturers to sell diagnostic tools and service information to repair shops.	12/12/96
Consumer products Adopted amendments to delay 25% VOC compliance date for aerosol adhesives, clarify portions of the regulation, exempt perchloroethylene from VOC definition, extend the sell-through time to three years, and add perchloroethylene reporting requirements.	11/21/96
Consumer products (test method) Adopted an amendment to add Method 310 for the testing of VOC content in consumer products.	11/21/96

CARB Board Action (Board)	Hearing Date
Pollutant transport designation Adopted amendments to modify transport couples from the Broader Sacramento area and add couples to the newly formed Mojave Desert and Salton Sea Air Basins.	11/21/96
Diesel fuel certification test methods Approved amendments specifying the test methods used for quantifying the constituents of diesel fuel.	10/24/96 6/4/97 EO
Wintertime requirements for utility engines & off-highway vehicles Optional hydrocarbon and NOx standards for snow throwers and ice augers, raising CO standard for specialty vehicles under 25hp.	9/26/96
Large off-road diesel Statement of Principles National agreement between ARB, U.S. EPA, and engine manufacturers to reduce emissions from heavy-duty off-road diesel equipment four years earlier than expected in the 1994 SIP for ozone.	9/13/96
Regulatory improvement initiative Rescinded two regulations relating to fuel testing in response to Executive Order W-127-95.	5/30/96
Zero emission vehicles Adopted amendments to eliminate zero emission vehicle quotas between 1998 and 2002, and approved MOUs with seven automobile manufacturers to accelerate release of lower emission "49 state" vehicles.	3/28/96 7/24/96 EO
CaRFG variance requirements Approved amendments to add a per gallon fee on non-compliant gasoline covered by a variance and to made administrative changes in variance processing and extension.	1/25/96 2/5/96 EO 4/2/96 EO
Utility and lawn and garden equipment engines Adopted an amendment to relax the CO standard from 300 to 350 ppm for Class I and II utility engines.	1/25/96
National security exemption of military tactical vehicles Such vehicles would not be required to adhere to exhaust emission standards.	12/14/95
CaRFG regulation amendments Approved amendments to allow for downstream addition of oxygenates and expansion of compliance options for gasoline formulation.	12/14/95
Required additives in gasoline (deposit control additives) Terms, definitions, reporting requirements, and test procedures for compliance are to be clarified.	11/16/95

CARB Board Action (Board)	Hearing Date
CaRFG test method amendments Approved amendments to designate new test methods for benzene, aromatic hydrocarbon, olefin, and sulfur content of gasoline.	10/26/95
Motor vehicle inspection and maintenance program Handled by BAR.	10/19/95 by BAR
Antiperspirants and deodorants, consumer products, and aerosol coating products Ethanol exemption for all products, modifications to aerosol special requirements, modifications for regulatory language consistency, modifications to VOC definition.	9/28/95
Low emission vehicle (LEV III) standards Reactivity adjustment factors, introduction of medium-duty ULEVs, window labels, and certification requirements and test procedures for LEVs.	9/28/95
Medium- and heavy-duty gasoline trucks Expedited introduction of ultra-low emission medium-duty vehicles and lower NOx emission standards for heavy-duty gasoline trucks to fulfill a 1994 ozone SIP commitment.	9/1/95
Retrofit emission standards: all vehicle classes to be included in the alternate durability test plan, kit manufacturers to be allowed two years to validate deterioration factors under the test plan, update retrofit procedures allowing manufacturers to disable specific OBDs if justified by law.	7/27/95
Gasoline vapor recovery systems Adopts revised certification and test procedures.	6/29/95
Onboard refueling vapor recovery standards 1998 and subsequent MY engine cars, LD trucks, and MD trucks less than 8500 GVWR.	6/29/1995 4/24/96 EO
Heavy duty vehicle exhaust emission standards for NOx Amendments to standards and test procedures for 1985 and subsequent MY HD engines, amendments to emission control labels, amendments to Useful Life definition and HD engines and in-use vehicle recalls.	6/29/95
Aerosol coatings regulation Adopted regulation to meet California Clean Air Act requirements and a 1994 ozone SIP commitment.	3/23/95
Periodic smoke inspection program Delays start of PSIP from 1995 to 1996.	12/8/94

CARB Board Action (Board)	Hearing Date
Onboard diagnostics phase II Amendments to clarify regulation language, ensure maximum effectiveness, and address manufacturer concerns regarding implementation.	12/8/94
Alternative control plan (ACP) for consumer products A voluntary, market-based VOC emissions cap upon a grouping of consumer products, flexible by manufacturer that will minimize overall costs of emission reduction methods and programs.	9/22/94
Diesel fuel certification: new specifications for diesel engine certification fuel, amended oxygen specification for CNG certification fuel, and amended commercial motor vehicle liquefied petroleum gas regulations.	9/22/94
Utility and lawn and garden equipment (UGLE) engines Modification to emission test procedures, ECLs, defects warranty, quality-audit testing, and new engine compliance testing.	7/28/94
Evaporative emissions standards and test procedures Adopted evaporative emissions standards for medium-duty vehicles.	2/10/94
Off-road recreational vehicles Adopted emission control regulations for off-road motorcycles, all-terrain vehicles, go-karts, golf carts, and specialty vehicles.	1/1/94
Perchloroethylene from dry cleaners Adopted measure to control perchloroethylene emissions from dry cleaning operations.	10/1/93
Wintertime oxygenate program Amendments to the control time period for San Luis Obispo County, exemption for small retailers bordering Nevada, flexibility in gasoline delivery time, calibration of ethanol blending equipment, gasoline oxygen content test method.	9/9/93
Onboard diagnostic phase II	7/9/93
Urban transit buses Amended regulation to tighten State NOx and particulate matter (PM) standards for urban transit buses beyond federal standards beginning in 1996.	6/10/93
1-year implementation delay in emission standards for utility engines	4/8/93
Non-ferrous metal melting Adopted Air Toxic Control Measure for emissions of cadmium, arsenic, and nickel from non-ferrous metal melting operations.	1/1/93
Certifications requirements for low emission passenger cars, light-duty trucks & medium duty vehicles	1/14/93

CARB Board Action (Board)	Hearing Date
Airborne toxic control measure for emissions of toxic metals from non-ferrous metal melting	12/10/92
Periodic self-inspection program Implemented State law establishing a periodic smoke self-inspection program for fleets operating heavy-duty diesel-powered vehicles.	12/10/92
Notice of general public interest for consumer products	11/30/92
Substitute fuel or clean fuel incorporated test procedures	11/12/92
New vehicle testing using CaRFG Phase 2 gasoline Approved amendments to require the use of CaRFG Phase 2 gasoline in the certification of exhaust emissions in new vehicle testing.	8/13/92
Standards and test procedures for alternative fuel retrofit systems	5/14/92
Alternative motor vehicle fuel certification fuel specification	3/12/92
Heavy-duty off-road diesel engines Adopted the first exhaust emission standards and test procedures for heavy-duty off-road diesel engines beginning in 1996.	1/9/92
Consumer Products - Tier II Adopted Tier II of regulations to reduce emissions from consumer products.	1/9/92
Wintertime oxygen content of gasoline Adopted regulation requiring the addition of oxygenates to gasoline during winter to satisfy federal Clean Air Act mandates for CO nonattainment areas.	12/1/91
CaRFG Phase 2 Adopted CaRFG phase 2 specifications including lowering vapor pressure, reducing the sulfur, olefin, aromatic, and benzene content, and requiring the year-round addition of oxygenates to achieve reductions in ROG, NOx, CO, oxides of sulfur (SOx) and toxics.	11/1/91
Low emissions vehicles amendments revising reactivity adjust factor (RAF) provisions and adopting a RAF for M85 transitional low emission vehicles	11/14/91
Onboard diagnostic, phase II	11/12/91
Onboard diagnostics for light-duty trucks and light & medium-duty motor vehicles	9/12/91
Utility and lawn & garden equipment Adopted first off-road mobile source controls under the California Clean Air Act regulating utility, lawn and garden equipment.	12/1/90
Control for abrasive blasting	11/8/90

CARB Board Action (Board)	Hearing Date
Roadside smoke inspections of heavy-duty vehicles Adopted regulations implementing State law requiring a roadside smoke inspection program for heavy-duty vehicles.	11/8/90
Consumer Products Tier I Adopted Tier I of standards to reduce emissions from consumer products.	10/11/90
CaRFG Phase I Adopted CaRFG Phase I reformulated gasoline regulations to phase-out leaded gasoline, reduce vapor pressure, and require deposit control additives.	9/1/90
Low-emission vehicle (LEV) and clean fuels Adopted the landmark LEV/clean fuel regulations which called for the gradual introduction of cleaner cars in California. The regulations also provided a mechanism to ensure the availability of alternative fuels when a certain number of alternative fuel vehicles are sold.	9/1/90
Evaporative emissions from vehicles Modified test procedure to include high temperatures (up to 105 F) and ensure that evaporative emission control systems function properly on hot days.	8/9/90
Dioxins from medical waste incinerators Adopted Airborne Toxic Control Measure to reduce dioxin emissions from medical waste incinerators.	7/1/90
CA Clean Air Act guidance for permitting Approved California Clean Air Act permitting program guidance for new and modified stationary sources in nonattainment areas.	7/1/90
Consumer products BAAQMD	6/14/90
Medium duty vehicle emission standards Adopted three new categories of low emission MDVs, required minimum percentages of production, and established production credit and trading.	6/14/90
Medium-duty vehicles Amended test procedures for medium-duty vehicles to require whole-vehicle testing instead of engine testing. This modification allowed enforcement of medium-duty vehicle standards through testing and recall.	6/14/90
Ethylene oxide sterilizers Adopted Airborne Toxic Control Measure to reduce ethylene oxide emissions from sterilizers and aerators.	5/10/90
Asbestos in serpentine rock Adopted Airborne Toxic Control Measure for asbestos-containing serpentine rock in surfacing applications.	4/1/90

CARB Board Action (Board)	Hearing Date
Certification procedure for aftermarket parts	2/8/90
Antiperspirants and deodorants Adopted first consumer products regulation, setting standards for antiperspirants and deodorants.	11/1/89
Residential woodstoves Approved suggested control measure for the control of emissions from residential wood combustion.	11/1/89
On-Board Diagnostic Systems II Adopted regulations to implement the second phase of on-board diagnostic requirements which alert drivers of cars, light-trucks and medium-duty vehicles when the emission control system is not functioning properly.	9/1/89
Cars and light-duty trucks Adopted regulations to reduce ROG and CO emissions from cars and light trucks by 35 percent.	6/1/89
Architectural coatings Approved a suggested control measure to reduce ROG emissions from architectural coatings.	5/1/89
Chrome from cooling towers Adopted Airborne Toxic Control Measure to reduce hexavalent chromium emissions from cooling towers.	3/1/89
Reformulated Diesel Fuel Adopted regulations requiring the use of clean diesel fuel with lower sulfur and aromatic hydrocarbons beginning in 1993.	11/1/88
Vehicle Recall Adopted regulations implementing a recall program which requires auto manufacturers to recall and fix vehicles with inadequate emission control systems (Vehicles are identified through in-use testing conducted by the ARB).	9/1/88
Suggested control measure for oil sumps Approved a suggested control measure to reduce emissions from sumps used in oil production operations.	8/1/88
Chrome platers Adopted Airborne Toxic Control Measure to reduce emissions of hexavalent chromium emissions from chrome plating and chromic acid anodizing facilities.	2/1/88
Suggested control measure for boilers Approved suggested control measure to reduce NOx emissions from industrial, institutional, and commercial boilers, steam generators and process heaters.	9/1/87

CARB Board Action (Board)	Hearing Date
Benzene from service stations Adopted Airborne Toxic Control Measure to reduce benzene emissions from retail gasoline service stations (Also known as Phase II vapor recovery).	7/1/87
Agricultural burning guidelines Amended existing guidelines to add provisions addressing wildland vegetation management.	11/1/86
Heavy-duty vehicle certification Amended certification of heavy-duty diesel and gasoline-powered engines and vehicles to align with federal standards.	4/1/86
Cars and light-duty trucks Adopted regulations reducing NOx emissions from passenger cars and light-duty trucks by 40 percent.	4/1/86
Sulfur in diesel fuel Removed exemption for small volume diesel fuel refiners.	6/1/85
On-Board Diagnostics I Adopted regulations requiring the use of on-board diagnostic systems on gasoline-powered vehicles to alert the driver when the emission control system is not functioning properly.	4/1/85
Suggested control measure for wood coatings Approved a suggested control measure to reduce emissions from wood furniture and cabinet coating operations.	3/1/85
Suggested control measure for resin manufacturing Approved a suggested control measure to reduce ROG emissions from resin manufacturing.	1/1/85

ATTACHMENT E
CARB ANALYSES OF KEY MOBILE SOURCE REGULATONS AND PROGRAMS PROVIDING EMISSION REDUCTIONS

Prepared by
California Air Resources Board
San Diego County Air Pollution Control District

March 2020

E.1 <u>Overview</u>

Given the severity of California's air quality challenges and the need for ongoing emission reductions, the California Air Resources Board (CARB) has implemented the most comprehensive mobile source emissions control program in the nation. CARB's comprehensive program relies on four fundamental approaches:

- Stringent emissions standards that minimize emissions from new vehicles and equipment;
- In-use programs that target the existing fleet and require the use of the cleanest vehicles and emissions control technologies;
- Cleaner fuels that minimize emissions during combustion; and,
- Incentive programs that remove older, dirtier vehicles and equipment and replace those vehicles with the cleanest technologies.

This multi-faceted approach has spurred the development of increasingly cleaner technologies and fuels and achieved significant emission reductions across all mobile source sectors that go far beyond national programs or programs in other states. These efforts extend back to the first mobile source regulations adopted in the 1960s, and pre-date the federal Clean Air Act Amendments (Act) of 1970, which established the basic national framework for controlling air pollution. In recognition of the pioneering nature of CARB's efforts, the Act provides California unique authority to regulate mobile sources more stringently than the federal government by providing a waiver of preemption for its new vehicle emission standards under Section 209(b). This waiver provision preserves a pivotal role for California in the control of emissions from new motor vehicles, recognizing that California serves as a laboratory for setting motor vehicle emission standards. Since then, CARB has consistently sought and obtained waivers and authorizations for its new motor vehicle regulations. CARB's history of progressively strengthening standards as technology advances, coupled with the waiver process requirements, ensures that California's regulations remain the most stringent in the nation. A list of regulatory actions CARB has taken since 1985 is provided in Attachment D to highlight the scope of CARB's actions to reduce mobile source emissions.

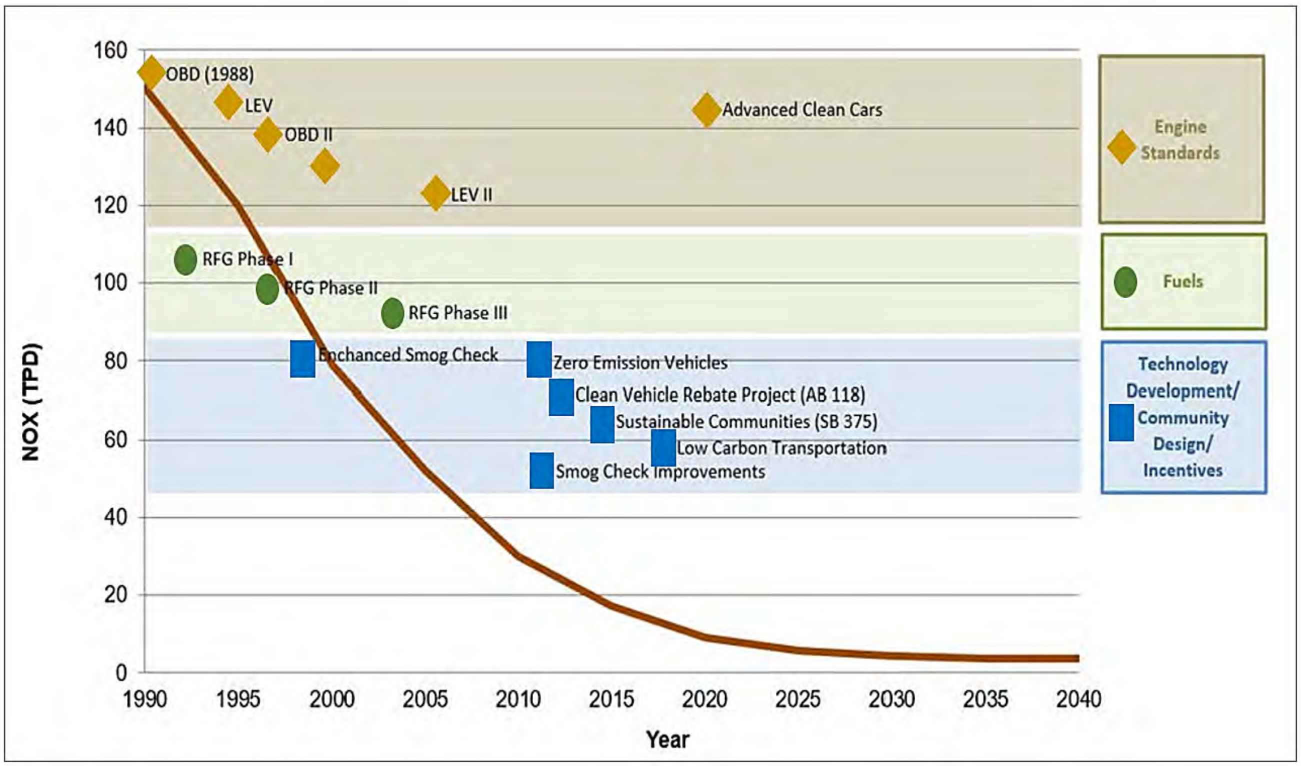
Since 2000, CARB adopted numerous regulations aimed at reducing exposure to diesel particulate matter and oxides of nitrogen, from freight transport sources like heavy-duty diesel trucks, transportation sources like passenger cars and buses, and off-road sources like large construction equipment. Phased implementation of these regulations will produce increasing emission reduction benefits through 2032 and beyond, as the regulated fleets are retrofitted, and as older and dirtier portions of the fleets are replaced with newer and cleaner models at an accelerated pace.

Further, CARB and District staff work closely on identifying and distributing incentive funds to accelerate cleanup of engines. Key incentive programs include: Low Carbon Transportation, Air Quality Improvement Program, VW Mitigation Trust, Community Air Protection, Carl Moyer Program, Goods Movement Program, and Funding Agricultural Replacement Measures for Emission Reductions (FARMER). These incentive-based programs work in tandem with regulations to accelerate deployment of cleaner technology.

E.2 Light-Duty Vehicles

Figure E-1 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 San Diego County have been reduced significantly since 1990 and will continue to go down through 2032 due to the benefits of CARB's longstanding light-duty mobile source program. From today, light-duty vehicle NOx emissions are projected to decrease by over 50 percent in 2032. Key light-duty programs include Advanced Clean Cars, On-Board Diagnostics, Reformulated Gasoline, Incentive Programs, and the Enhanced Smog Check Program.

FIGURE E-1
Key Programs to Reduce Light-Duty NOx Emissions



Since setting the nation's first motor vehicle exhaust emission standards in 1966 that led to the first pollution controls, California has dramatically tightened emission standards for light-duty vehicles. Through CARB regulations, today's new cars pollute 99 percent less than their predecessors did thirty years ago. In 1970, CARB required auto manufacturers to meet the first standards to control NOx emissions along with hydrocarbon emissions. The simultaneous control of emissions from motor vehicles and fuels led to the use of cleaner burning reformulated gasoline (RFG) that has removed the emissions equivalent of 3.5 million vehicles from California's roads. Since CARB first adopted it in 1990, the Low Emission Vehicle Program (LEV and LEV II) and Zero-Emission Vehicle (ZEV) Program have resulted in the production and sales of hundreds of thousands of zero emission vehicles (ZEVs) in California.

E.2.1 Advanced Clean Cars

CARB's groundbreaking Advanced Clean Cars (ACC) program is now providing the next generation of emission reductions in California and ushering in a new zero emission passenger transportation system. The success of these programs is evident: California is the world's largest market for Zero Emission Vehicles (ZEVs), with over 21 models available today, and a wide variety are now available at lower price points, attracting new consumers. As of October 2019, Californians drive nearly 50 percent of all ZEVs on the road in the United States, while the U.S. makes up about half of the world market. This movement towards commercialization of advanced clean cars has occurred due to CARB's ZEV regulation, part of ACC, which affects passenger cars and light-duty trucks.

CARB's ACC Program, approved in January 2012, is a pioneering approach of a 'package' of regulations that - although separate in construction - are related in terms of the synergy developed to address both ambient air quality needs and climate change. The ACC program combines the control of smog, soot causing pollutants and greenhouse gas emissions into a single coordinated package of requirements for model years 2015 through 2025. The program assures the development of environmentally superior cars that will continue to deliver the performance, utility, and safety vehicle owners have come to expect

The ACC program approved by CARB in January 2012 also included amendments affecting the current ZEV regulation through the 2017 model year in order to enable manufacturers to successfully meet 2018 and subsequent model year requirements. These ZEV amendments are intended to achieve commercialization through simplifying the regulation and pushing technology to higher volume production in order to achieve cost reductions. The ACC Program benefits will increase over time as new cleaner cars enter the fleet displacing older and dirtier vehicles. However, in 2018, the federal government proposed the Safer Affordable Fuel-Efficient (SAFE) Vehicles Rule, which threatens the ACC Program and clean air quality progress made in California.

E.2.2 On Board Diagnostics

California's first OBD regulation required manufacturers to monitor some of the emission control components on vehicles starting with the 1988 model year. In 1989, CARB adopted OBD II, which required 1996 and subsequent model year passenger cars, light duty trucks, and medium duty vehicles and engines to be equipped with second generation OBD systems. OBD systems are designed to identify when a vehicle's emission control systems or other emission-related computer-controlled components are malfunctioning, causing emissions to be elevated above the vehicle manufacturer's specifications. CARB subsequently strengthened OBD II requirements and added OBD II specific enforcement requirements for 2004 and subsequent model year passenger cars, light-duty trucks, and medium-duty vehicles and engines.

E.2.3 Reformulated Gasoline

Since 1996, CARB has been regulating the formulation of gasoline resulting in California gasoline being the cleanest in the world. California's cleaner-burning gasoline regulation is one of the cornerstones of the State's efforts to reduce air pollution and cancer risk. Reformulated gasoline is fuel that meets specifications and requirements established by CARB. The specifications reduced motor vehicle toxics by about 40 percent and reactive organic gases by about 15 percent. The results from cleaning up fuel can have an immediate impact as soon as it is sold in the State. Vehicle manufacturers design low-emission emission vehicles to take full advantage of cleaner-burning gasoline properties.

E.2.4 Incentive Programs

There are a number of different incentive programs focusing on light-duty vehicles that produce extra emission reductions beyond traditional regulations. The incentive programs work in two ways, encouraging the retirement of dirty older cars and encouraging the purchase of a cleaner vehicle.

Voluntary accelerated vehicle retirement or "car scrap" programs provide monetary incentives to vehicle owners to retire older, more polluting vehicles. The purpose of these programs is to reduce fleet emissions by accelerating the turnover of the existing fleet and subsequent replacement with newer, cleaner vehicles. Both State and local vehicle retirement programs are available.

California's voluntary vehicle retirement program is administered by the Bureau of Automotive Repair (BAR) and provides $1,000 per vehicle and $1,500 for low-income consumers for unwanted vehicles that have either failed or passed their last Smog Check Test and that meet certain eligibility guidelines. This program is referred to as the Consumer Assistance Program.

In recent years, the California Legislature has allocated significant funding increases towards incentive-based programs. In fiscal year 2019-20, the Clean Vehicle Rebate Project (CVRP) was allocated $238 million. CVRP is designed to offer vehicle rebates on a first-come, first-serve basis for light-duty ZEVs, plug-in hybrid electric vehicles, and zero-emission motorcycles. Through March 2019, CVRP has provided rebates for nearly 320,000 vehicles at a total of just over $720 million since the project's launch in 2010.

Clean Cars 4 All (formerly known as the Enhanced Fleet Modernization Program Plus Up Pilot Project) provides incentives for lower-income consumers living in and near disadvantaged communities who scrap their old vehicles and purchase new or used hybrid, plug-in hybrid, or zero-emission vehicle replacement vehicles. Since fiscal year 2014-15, CARB has allocated $112 million for Clean Cars 4 All.

E.2.5 California Enhanced Smog Check Program

BAR is the State agency charged with administration and implementation of the Smog Check Program. The Smog Check Program is designed to reduce air pollution from California registered vehicles by requiring periodic inspections for emission-control system problems, and by requiring repairs for any problems found. In 1998, the Enhanced Smog Check program began in which Smog Check stations relied on the BAR-97 Emissions Inspection

System (EIS) to test tailpipe emissions with either a Two Speed Idle (TSI) or Acceleration Simulation Mode (ASM) test depending on where the vehicle was registered. For instance, vehicles registered in urbanized areas received an ASM test, while vehicles in rural areas or received a TSI test. In 2009, the following requirements were added in to improve and enhance the Smog Check Program, making it more inclusive of motor vehicles and effective on smog reductions:

- Low pressure evaporative test;
- More stringent pass/fail cutpoints;
- Visible smoke test; and
- Inspection of light- and medium-duty diesel vehicles.

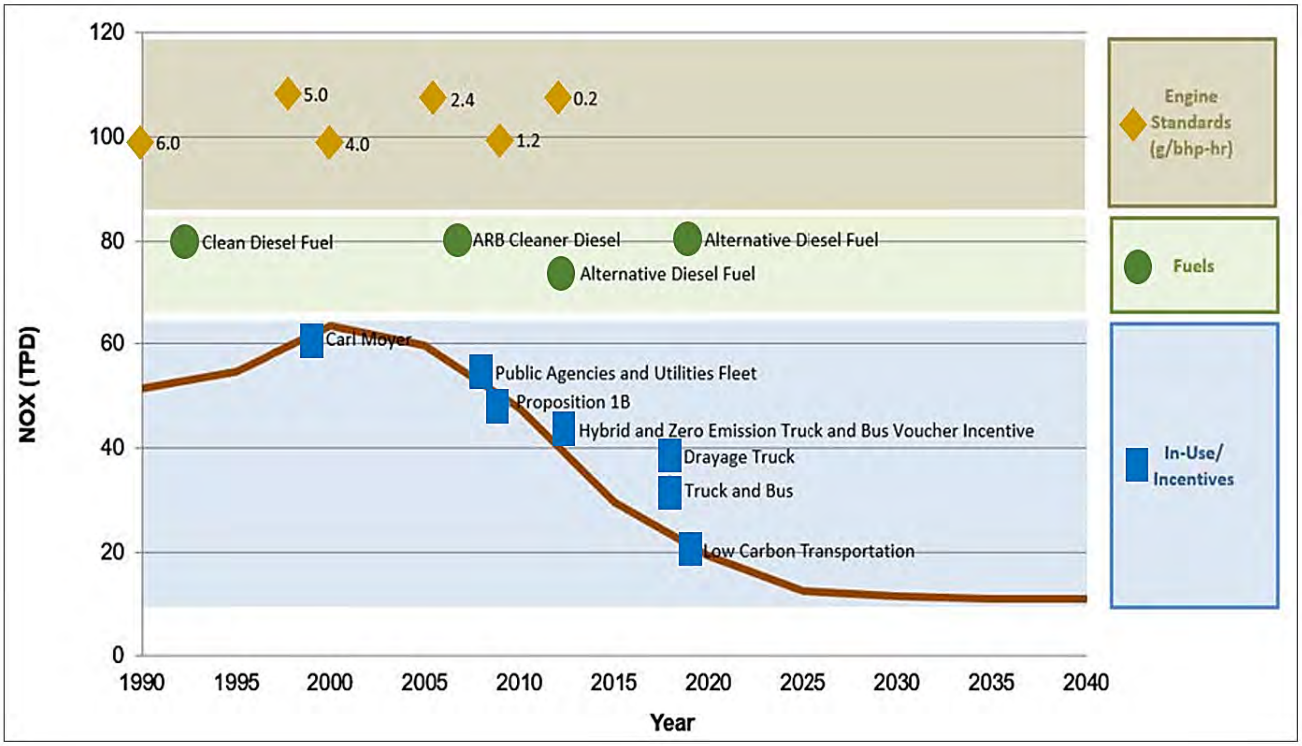
The next major change was due to AB 2289, adopted in October 2010, a new law restructuring California's Smog Check Program, streamlining and strengthening inspections, increasing penalties for misconduct, and reducing costs to motorists. This new law sponsored by CARB and BAR, promised faster and less expensive Smog Check inspections by talking advantage of OBD software installed on all vehicles since 2000. The new law also directs vehicles without this equipment to high-performing stations, helping to ensure that these cars comply with current emission standards. This program will reduce consumer costs by having stations take advantage of diagnostic software that monitors pollution-reduction components and tailpipe emissions. Beginning mid-2013, testing of passenger vehicles using OBD was required on all vehicles model years 2000 or newer.

E.3 Heavy-Duty Trucks

Figure E-2 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 San Diego County have been reduced significantly since 1990 and will continue to decrease through 2032 due to the benefits of CARB's longstanding heavy-duty mobile source program. From today, heavy-duty NOx emissions are reduced by over 40 percent in 2032. Key programs include Heavy-Duty Engine Standards, Clean Diesel Fuel, the Truck and Bus Regulation and Incentive Programs.

(CONTINUED ON NEXT PAGE)

FIGURE E-2
Key Programs to Reduce Heavy-Duty Emissions



E.3.1 Heavy-Duty Engine Standards

Since 1990, heavy-duty engine NOx emission standards have become dramatically more stringent, 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 addition to mandatory NOx standards, there have been several generations of optional lower NOx standards put in place over the past 15 years. Most recently in 2015, engine manufacturers can certify to three optional NOx emission standards of 0.1 g/bhp hr, 0.05 g/bhp-hr, and 0.02 g/bhp-hr (i.e., 50 percent, 75 percent, and 90 percent lower than the current mandatory standard of 0.2 g/bhp-hr). The optional standards allow local air districts and CARB to preferentially provide incentive funding to buyers of cleaner trucks, to encourage the development of cleaner engines.

E.3.2 Clean Diesel Fuel

Since 1993, CARB has required that diesel fuel have a limit on the aromatic hydrocarbon content and sulfur content of the fuel. Diesel powered vehicles account for a disproportionate amount of the diesel particulate matter, which is considered a toxic air contaminant. In 2006, CARB 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 CARB formulation.

E.3.3 Cleaner In-Use Heavy-Duty Trucks (Truck and Bus Regulation)

The Truck and Bus Regulation was first adopted in December 2008. This rule represents a multi-year effort to turn over the legacy fleet of engines and replace them with the cleanest technology available. In December 2010, CARB revised specific provisions of the in-use heavy-duty truck rule, in recognition of the deep economic effects of the recession on businesses and the corresponding decline in emissions.

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 will be upgraded to have 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 yard goats, 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. Finally, California sellers of a vehicle subject to the regulation would have to disclose the regulation's potential applicability to buyers of the vehicles. Approximately 170,000 businesses in nearly all industry sectors in California, and almost a million vehicles that operate on California roads each year are affected. Some common industry sectors that operate vehicles subject to the regulation include: for-hire transportation, construction, manufacturing, retail and wholesale trade, vehicle leasing and rental, bus lines, and agriculture.

In 2017, California passed legislation ensuring compliance with the Truck and Bus Regulation through the California Department of Motor Vehicles (DMV) vehicle registration program. Starting January 1, 2020, DMV will verify compliance to ensure that vehicles subject to the Truck and Bus Regulation meet the requirements prior to obtaining DMV vehicle registration. The law requires the DMV to deny registration for any vehicle that is non-compliant or has not reported to CARB as compliant or exempt from the Truck and Bus Regulation.

CARB compliance assistance and outreach activities that are key in support of the Truck and Bus Regulation include:

- The Truck Regulations Upload and Compliance Reporting System, an online reporting tool developed and maintained by CARB staff;
- The Truck and Bus regulation's fleet calculator, a tool designed to assist fleet owners in evaluating various compliance strategies;
- Targeted training sessions all over the State; and
- Out-of-state training sessions conducted by a contractor.

CARB staff also develops regulatory assistance tools, conducts and coordinates compliance assistance and outreach activities, administers incentive programs, and actively enforces the entire suite of regulations. Accordingly, CARB's approach to ensuring compliance is based on a comprehensive outreach and education effort.

E.3.4 Incentive Programs

There are a number of different incentive programs focusing on heavy-duty vehicles that produce extra emission reductions beyond traditional regulations. The incentive programs encourage the purchase of cleaner trucks.

Several State and local incentive funding pools have been used historically -- and remain available -- to fund the accelerated turnover of on-road heavy duty vehicles. Since the Carl Moyer Memorial Air Quality Standards Attainment Program (Moyer Program) began in 1998 nearly $1 billion in Moyer Program incentive grants have been used to clean up over 60,000 older engines in California. This has reduced NOx and ROG emissions by more than 183,000 tons, and particulate matter by more than 6,700 tons statewide.

Beginning in 2008, the Goods Movement Emission Reduction Program funded by Proposition 1B has funded cleaner trucks for the region’s transportation corridors; the final increment of funds will implement projects through 2020

The California Legislature has recently allocated significant funding increases towards heavy-duty vehicle incentive-based programs. The Hybrid and Zero-Emission Truck and Bus Voucher Incentive Project (HVIP) is the cornerstone of advanced technology heavy-duty incentives, providing funding since 2010 to support the long-term transition to zero-emission vehicles in the heavy-duty market. Since its inception in 2009, HVIP has been allocated over $447 million. HVIP has supported the purchase of 2,559 zero emission trucks and buses, 2,631 hybrid trucks, 2,068 low NOx engines, and 195 trucks with electric power take off systems by California fleets through June 30, 2019.

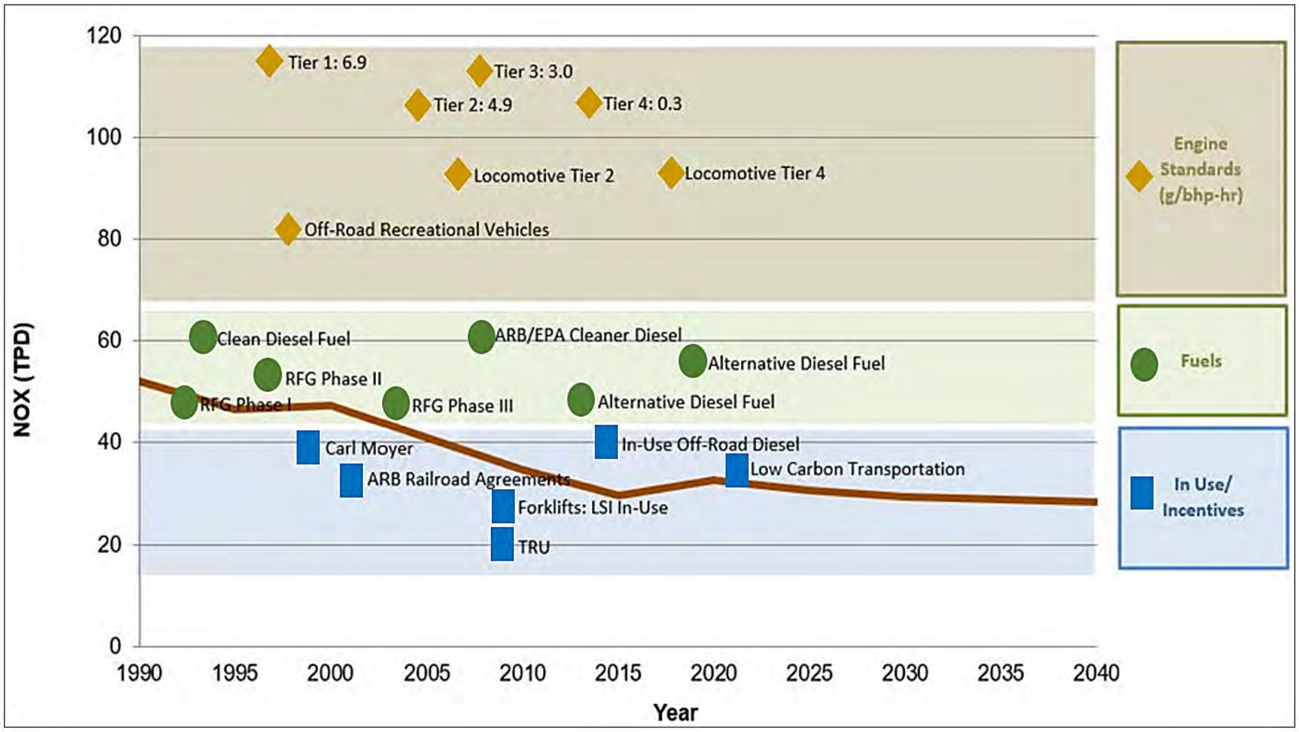
CARB has also administered a Truck Loan Assistance Program since 2009. As of June 30, 2019, about $113.2 million in Truck Loan Assistance Program funding has been expended to provide about $1.5 billion in financing to small-business truckers for the purchase of approximately 26,000 cleaner trucks, exhaust retrofits, and trailers.

E.4 <u>Off-Road Sources</u>

Off-road sources encompass equipment powered by an engine that does not operate on the road. Sources vary from ships to lawn and garden equipment and for example, include sources like locomotives, aircraft, tractors, harbor craft, off-road recreational vehicles, construction equipment, forklifts, and cargo handling equipment.

Figure E-3 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 Diego County have been reduced significantly since 1990 and will continue to decrease through 2032 due to the benefits of CARB’s and U.S. EPA longstanding programs. From today, off-road NOx emissions are reduced by over 10 percent in 2024. Key programs include Off-Road Engine Standards, Locomotive Engine Standards, Clean Diesel Fuel, Cleaner In-Use Off-Road Regulation and In-Use Large Spark Ignition (LSI) Fleet Regulation.

FIGURE E-3
Key Programs to Reduce Off-Road Emissions



E.4.1 Off-Road Engine Standards

The Clean Air Act preempts states, including California, from adopting requirements for new off-road engines less than 175 HP used in farm or construction equipment. California may adopt emission standards for in-use off-road engines pursuant to Section 209(e)(2), but must receive authorization from U.S. EPA before it may enforce the adopted standards.

CARB first approved regulations to control exhaust emissions from small off-road engines (SORE) such as lawn and garden equipment in December 1990 with amendments in 1998, 2003, 2010, 2011, and 2016. These regulations were implemented through three tiers of progressively more stringent exhaust emission standards that were phased in between 1995 and 2008.

Manufacturers of forklift engines are subject to new engine standards for both diesel and Large Spark Ignition (LSI) engines. Off-road diesel engines were first subject to engine standards and durability requirements in 1996 while the most recent Tier 4 Final emission standards were phased in starting in 2013. Tier 4 emission standards are based on the use of advanced after-treatment technologies such as diesel particulate filters and selective catalytic reduction. LSI engines have been subject to new engine standards that include both criteria pollutant and durability requirements since 2001 with the cleanest requirements phased-in starting in 2010.

E.4.2 Locomotive Engine Standards

The Clean Air Act and the U.S. EPA national locomotive regulations expressly preempt states and local governments from adopting or enforcing “any standard or other requirement relating to the control of emissions from new locomotives and new engines used in locomotives” (U.S. EPA interpreted new engines in locomotives to mean remanufactured engines, as well). U.S. EPA has approved two sets of national locomotive emission regulations (1998 and 2008). In 1998, U.S. EPA approved the initial set of national locomotive emission regulations. These regulations primarily emphasized NOx reductions through Tier 0, 1, and 2 emission standards. Tier 2 NOx emission standards reduced older uncontrolled locomotive NOx emissions by up to 60 percent, from 13.2 to 5.5 g/bhp-hr.

In 2008, U.S. EPA approved a second set of national locomotive regulations. Older locomotives upon remanufacture are required to meet more stringent particulate matter (PM) emission standards which are about 50 percent cleaner than Tier 0-2 PM emission standards. U.S. EPA refers to the PM locomotive remanufacture emission standards as Tier 0+, Tier 1+, and Tier 2+. The new Tier 3 PM emission standard (0.1 g/bhp-hr), for model years 2012-2014, is the same as the Tier 2+ remanufacture PM emission standard. The 2008 regulations also included new Tier 4 (2015 and later model years) locomotive NOx and PM emission standards. The U.S. EPA Tier 4 NOx and PM emission standards further reduced emissions by approximately 95 percent from uncontrolled levels.

In April 2017, CARB petitioned U.S. EPA for rulemaking, seeking the amendment of emission standards for newly built locomotives and locomotive engines and lower emission standards for remanufactured locomotives and locomotive engines. The petition asks U.S. EPA to update its standards to take effect for remanufactured locomotives in 2023 and for newly built locomotives in 2025. The new emission standards would provide critical criteria pollutant reductions, particularly in the disadvantaged communities that surround railyards.

E.4.3 Clean Diesel Fuel

Since 1993, CARB has required that diesel fuel have a limit on the aromatic hydrocarbon content and sulfur content of the fuel. Diesel powered vehicles account for a disproportionate amount of the diesel particulate matter which is considered a toxic air contaminant. In 2006, CARB 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 CARB formulation.

E.4.4 Cleaner In-Use Off-Road Equipment (Off-Road Regulation)

The Off-Road Regulation which was first approved in 2007 and subsequently amended in 2010 in light of the impacts of the economic recession. 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 Off-Road Regulation will significantly reduce emissions of diesel PM and NOx from the over 150,000 in-use off road diesel vehicles that operate in California. The regulation affects dozens of vehicle types used in thousands of fleets by requiring owners to modernize their fleets by replacing older engines or vehicles with newer, cleaner models, retiring older vehicles or using them less often, or by applying retrofit exhaust controls.

The Off-Road Regulation imposes idling limits on off-road diesel vehicles, requires a written idling policy, and requires a disclosure when selling vehicles. The regulation also requires that all vehicles be reported to CARB and labeled, restricts the addition of older vehicles into fleets, and requires fleets to reduce their emissions by retiring, replacing, or repowering older engines, or installing verified exhaust retrofits. The requirements and compliance dates of the Off-Road Regulation vary by fleet size.

Fleets are subject to increasingly stringent restrictions on adding older vehicles. The regulation also sets performance requirements. While the regulation has many specific provisions, in general by each compliance deadline, a fleet must demonstrate that it has either met the fleet average target for that year, or has completed the Best Available Control Technology requirements. The performance requirements of the Off-Road Regulation were phased in from January 1, 2014 through January 1, 2019.

Compliance assistance and outreach activities in support of the Off-Road Regulation include:

- The Diesel Off-road On-line Reporting System, an online reporting tool developed and maintained by CARB staff.
- The Diesel Hotline (866-6DIESEL), which provides the regulated public with questions about the regulations and access to CARB staff. Staff is able to respond to questions in English, Spanish and Punjabi.
- The Off-road Listserv, providing equipment owners and dealerships with timely announcement of regulatory changes, regulatory assistance documents, and reminders for deadlines.

E.4.5 LSI In-Use Fleet Regulation

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.

E.4.6 Incentive Programs

There are a number of different incentive programs focusing on off-road mobile sources that increase the penetration of cleaner technologies into the market. The incentive programs encourage the purchase of cleaner diesel engines.

The Clean Off-Road Equipment Voucher Incentive Project (CORE) is a voucher project similar to HVIP, but for advanced technology off-road equipment. The fiscal year 2017 18 Funding Plan allocated $40 million to support zero-emission freight equipment through CORE. CARB launched CORE at the end of 2019.

California's agricultural industry consists of approximately 77,500 farms and ranches, providing over 400 different commodities, making agriculture one of the State's most diverse industries. In recognition of the strong need and this industry's dedication to reducing their emissions, the State Legislature has allocated over $330 million towards the FARMER Program since 2017. CARB staff developed the FARMER Program to meet the State Legislature's objectives and help meet the State's criteria, toxic, and greenhouse gas emission reduction goals. As of September 30, 2019, the FARMER Program has spent $97 million on over 2,500 pieces of agricultural equipment and will reduce 250 tons of PM2.5 and 4,200 tons of NOx over the lifetime of the projects.

ATTACHMENT F
PRE-BASELINE BANKED EMISSION REDUCTION CREDITS

TABLE F-1
District Banking Registry Summary
Emission Reduction Credits Issued in 2017 and Earlier

Company Name	Certificate Number	NOx (TPY)	VOC (TPY)	Cumulative Total NOx (TPY)	Cumulative Total VOC (TPY)
Applied Energy LLC	2010-000018-01	34.55		34.55	0.0
Cabrillo Enterprises, LLC	080527-01		1.25	34.55	1.25
Cabrillo Power II LLC	981518-01	1.16		35.71	1.25
Callaway Golf Co.	2012-ERC-000019		6.09	35.71	7.34
	2012-ERC-000020		6.09	35.71	13.43
City of San Diego, Metropolitan Wastewater Dept.	950766-06		0.38	35.71	13.81
	970821-02		22.76	35.71	36.57
Dynergy	2011-000050-01	0.95		36.66	36.57
General Dynamics Properties, Inc.	970809-02	1.26		37.92	36.57
	970809-05		0.23	37.92	36.80
Grey K. Environmental Fund, LP	000098-01		2.10	37.92	38.90
	060328-01	1.90		39.82	38.90
	060328-02	2.20		42.02	38.90
	060328-03		2.90	42.02	41.80
	060328-04		0.54	42.02	42.34
	060328-05		0.10	42.02	42.44
	060328-06		0.30	42.02	42.74
	060803-04		36.70	42.02	79.44
	070731-01		20.70	42.02	100.14
Hanson Aggregates, Pacific SW Region	980772-01	0.93		42.95	100.14
	980772-03		0.26	42.95	100.40
Hughes-Aircraft Co., Electro-Opti Cal Systems	940261-01		1.06	42.95	101.46
	940261-02		0.22	42.95	101.68
Koch Membrane Systems, Inc.	APCD2013-ERC-000025		2.91	42.95	104.59
Kyocera America	2012-ERC-000022	16.70		59.65	104.59
	2012-ERC-000023		7.60	59.65	112.19
Muht-Hei, Inc.	981002-01		0.18	59.65	112.37
	981002-02		0.18	59.65	112.55

Company Name	Certificate Number	NOx (TPY)	VOC (TPY)	Cumulative Total NOx (TPY)	Cumulative Total VOC (TPY)
Muht-Hei, Inc.	981002-03		0.18	59.65	112.73
	981002-04		0.18	59.65	112.91
	981002-05		0.57	59.65	113.48
	981002-06		0.19	59.65	113.67
	981002-07		2.23	59.65	115.90
	981002-08		1.28	59.65	117.18
	981002-09		0.18	59.65	117.36
	981002-10		2.07	59.65	119.43
	981002-11		1.28	59.65	120.71
	981002-12		0.57	59.65	121.28
National Steel & Shipbuilding	40995-02	0.18		59.83	121.28
	40995-03		0.60	59.83	121.88
	40996-02	0.04		59.87	121.88
	40997-02	0.32		60.19	121.88
	40997-03		0.02	60.19	121.90
Naval Air Station, North Island	991014-01	8.00		68.19	121.90
	991015-01	3.30		71.49	121.90
	991016-01	18.70		90.19	121.90
Naval Station, San Diego	950949-01	4.83		95.02	121.90
	940206-01	0.67		95.69	121.90
	940206-03		0.05	95.69	121.95
Navy Region Southwest	990223-01	12.02		107.71	121.95
Northrop-Grumman Ryan Aeronautical Center	975000-01		1.20	107.71	123.15
Olduvai Gorge LLC	070430-01	2.00		109.71	123.15
	070502-01	14.72		124.43	123.15
	070822-01	1.20		125.63	123.15
	070822-02		0.10	125.63	123.25
	070822-04		11.05	125.63	134.30
	071004-01		10.80	125.63	145.10
	071004-02	12.00		137.63	145.10
	080527-01		16.90	137.63	162.00
	080722-01		21.18	137.63	183.18
Otay Mesa Generating Co., LLC	000427-05	0.78		138.40	183.18
	000224-01	4.40		142.80	183.18
Performance Contracting Inc.	071217-01		1.00	142.80	184.18
Pio Pico Energy Center, LLC	2014-ERC-000034		6.60	142.80	190.78

Company Name	Certificate Number	NOx (TPY)	VOC (TPY)	Cumulative Total NOx (TPY)	Cumulative Total VOC (TPY)
Qualcomm	2013-000026	20.60		163.40	190.78
SDG&E	983811-01	4.00		167.40	190.78
	060324-01		0.40	167.40	191.18
	060324-02	19.90		187.30	191.18
Sherwin Williams	987553-01		7.46	187.30	198.64
Shipyard Supplies, Inc.	060824-02		1.00	187.30	199.64
	070529-01		1.00	187.30	200.64
Solar Turbines	970123-04	10.00		197.30	200.64
	950562-01		0.60	197.30	201.24
Southern California Edison Company	950171-01	0.51		197.81	201.24
	950171-03		0.02	197.81	201.26
Surface Technologies	990325-01		1.48	197.81	202.74
United States Marine Corps	030507-01	3.00		200.81	202.74
US Foam	974375-03		0.10	200.81	202.84
SW Division, Naval Facilities Engineering Cmd.	954185-01		2.00	200.81	204.84
	960709-01		9.00	200.81	213.84
	970311-01		13.00	200.81	226.84
	980511-03		3.15	200.81	229.99
	980521-02		13.25	200.81	243.24
	980529-02		7.40	200.81	250.64
Unisys Corporation	901238-01		3.66	200.81	254.30
	921410-01		1.25	200.81	255.55
	940577-01		2.95	200.81	258.50
USN Communications Station	940560-01	2.40		203.21	258.50
	940560-04		0.05	203.21	258.54
	940561-01	0.12		203.33	258.54
	940561-03		0.00	203.33	258.54
	940562-01	0.12		203.45	258.54
	940562-03		0.00	203.45	258.54
Veterans Administration Hospital	979555-01	1.90		205.35	258.54
TOTALS (tons/year)				**205.35**	**258.54**
TOTALS (tons/day)				**0.56**	**0.71**

ATTACHMENT G
ANALYSES OF POTENTIAL ADDITIONAL STATIONARY SOURCE CONTROL MEASURES

TABLE G-1
Stationary Source Categories for Which More Stringent Control Requirements Have Been Adopted by Another Air District

Control Measure	Existing San Diego Rule Number	Other Air District Rule Number*	Estimated Emission Reduction Potential (Tons/Day) VOC	Estimated Emission Reduction Potential (Tons/Day) NOx	Implement-ation Period (Years)
Further Control of Existing Rules					
G.1 - Receiving and Storing Volatile Organic Compounds at Bulk Plants and Bulk Terminals	61.1	SC 1178	0.03		3
G.2 - Transfer of Organic Compounds into Mobile Transport Tanks	61.2	SJV 4621 SJV 4622	0.01		1
G.3 - Metal Parts and Product Coating Operations	67.3	SBC 337	0.003		1
G.4 - Paper, Film, and Fabric Coatings	67.5	SJV 4607	0.01		1
G.5 - Aerospace Coating Operations	67.9	SC 1124 SJV 4605	0.005		1
G.6 - Graphic Arts Operations	67.16	SC 1130 SJV 4607	0.05		1
G.7 - Marine Coating Operations	67.18	SC 1106	0.01		1
G.8 – Adhesive Materials Application Operations	67.21	SC 1168 VEN 74.20	0.09		3

Control Measure	Existing San Diego Rule Number	Other Air District Rule Number*	Estimated Emission Reduction Potential (Tons/Day) VOC	Estimated Emission Reduction Potential (Tons/Day) NOx	Implement-ation Period (Years)
G.9 - Industrial and Commercial Boilers, Process Heaters and Steam Generators	69.2	SJV 4306		0.1	2
G.10 - Natural Gas-Fired Fan-Type Central Furnaces	69.6	SC 1111		0.14	10 **
G.11 – Stationary Gas Turbine Engines	69.3 & 69.3.1	VEN 74.23		0.14	30***
Possible Control of Additional Source Categories					
G.12 - Vacuum Truck Operations	N/A	BA 8-53	0.04		1
G.13 - Miscellaneous NOx Sources	N/A	SAC 419		0.015	1
G.14 - Equipment Leaks	N/A	BA 8-18	0.01		1
G.15 – Restaurant Cooking Operations	N/A	SC 1138 VEN 74.25	0.02		1
G.16 - Food Products Manufacturing/ Processing	N/A	SC 1131	0.03		1
G.17 – Metalworking Fluids and Direct-Contact Lubricants	N/A	VEN 74.31 SC 1144	0.1		1
TOTAL POSSIBLE EMISSION REDUCTIONS			**0.408**	**0.395**	**1-30**

* SC = South Coast AQMD; BA = Bay Area AQMD; SJV = San Joaquin Valley APCD; SAC = Sacramento Metropolitan AQMD; VEN = Ventura County APCD; SBC = Santa Barbara County APCD

** Emissions reductions would occur gradually, as new low-emitting units replace existing higher-emitting units at the end of their useful lives.

*** Reductions reflect nine years of implementation between 2024 and 2032 and assume half of existing equipment in operation has emission control technology installed already.

G.1 Further Control of Petroleum Storage Tanks

Existing District Rule 61.1 (Receiving and Storing Volatile Organic Compounds at Bulk Plants and Bulk Terminals) regulates large storage tanks for gasoline and other high volatility motor vehicle fuels. Based on emission inventory information and updated equipment descriptions, estimated emissions from this source category are about 0.12 tons per day. Rule 61.1 has standards for fittings for internal floating roof tanks, external floating roof tanks, and fixed roof tanks and requires Best Available Control Technology (BACT) for new or replacement rim seals for external and internal floating roof tanks.

SCAQMD Rule 1178 (Further Reductions of VOC Emissions from Storage Tanks at Petroleum Facilities) has further control measures for this source category. This rule is applicable to above-ground storage tanks at petroleum facilities emitting more than 0.05 tons of VOC tons per day. The rule specifies rim seal types and fittings for external and internal floating roof tanks and fixed roof tanks. The rule also required all external floating roof tanks subject to the rule be domed by July 1, 2008.

San Diego County has two petroleum storage facilities that emit more than 0.05 tons per day. Examination of the existing rim seals and fittings for the storage tanks at these facilities indicates that most of the existing seals and fittings at these facilities would meet the standards in SCAQMD Rule 1178. Based on emission factors in the SCAQMD Rule 1178 staff report, if the standards of SCAQMD Rule 1178 were incorporated in Rule 61.1 the estimated emission reduction potential would be about 0.05 tons per day. About 40% of the emission reduction potential (0.02 tons per day) would result from upgrading rim seals. However, since ongoing BACT adherence is required by Rule 61.1 for rim seal replacement, these emission reductions will be achieved over time by existing Rule 61.1. District permit data suggests rim seals are usually replaced between 12-16 years, and some facilities have already installed upgraded rim seals. The remaining potential emission reduction benefit of the Rule 1178 standards would be approximately 0.03 tons per day, from the more stringent requirements for fittings and the requirement for external floating roof tanks to be domed. Based on this evaluation, the District has assigned this measure as a lower priority for rule development because of the very limited VOC emission reduction potential.

G.2 Further Control of Mobile Transport Tanks Loading

Existing District Rule 61.2 (Transfer of Organic Compounds into Mobile Transport Tanks) controls vapors displaced by loading of mobile transport tanks with gasoline and other high volatility fuels from bulk terminals and vapor and liquid leaks during the loading process. The primary standard of Rule 61.2 requires a 90% emission reduction for all VOC vapors displaced during the transport tank loading process. Based on emission inventory information, total estimated VOC emissions in San Diego County due to vapor displacement are about 0.03 tons per day from three bulk terminal loading rack facilities. San Joaquin Valley Air Pollution Control District (SJVAPCD) Rule 4621 (Gasoline Transfer into Stationary Storage Containers, Delivery Vessels and Bulk Plants) requires a 95% emission reduction for displaced VOC vapors. Source testing data for the largest San Diego County facility shows that it consistently achieves greater than 97% control of VOC vapors released in the loading process. The emission reduction potential for the two remaining facilities is about 0.01 tons per day if they were required to meet a 95% control level instead of the 90% control level in existing Rule 61.2. Based on this evaluation, the District has assigned this measure as a lower priority for rule development because of the very limited VOC emission reduction potential.

G.3 Further Control of Metal Parts and Product Coating Operations

District Rule 67.3 (Metal Parts and Products Coating Operations) controls VOC emissions for the source category by limiting the VOC content of paints and cleaning solvents and specifies methods to minimize VOC emissions during equipment cleaning operations. Rule 67.3 also requires the use of high-transfer efficiency application equipment. One specialty coating limit found in Rule 67.3 (chemical agent resistant coatings, or CARC) has a VOC limit that exceeds the CTG requirements. Rule 67.3 requires CARC to not exceed 420 grams of VOC per liter when air-dried, or 420 grams of VOC per liter when baked. Limits for CARC are not specified directly in applicable federal guidelines; thus, it can be construed that CARC limits could adhere to “general” coating limits of 340 grams of VOC per liter (air-dried) or 280 grams of VOC per liter when baked.

Additional analysis by the District determined that historical CARC use in San Diego County was conservatively estimated to be no more than 1.4% of the total emission inventory for miscellaneous metal and plastic parts coatings countywide. A total of 19 companies use metal parts coatings subject to Rule 67.3 in the County. However, only one facility may use CARC, though its usage was inconclusive based on available inventory data. The limited use of CARC produces a negligible impact to miscellaneous metal and plastic part coating emissions, and even less of an impact to total countywide VOC emissions. Nonetheless, the emission reduction potential for the lowering of the VOC limit for CARC is about 0.003 tons of VOC per day. Based on this evaluation, the District has assigned this measure as a lower priority for rule development because of the very limited VOC emission reduction potential.

G.4 Further Control of Paper, Film, and Fabric Coatings

Existing District Rule 67.5 regulates VOC emissions from paper, film, and fabric coating operations. Generally, the rule has analogous product VOC content limits and control device efficiency rates to what is found in other California air districts. However, since the rule was last revised in 1996, more product categories have entered the market; some of which may require further control at the local level. An assessment is necessary to determine whether additional (or lower) VOC limits of paper, film, and fabric coating materials could occur. Consideration will also be given to lowering the VOC limits of cleaning materials used in such operations, which is currently set at 200 grams or less of VOC per liter of coating. Emission reductions from these minor amendments would reduce emissions by 0.01 tons of VOC per day. Only three facilities are subject to the rule in San Diego County, thus, emission reductions are anticipated to be limited. Despite minimal emission reduction potential, the District may still update the existing rule in the future, as the existing rule may need to be revised to reflect current best practices and available products.

G.5 Further Control of Aerospace Manufacturing Operations

Existing District Rule 67.9 (Aerospace Coating Operations) controls VOC emissions from coating, stripping, and cleaning operations used in the manufacture and repair of aerospace components. Emissions in this category have greatly declined in San Diego County since 1990 due to implementation of Rule 67.9, the decline in government funding for aerospace operations and, in particular, the closing of one large facility. All operations now primarily involve maintenance and rework. No aerospace manufacturing operations occur in the County.

Coating limits in Rule 67.9 generally align with comparable rules at other air districts. SCAQMD Rule 1124 (Aerospace Assembly and Component Manufacturing Operations) has slightly lower VOC limits in some coating categories such as adhesive bonding primers, antichafe coatings, dry lubricative materials (nonfastener), form release coatings, fuel tank coatings, paint strippers, and sealants. Total estimated VOC emissions in San Diego County for materials in these coating categories, and for strippers that exceed the limits in SCAQMD Rule 1124, are less than 0.01 tons per day. Emission reductions would be less than 0.005 tons per day.

Based on this evaluation, the District has assigned this measure as a lower priority for rule development because of the very limited VOC emission reduction potential. Nonetheless, the District may still update the existing rule in the future, as the existing rule may need to be revised to reflect current best practices and available products.

G.6 Further Control of Graphic Arts Operations

Existing District Rule 67.16 (Graphic Arts Operations) controls VOC emissions from inks, cleaning solvents, and other graphic arts materials used in printing operations. Based on emission inventory information at the time of amending the rule in 2011, total estimated VOC emissions from this source category were about 0.17 tons per day. The emissions result from printing processes or related coating processes.

SCAQMD Rule 1130 (Graphic Arts) has lower VOC limits than Rule 67.16 for fountain solutions. If the SCAQMD Rule 1130 VOC limits were incorporated in Rule 67.16, the estimated potential VOC emission reductions would be about 0.02 tons per day. Rule 1130 also has lower VOC limits than Rule 67.16 in several specialty ink or solvent cleaning categories (for example, flexographic ink on porous substrates and flexographic printing cleanup). While none of these materials have been identified as being used in San Diego County to date, if usage was occurring and the County adopted similar standards to Rule 1130, the potential VOC emission reductions would be about 0.05 tons per day.

Based on this evaluation, the District has assigned this measure as a lower priority for rule development time because of the very limited VOC emission reduction potential.

G.7 Further Control of Marine Coating Operations

Existing District Rule 67.18 (Marine Coating Operations) regulates VOC emissions from coating of marine vessels, including ships and pleasure boats. Based on emission inventory information, total VOC emissions from this source category are approximately 0.65 tons of VOC per day. VOC limits in Rule 67.18 are generally consistent with SCAQMD Rule 1106 (Marine Coating Operations). Specifically, for pleasure craft, some coating limits in San Diego County are more stringent than Rule 1106, which include antenna coatings, antifoulants for aluminum substrates, high gloss coatings, pretreatment wash primers, and special markings.

In other pleasure craft coating categories, such as extreme high gloss topcoats, SCAQMD has a lower VOC content limit. However, as noted in the District's RACT SIP ("*2020*

Reasonably Available Control Technology Demonstration for the National Ambient Air Quality Standards for Ozone in San Diego County.”), industry and vessel owners in San Diego and Ventura Counties have indicated that, while compliant coatings at the lower 490 grams per liter (g/l) limit are available, they exhibit durability and gloss retention concerns when applied. Thus, the higher VOC content limit material was generally accepted for use in extreme high gloss topcoat applications. The industry-accepted extreme high gloss coatings available for pleasure craft currently do not meet the 490 g/l limit established by SCAQMD, but are still in compliance with Rule 67.18.

Further emission reductions by lowering the extreme high gloss coatings limits may be possible in the future but would not be substantial. Additional emission reductions from updates to Rule 67.18 would more likely occur by lowering the VOC limit of materials used in the cleaning process. Less than 0.01 tons per day of additional VOC emission reductions would occur should the VOC limit of cleaning materials be lowered to 25 g/l. These would be primarily from smaller facilities, as the largest source already uses cleaning material that complies with what would be the lower standard in an amended rule. Based on this evaluation, the District has assigned this measure as a lower priority for rule development because of the very limited VOC emission reduction potential.

G.8 Further Control of Adhesive Materials Application Operations

District Rule 67.21 (Adhesive Materials Application Operations) regulates VOC emissions from the use of adhesives and sealants. Rule 67.21 was found by the EPA to represent RACT in March 2020. The same determination with made by the District as part of the companion 2020 RACT Demonstration for both ozone standards. VOC limits found in Rule 67.21 are generally similar to the comparable adhesive rule found at San Joaquin Valley APCD (SJVAPCD) Rule 4653 (Adhesives and Sealants). Like South Coast AQMD, SJVAPCD typically has the most stringent air pollution controls in the nation.

In 2017, South Coast AQMD amended their adhesive Rule 1168 (Adhesive and Sealant Applications) and reduced VOC contents for a variety of products, including certain flooring adhesives, plastic welding products, and various types of sealants. Many of these lowered limits do not take effect until January 1, 2023. As such, the possible incorporation of more stringent VOC limits found within Rule 1168 into Rule 67.21 could potentially reduce VOC by 0.09 tons per day in the same timeframe. Based on this evaluation, the District has assigned this measure as a lower priority for rule development because of the very limited VOC emission reduction potential.

G.9 Further Control of Industrial and Commercial Boilers, Process Heaters, and Steam Generators

Existing District Rule 69.2 (Industrial and Commercial Boilers, Process Heaters and Steam Generators) regulates NOx emissions from boilers with rated heat inputs of 5 million (MM) BTU/hour or more. Currently, Rule 69.2 exempts from NOx emission standards any unit with an annual heat input of less than 220,000 therms (for units with a heat input rating of less than or equal to 50 MMBTU/hour). These units are subject only to operational standards, such as unit maintenance, recordkeeping, and an annual boiler tune-up to minimize NOx emissions to the extent feasible. Facilities with annual heat inputs of 220,000 therms or more (or greater than 10% capacity factor for units with heat input ratings greater than 50 MMBTU/hour) must comply with NOx emission standards of 30 parts per million by volume (ppmv) for gas-fired units, and 40 ppmv for oil-fired units. Estimated NOx emissions from this source category are about 0.22 tons per day with over 99% of the emissions from gas-fired units.

The District has evaluated the feasibility, cost-effectiveness and emissions reduction potential of amending Rule 69.2 to be consistent with the more stringent emission limits included in Santa Barbara County APCD (SBCAPCD) Rule 342 (Boilers, Steam Generators, and Process Heaters – 5 MMBtu/hr and greater, June 20, 2019), as well as lowering the exemption level to 90,000 therms per year for gas-fired boilers. The District evaluated the cost-effectiveness for the following three cases:

1. Lower Exemption Threshold/Retain Existing Emission Standards. Require that all boilers with annual heat input between 90,000 and 220,000 therms meet the 30-ppmv NOx standard of existing Rule 69.2 and retain the existing 30-ppmv NOx standard for higher usage boilers. This measure would apply to about 29 units with annual heat input between 90,000 and 220,000 therms, requiring installation of low- NOx burners and/or flue gas recirculation to meet the 30-ppmv NOx standard.

2. Lower Exemption Threshold/Tighten Emission Standards. Require that all boilers with annual heat input of 90,000 therms or more meet more stringent standards of 9 ppmv NOx for units rated at less than or equal to 20 million BTU/hr heat input, and 7 ppmv NOx for units rated at greater than 20 million BTU/hr heat input. These NOx standards and exemption threshold are consistent with those for SBCAPCD Rule 342. This measure would require about 103 units with annual heat input of 90,000 therms or more to install emission controls such as ultra-low NOx burners and/or flue gas recirculation, to meet the more stringent limits.

3. Retain Existing Exemption Threshold/Tighten Emission Standards. Require that boilers with annual heat input of 220,000 therms or more meet the more stringent (9 ppmv / 7 ppmv) NOx standards. Units with annual heat input rates of less than 220,000 therms would remain exempt. This measure would require only the approximately 74 units with annual heat input of 220,000 therms or more to install emission controls such as ultra-low NOx burners and/or flue gas recirculation to meet the more stringent limits.

For each case, cost-effectiveness values were estimated for each affected boiler. The potential emission reductions (averaged over 365 days of operation per year) and overall cost- effectiveness values for each of the three cases are summarized in Table G-2.

Table G-2
Cost-Effectiveness Range, Further Control of Industrial and Commercial Boilers, Process Heaters, and Steam Generators

Case	NOx Emission Reductions (tons/day)	Cost-Effectiveness Range ($/ton reduced)	Average Cost-Effectiveness ($/ton NOx reduced)
1	0.03	$7,800 to $23,700	$16,500
2	0.11	$5,800 to $207,000	$51,400
3	0.06	$5,800 to $207,000	$68,400

For all three cases, the estimated overall cost-effectiveness exceeds the District's threshold for cost-effective feasible measures. Based on this evaluation, the District has assigned this measure as a lower priority for rule development because of the very limited NOx emission reduction potential and poor cost-effectiveness.

G.10 Further Control of Natural Gas-Fired Fan-Type Central Furnaces

Existing District Rule 69.6 (Natural Gas-Fired Fan-Type Central Furnaces) is a point-of-sale rule that limits NOx emissions of new natural gas-fired residential-type central furnaces. The District adopted Rule 69.6 on June 17, 1998, establishing NOx emission limits of 40 ng/J for new residential furnaces. In 2014, SCAQMD amended their equivalent rule (Rule 1111 – Reductions of NOx Emissions from Natural-Gas-Fired, Fan-Type Central Furnaces) mandating a NOx limit of 14 ng/J on complying units and establishing an optional per unit mitigation fee for noncompliant units. Rule 1111 was considered to be technology forcing at the time of adoption, as complying units were generally not available. In 2018, SCAQMD increased mitigation fees for noncompliant units, and established a voluntary incentive program (i.e. "Cleanair Furnace Rebate Program") further encouraging adoption of complying units in the South Coast air basin. Consequently, almost 90 units are now certified by SCAQMD meeting the more stringent 14 ng/J limit.

Given the proliferation of complying units, during the next three years, the District will assess the viability of a proposed amendment to Rule 69.6 is cost-effective to implement (without the use of incentives). Should a sufficient number of compliant models be found to be available and cost-effective to purchase without voluntary incentive programs, the District will schedule further evaluation of a proposed amendment to Rule 69.6, and if warranted, will consider adoption of the lower emission limit during the next three years. Preliminary estimates for annual emission reductions in San Diego County, if similar controls are found to be feasible and cost-effective, are 0.14 tons of NOx per day, about a 65% reduction in NOx emissions. Full implementation would be expected 10 years after rule adoption, considering an existing unit's useful life of 10 years.

G.11 Further Control of Stationary Gas Turbine Engines

District Rule 69.3 (Stationary Gas Turbine Engines) and Rule 69.3.1 (Stationary Gas Turbine Engines – BARCT) regulate NOx emissions from the source category. Stationary gas turbine engines are non-mobile internal combustion engines running on gaseous fuels that use pressurized air. Their use varies widely, but smaller turbine engines are often used at institutional and industrial facilities as part of cogeneration systems. Larger turbine engines are used in simple or combined cycle configurations to produce power for the electrical grid. in the source category.

South Coast AQMD Rule 1134 (Emissions of Oxides of Nitrogen from Stationary Gas Turbines) was amended in 2019 to lower NOx emission limits for some turbine engines by January 1, 2024. Notably, the AQMD staff report for this amendment indicated half the turbines subject to the rule would already meet the more stringent emission NOx limits or would be exempt from upgrading because doing so would not be cost-effective or economically feasible. The remaining equipment requiring upgrades would be required to install Selective Catalytic Reduction (SCR) technology on existing turbines, or be replaced with new turbines already equipped with SCR technology.

The possible incorporation of more stringent NOx limits found at South Coast AQMD beginning in 2024 could potentially reduce NOx emissions in San Diego County by up to 0.14 tons per day by 2032. Full implementation would be expected 30 years after rule adoption, considering an existing unit's useful life of 30 years. The District will consider further reductions in an upcoming rulemaking by Spring 2021. However, such reductions are not expected to be cost-effective at this time or for the majority of permitted equipment in the region.

G.12 Possible Control of Vacuum Truck Operations

The District does not currently have a rule controlling emissions from vacuum trucks. A vacuum truck is an industrial vacuum on wheels used to collect materials, primarily liquids and semi-solids, and transfer them, typically to another part of an industrial facility. Vacuum trucks are heavy-duty trucks widely used to remove trash from parking lots, clean out sewers and water mains for maintenance work, and remove waste from septic tanks and portable toilets. However, if the materials transferred contain petroleum, petroleum products, or other hydrocarbon liquids, vacuum truck operations have potential to release VOC into the ambient atmosphere. Emissions typically come from materials containing hydrocarbons contained in sludge, recovered oil, slop oil, crude oil, gasoline, petroleum distillates, feed stock, blending stock, water used to clean tanks and vessels, wastewater, and various mixtures and slurries.

Regulatory authority to control emissions of the propulsion engine unit of the truck lies with CARB. However, emissions emanating from a non-vehicular source such as the tank affixed to the vacuum truck (and/or upon its connection to a stationary source like a storage tank), are within the regulatory authority of local air districts. At least two air districts in California have adopted or amended regulations to control ROG emissions from vacuum truck operations, including SCAQMD Rule 1149 (Storage Tank and Pipeline Cleaning and Degassing) and BAAQMD Rule 8-53 (Vacuum Truck Operations). Both rules require facilities to use vacuum trucks equipped with on-board emission controls or by coupling emission control technology to an uncontrolled truck. Carbon adsorption systems (either on-board or portable) are the most typical emission control systems utilized. Though vacuum trucks are used in a wide variety of applications, the rules are only applicable to industries that transport volatile organic liquids, such as refineries, bulk plants, bulk terminals, marine terminals, and organic liquid pipeline facilities.

Rule 8-53 estimated VOC emissions could be reduced by up to 1.05 tons per day (or 85%

of vacuum truck emissions) at the time of rule adoption in 2012. For the purposes of this RACM analysis, the District determined the total VOC emissions from all Heavy-Heavy Duty gas or diesel trucks operating in San Diego County, as of 2019, was 0.48 tons of VOC emitted per day. Vacuum truck population data is unavailable; however, for the purposes of this RACM analysis, the District conservatively assumed 10% of all Heavy-Heavy Duty truck VOC emissions in San Diego County were vacuum trucks.[164] Thus, approximately 0.05 tons of VOC per day is currently uncontrolled from existing vacuum truck operations in San Diego County.

Using the estimated 85% VOC reduction metric from BAAQMD, the District conservatively estimates that 0.04 tons per day of VOC reductions might be possible from implementation of a similar measure in San Diego County. However, true emission reductions are likely to be lower than achieved in the Bay Area, as San Diego County has far fewer petroleum terminals and no petroleum refineries in the region, nor is 10% of the local heavy-heavy duty trucks comprised solely of vacuum trucks. Nonetheless, the District has scheduled further evaluation of the proposed measure, and if warranted, will consider adoption of a new rule during the next three years.

G.13 Possible Control of Miscellaneous NOx Sources

The District does not currently have a rule controlling emissions from smaller miscellaneous NOx sources. The District already regulates emissions from a variety of large NOx sources, such as boilers, power plants, and stationary engines. However, a number of smaller gaseous and liquid-fueled combustion equipment used in various industrial, commercial, and institutional facilities, are not required to upgrade to the cleanest technology available. These include, but are not limited to, ovens, dryers, dehydrators, kilns, incinerators, asphalt plants, cookers, roasters, and fryers. Since 2005, other California air districts have adopted (and since amended) rules requiring the use of low-NOx burners, including SCAQMD (Rule 1147-NOx Reductions from Miscellaneous Sources, and Rule 1153.1-Emissions of Oxides of Nitrogen from Commercial Food Ovens), SJVAPCD (Rule 4309-Dryers, Dehydrators, and Ovens), and most recently, Sacramento Metropolitan Air Quality Management District (Sac Metro AQMD) (Rule 419-NOx from Miscellaneous Combustion Units).

Such rules vary in regards to their method of implementation and compliance demonstration; some rules require source-testing, while others provide options for vendors to certify equipment to air district standards/protocol (i.e. point-of-sale). As part of its evaluation, the District will assess all methods of possible implementation and compliance demonstration. Sac Metro AQMD estimated a reduction of 0.015 tons of NOx per day from 19 permitted units subject to Rule 419. Preliminary estimates for annual emission reductions and cost-effectiveness in San Diego County, if similar controls are found to be feasible, are anticipated to be comparable to Sac Metro's estimates, given the similarities in population size and industries affected. For the purposes of this RACM analysis, the District is conservatively estimating VOC emissions could be reduced in San Diego County by this amount. Consequently, the District has scheduled further evaluation of the proposed measure, and if warranted, will consider adoption of a new rule during the next three years.

G.14 Possible Control of Equipment Leaks

The District does not currently have a dedicated rule controlling emissions from equipment leaks. Consideration of this source category is prompted by Bay Area Air Quality

Management District's (BAAQMD) Rule 8-18 (Equipment Leaks), which establishes vapor and liquid leak standards to reduce emissions of VOC from leaking equipment at refineries, bulk terminals, bulk plants, and chemical plants. The District currently has no comparable rule due to the limited associated emission reduction potential. BAAQMD Rule 8-18 exempts facilities with fewer than 100 valves or fewer than ten pumps and compressors (Rule 8-22, Valves and Flanges at Chemical Plants, applies in those cases). It also exempts equipment handling organic liquids having initial boiling points above 302º F. It does not apply to connections between the loading racks at bulk terminals and bulk plants and the vehicle (mobile transports) being loaded. It sets inspection frequency criteria (daily visual, quarterly instrument checks for most components), repair requirements, and leak standards – three drops per minute for liquid leaks, 100 ppmv as methane for most vapor leaks, and 500 ppmv as methane for pumps, compressors and pressure relief devices.

The Rule 8-18 definition of chemical plants includes any facility engaged in producing organic or inorganic chemicals or the manufacture of products by chemical processes and having "325" as the first three digits in the applicable NAICS code. This code applies to dozens of facilities in San Diego County, but few have 100 or more valves or ten or more pumps or compressors in VOC service. San Diego County has no petroleum refineries that would be subject to such a rule. Possibly, a rule such as Rule 8-18 could apply to the major gasoline bulk terminals, some of the bulk plants, and one kelp-processing facility. However, a valve, pump and compressor count would be needed to determine if such a rule would apply to these facilities.

Rule 8-18 establishes the same liquid leak standard (three drops per minute) as San Diego County rules applicable to gasoline bulk terminals and bulk plants (Rules 61.1, 61.2 and 61.7), kelp processing (Rule 67.10), coating and printing ink manufacturers (Rule 67.19), and pharmaceutical and cosmetics manufacturers (Rule 67.15). However, the District rules have a shorter allowable leak repair period than Rule 8-18 (zero to three days versus seven days). Rule 8-18 has a more stringent vapor leak standard for equipment at bulk terminals and bulk plants than District Rules 61.1 and 61.2 (100-500 ppmv @1.0 cm versus 1375 ppmv @1.3 cm as methane). However, District Rule 61.1 applies to the vapor transfer path including the connection to a mobile transport, while BAAQMD Rule 8-18 specifically exempts such connections. Inspectors in San Diego County generally do not find vapor leaks at the bulk terminals and bulk plants along the hard-piped components. Vapor leaks are more commonly found at the loading rack/mobile transport interface, and from the vapor fittings (e.g., drybreaks) on the mobile transports themselves.

The most recent inventory of these sources showed only about 0.03 tons per day of total VOC emissions from loading rack operations. Fugitive vapor and liquid leak emissions emanating from hard-piped components, pumps and compressors comprise only 0.01 tons per day. Furthermore, fugitive vapor emissions from operations subject to Rule 67.10 (kelp processing) have declined substantially since 2013 because of plant process changes and revised calculation methods. Lines used to transport VOC/air streams within the kelp processing facility are operated at only a few inches of water gauge pressure. It is anticipated that requiring additional requirements to control leaks from these facilities would not be very cost-effective because of the low emission reduction potential.

Based on this evaluation, the District has assigned this measure as a lower priority for rule development because of the limited emission reduction potential.

G.15 Possible Control of Restaurant Cooking Operations

The District does not currently have a rule controlling emissions from restaurant cooking operations. Restaurants typically cook meat using one of two types of commercial charbroilers: chain-driven and under-fired. Chain-driven charbroilers, most common in fast food restaurants, are semi-enclosed broilers designed to move food mechanically on a grated grill through the device as the food cooks. Food cooks quickly because chain-driven charbroilers have fuel burners located both above and below the grilling surface. Conversely, under-fired charbroilers employ a metal “grid”, a heavy-duty grill similar to that of a home barbeque, that cook food largely one side at a time. Under-fired charbroilers are typically fueled by natural gas, but can also be fueled via charcoal or electric heating elements. As food cooks on either type of device, fat drippings burn on the heating elements, creating flame and smoke. The resulting smoke and vapors is primarily composed of particulate matter (PM) and water, but also includes measurable amounts of VOC.[165] Absent a secondary emission control device being installed on the charbroiling unit, such VOC is typically exhausted into the atmosphere and surrounding communities.

Several air districts in California have regulated commercial charbroilers since 2002, largely as a control measure to reduce PM in their respective areas. Examples include SJVAPCD Rule 4692 (Commercial Charbroiling), BAAQMD Rule 6-2 (Commercial Cooking Equipment), SCAQMD Rule 1138 (Control of Emissions from Restaurant Operations) and Ventura County APCD Rule 74.25 (Restaurant Cooking Operations). San Diego County has historically been in attainment with federal PM air quality standards, thus avoiding the need for any additional regulatory controls. However, other air districts that have implemented such measures have also been able to reduce VOCs as a co-benefit. Today, emission control devices are readily available that achieve can achieve at least 83% reductions in VOC and PM. Consequently, the opportunity presents itself that San Diego County, which does not require any emission controls currently, could reduce VOC emissions from such devices if similar measures were locally adopted.

SJVAPCD Rule 4692 estimated that their rule would affect approximately 150 restaurants in their region, and combined would reduce VOC emissions by approximately 0.033 tons per day.[166] A preliminary estimate of at least 100 restaurants in San Diego County are believed to have conveyorized charbroilers.[167] If utilizing a simple ratio and the same emission factors, a similar control measure in San Diego County could reduce annual VOC emissions by 0.02 tons per day. Estimates in San Diego County would need to be refined to reflect the number of equipment affected by such a measure. Commercial charbroiling, in total, is currently estimated to emit about 0.4 tons of VOC per day in San Diego County, a number that is projected to steadily rise through 2035. Consequently, the District has scheduled further evaluation of the proposed measure, and if warranted, will consider adoption of a new rule during the next three years.

G.16 Possible Control of Food Products Manufacturing/Processing

The District does not currently have a rule controlling emissions from food product manufacturing and processing. Consideration of this source category is prompted by SCAQMD Rule 1131 (Food Product Manufacturing and Processing Operations). Rule 1131 requires use of solvents with less than 120 g/l VOC, or an 85% emission reduction for non-sterilization operations (emission reductions of about 75% are required for sterilization operations). The staff report for SCAQMD Rule 1131 indicates that the two solvents most often used for processing operations and sterilization processes in the food industry are hexane and IPA. The Socioeconomic Impact Assessment for SCAQMD Rule 1131 also indicates the Rule primarily affects the food manufacturing sector (SIC 20). A facility analysis was conducted of industries in this sector in San Diego County, and determined that no major facilities exist. However, one kelp-processing facility in the region does manufacture products used in food preparation, such as Xanthan and Gellan gums, that could potentially be subject to such a rule.

In 2014, this facility used 0.002 tons per day of hexane and 0.02 tons per day of IPA, resulting in VOC emissions of approximately 0.03 tons per day of VOC. The facility is already regulated by District Rule 67.10 (Kelp Processing and Bio-Polymer Manufacturing Operations). Under Rule 67.10, the kelp-processing facility has reduced their VOC emissions more than 90%. If a rule incorporating SCAQMD standards for VOC emissions for food processing facilities were adopted, potential VOC emission reductions from the remaining unregulated IPA emissions would be 0.03 tons per day. Based on this evaluation, the District has assigned this measure as a lower priority for rule development because of the very limited VOC emission reduction potential.

G.17 Possible Control of Metalworking Fluids and Direct-Contact Lubricants

The District does not currently have a rule controlling emissions from metalworking fluids and direct-contact lubricants. Metalworking fluids are used to reduce heat and friction, as well as to remove metal particles during industrial machining and grinding operations. A variety of fluids are used during these processes, including vanishing oils, lubricants, and rust inhibitors. Products vary in their formulations, including straight oils (such as petroleum-based oils) and water/vegetable-based fluids. Operations that typically use such fluids include steel tube and spring manufacturers, aerospace manufacturers, and automobile parts manufacturers and rebuilders. Fluids and lubricants are also used frequently by machine shops for broaching, drilling, drawing, heading, honing, forging, milling, stamping, tapping, threading, and turning.

Until a decade ago, air pollution controls in the metalworking industry focused primarily on the reduction of PM. However, an SCAQMD study conducted in 2006 determined such fluids were a larger source of VOC than what was previously thought. Consequently, in 2009, SCAQMD adopted Rule 1144 (Metalworking Fluids and Direct-Contact Lubricants), which established a sales prohibition of noncompliant fluids by manufacturers and suppliers. Similarly, four years later, VCAPCD adopted Rule 74.31 (Metalworking Fluids and Direct-Contact Lubricants), mirroring the requirements set forth in SCAQMD Rule 1144 and supported by the local trade association.[168]

The extent of metalworking fluid and direct-contact lubricant use in San Diego County is unknown. It is possible that lower-VOC content liquids and lubricants are already being sold through local distributors and retail establishments, as product distribution channels typically apply to the Southern California at large. Thus, SCAQMD and VCAPCD compliant products may already be available and in-use by local businesses. However, because no limit applies in San Diego County, manufacturers have no incentive or requirement to sell lower-VOC content products, despite the relatively low-cost difference between high and low VOC content products.

Consequently, the District has scheduled further evaluation of the proposed measure during the next three years to determine if such a measure is feasible in San Diego County. For their respective rule adopted in 2013, VCAPCD estimated reductions in their region of up to 0.1 tons of VOC per day. Reductions in San Diego County are likely to mirror Ventura's results than SCAQMD, given the proliferation of low-VOC products available today, smaller population size, as well as local industries affected. Thus, for the purposes of this RACM analysis, the District is conservatively estimating VOC emissions could be reduced in San Diego County by the amount estimated in Ventura County. If warranted, the District will consider adoption of a new rule if it is found to be feasible and cost-effective to implement.

ATTACHMENT H
IMPLEMENTATION STATUS OF TRANSPORTATION CONTROL MEASURES

TABLE H-1
Transportation Control Measures listed in CAA §108(f), Implementation Status in San Diego County

Transportation Control Measures	Implemented?	In 1982 SIP?
1. Programs for improved public transit	Yes	Yes
2. Restriction of certain roads or lanes to, or construction of such roads or lanes for use by, passenger buses or high occupancy vehicles	Yes	
3. Employer-based transportation management plans, including incentives	Yes	Yes
4. Trip-reduction ordinances	No*	
5. Traffic flow improvement programs that achieve emission reductions	Yes	Yes
6. Fringe and transportation corridor parking facilities serving multiple occupancy vehicle programs or transit service	Yes	
7. Programs to limit or restrict vehicle use in downtown areas or other areas of emission concentration particularly during periods of peak use	No	
8. Programs for the provision of all forms of high-occupancy, shared-ride services	Yes	Yes
9. Programs to limit portions of road surfaces or certain sections of the metropolitan area to the use of non-motorized vehicles or pedestrian use, both as to time and place	Yes	
10. Programs for secure bicycle storage facilities and other facilities, including bicycle lanes, for the convenience and protection of bicyclists, in both public and private areas	Yes	Yes
11. Programs to control extended idling of vehicles	Yes	
12. Programs to reduce motor vehicle emissions, consistent with Title II, which are caused by extreme cold start conditions	Not Applicable	
13. Employer-sponsored programs to permit flexible work schedules	Yes	

Transportation Control Measures	Implemented?	In 1982 SIP?
14. Programs and ordinances to facilitate non-automobile travel, provision and utilization of mass transit, and to generally reduce the need for single-occupant vehicle travel, as part of transportation planning and development efforts of a locality, including programs and ordinances applicable to new shopping centers, special events, and other centers of vehicle activity	Yes	
15. Programs for new construction and major reconstructions of paths, tracks or areas solely for the use by pedestrian or other non-motorized means of transportation when economically feasible and in the public interest	Yes	
16. Program to encourage the voluntary removal from use and the marketplace of pre-1980 model year light duty vehicles and pre-1980 model light duty trucks	Yes	

*Adopted in 1994, but rescinded in 1995 when federal and State laws were amended eliminating the mandate for such measures

TCM 1 – Improved Public Transit

The Transit measure commitments included in the 1982 SIP were fully implemented by 1995, but further implementation of the TCM continues. Total regional transit rail and bus ridership in FY 2017 (99 million) represents a decrease of 4% since FY 2008. Over the past ten years, total revenue miles[169] in San Diego County have increased 0.7 percent totaling nearly 42 million miles in FY 2017. Revenue hours have increased during this same period, from approximately 3 million in FY 2008 to 3.2 million in FY 2017. Total passengers per revenue mile (a measure of system productivity) have decreased by more than 4% over that same period.

The Trolley[170] Renewal Project, completed in 2015, funded the purchase of 65 new, low-floor trolley cars that are easier to board (especially for persons with disabilities) and provide better operations in the downtown area. Several stations along the lines required renovation for easier and safer access to the new cars. Additionally, construction is underway for an 11-mile extension to the Blue Line ("Mid-Coast Trolley Extension"), with revenue service anticipated to begin in 2021. Ridership along the SPRINTER light-rail line connecting Oceanside to Escondido has increased since opening in 2008. Additional locomotives are budgeted to increase service frequency of the COASTER commuter rail service.[171]

San Diego County's Bus Rapid Transit (BRT) service ("*Rapid*") started revenue service in 2014. *Rapid* service utilizes standard and articulated compressed natural gas (CNG) buses to provide fast, limited-stop, service in the Interstate 15 (I-15) and Mid-City corridors utilizing freeway managed lanes and arterial transit priority measures to improve speed and travel time reliability. The 26-mile South Bay Rapid route connecting Otay Mesa, Chula Vista, and downtown San Diego began with revenue service started in 2019. The region's two operators[172] also continue to make improvements to the local bus system, with higher frequency service on several lines.

While many areas of San Diego County have developed around low-density, auto-oriented development patterns, local jurisdictions have updated their general plans to shift development toward urban areas and along existing and planned rail/Rapid bus corridors. The transit strategy included in SANDAG's San Diego Forward: The 2019 Federal Regional Transportation Plan (2019 Federal RTP) focuses transit improvements in Regional Smart Growth centers and key corridors, to provide transportation options and greater connectivity. Several major transit improvements are included in the plan, and the system will continue to mature over the life of the RTP.

TCM 2 – High Occupancy Vehicle (HOV) Lanes
Currently, there are three freeways in the San Diego region with HOV lanes: I-5 (San Diego Freeway), I-805 (Jacob Dekema Freeway), and I-15 (Escondido Freeway). Additional HOV lanes are currently under construction on I-5.

- The I-5 HOV lane extends seven miles from the I-5/I-805 junction to just south of Manchester Avenue. The current configuration of the I-805 HOV lane is segmented, consisting of five miles between State Route (SR) 52 and the I-5/I-805 junction, and another eight miles between East Palomar Street and SR 94. Direct Access Ramps (DARs) are available at East Palomar Street and Carroll Canyon Road on I-805.
- The I-15 Express Lanes extend 20 miles from SR 163 to just south of SR 78. Direct access is available at the north and south ends, and DARs are available at Hale Avenue, Del Lago Boulevard, West Bernardo Drive, SR 56/Ted Williams Parkway, and Hillary Drive. Intermediate access points that provide direct access from the main lanes to the Express Lanes are approximately every two to three miles. Vehicles with two or more occupants (or powered by certain alternative fuels), buses, motorcycles and certain clean-air vehicles may use the I-15 Express Lanes for free, and solo drivers participating in the FasTrak® Program may use the Express Lanes for a per-trip toll.
- A buses-only northbound lane on SR 163, extending 0.4 miles from A Street in downtown San Diego to I-5, enables buses to bypass general purpose traffic entering SR 163. The SR 15 Mid-City Centerline project provides dedicated transit lanes from just north of I-805 to just south of I-8 and includes new transit stations at El Cajon Boulevard and University Avenue.
- The South Bay Rapid project adds nearly six miles of transit-only lanes in Chula Vista with bus prioritization at signalized intersections and transit only lanes on East Palomar Street and Eastlake Parkway.

Other HOV Lane development in the region includes:

- <u>Metered Ramps</u>. HOV preferential lanes are provided at 191 (58%) of the 329 metered ramps on the region's freeways. The HOV preferential lanes do not bypass the meters but they do provide a shorter queue, reducing travel time.
- <u>I-15 Express Lanes</u>. The region has committed $1.4 billion to the I-15 Express Lanes project to ease traffic congestion, support Rapid bus service, and provide multimodal travel in the I-15 corridor from SR 163 to SR 78 in Escondido. Construction was completed in 2014. The project includes four lanes with a moveable median barrier to

accommodate two to three lanes in the peak direction and one to two lanes in the opposite direction. The Express Lanes are separated from the general-purpose lanes by a barrier, with access provided every two to three miles.

- I-5 North Coast Corridor Express Lanes. The I-5 North Coast Express Lanes will build upon existing and near-term HOV lane improvements and feature multiple access points to/from the facility to the general-purpose lanes and direct access ramps that connect local arterials directly to the Express Lanes facility. Other Express Lane features, such as value pricing[173] will be implemented as needed to meet the needs on the North Coast Corridor.
- Managed Lanes/HOV Network. SANDAG's San Diego Forward: The 2019 Federal Regional Transportation Plan (2019 Federal RTP) includes a robust Managed Lane (Express Lane)/HOV network. Shared by highway and transit users, the Managed Lanes/HOV system will be expanded from approximately 30 miles to include over 160 miles in the future. The 2019 Federal RTP includes:
    - Four-lane Managed Lane facilities on I-5, I-15, and I-805 with value pricing;
    - Two-lane Managed Lane facilities on SR 52, SR 54, SR 78, SR 94, and SR 125; and
    - In addition to mainline Managed Lane improvements, the Plan includes direct HOV to HOV connectors at eight interchanges where major HOV facilities intersect.

TCM 3 – Employer-Based Transportation Management Plans

In the 1982 SIP, the Employer-Based Transportation Management Plans measure (TCM 3) was combined with the Shared-Ride Services measure (TCM 8) to form a more comprehensive measure, the "Ridesharing" TCM. The Ridesharing TCM commitments included in the 1982 SIP were fully implemented by 1988 but further implementation of the TCM continues.

Traffic Abatement Plan requirements of District Rule 132 were included as part of the Ridesharing TCM. Pursuant to federal requirements for abating air pollution emergency episodes,[174] employer-based Traffic Abatement Plan measures are triggered by ozone levels exceeding 0.35 parts per million (ppm). No ozone concentrations of this level or higher have been recorded in San Diego County since 1979.

TCM 4 – Trip-Reduction Ordinances

A regional trip-reduction ordinance was adopted by the District as part of the 1994 Ozone SIP, but was rescinded in 1995 when federal and State laws were amended, eliminating the mandate for such measures based on public opposition.

TCM 5 – Traffic Flow Improvements to Reduce Emissions

Traffic Flow Improvements mostly consist of traffic signal improvements to reduce idling and associated emissions. The Traffic Flow Improvements TCM commitments included in the 1982 SIP were fully implemented by 1990 but further implementation of the TCM continues.

The 2018 Regional Transportation Improvement Plan (RTIP) includes two federally funded safety projects, one state funded project, as well as 25 locally funded traffic signal improvements. These projects are also inclusive of the Regional Arterial Management System (RAMS) program. This program includes the installation of the regional traffic signal management software and linking of the local agencies to a common system. The system has been implemented by local agencies throughout the County along with Caltrans District 11, with SANDAG serving as the program administrator and regional operator. The San Diego Regional Traffic Engineers Council (SANTEC), a SANDAG working group, meets regularly and reviews the RAMS program and other traffic signal improvements.

TCM 6 – Park-and-Ride Facilities
There are over 100 active Park-and-Ride lots in the region, representing nearly 21,000 spaces. This Park-and-Ride inventory is owned and operated by a variety of stakeholders including local transit agencies and the local California Department of Transportation (Caltrans) District 11. Approximately 16,000 spaces are dedicated to transit patrons only, such as for Bus Rapid Transit, COASTER, SPRINTER, or Trolley riders; the remaining spaces are shared with or dedicated to carpools and vanpools.

TCM 7 – Peak-Period Vehicle Restrictions in Downtown Areas
This measure is feasible only in high-density portions of compact metropolitan areas with an extensive transit system. Given the San Diego region's historically low-density land use pattern, and therefore longer transit travel times, this measure is not yet feasible. However, SANDAG's Smart Growth Incentive Program provides funding to cities for infrastructure projects which enhance alternatives to driving in higher density areas.

TCM 8 – Shared-Ride Services
As mentioned above, in the 1982 SIP, TCM 8 was combined with TCM 3 in a "Ridesharing" TCM. The Ridesharing TCM commitments included in the 1982 SIP were fully implemented by 1988 but further implementation of the TCM continues.

SANDAG partners with the "511" transportation information service in support of "iCommute", the regional transportation demand management program charged with providing shared-ride services and education to employers and individuals on all ridesharing and biking options. Example services include:

- iCommute Website–Allows the public to compare transportation choices in addition to finding vanpool matches.
- Employer services – iCommute provides assistance and tools to help local employers design and implement customized commuter benefit programs to support employee use of alternative modes of travel.
- Guaranteed Ride Home Service – Qualifying ride sharers are provided with three vouchers per year for taxi fares, or 24-hour rental cars to travel home in the event of a personal or family emergency, unscheduled overtime, or carpool/vanpool not being available due to breakdown.
- Promotion of Teleworking and Alternative Work Schedules (see TCM 13) – iCommute works with employers and employees to create programs offering alternative work arrangements (such as flex time and teleworking) to reduce commute trips and peak hour traffic congestion.
- Park and Ride Programs (see TCM 6) – Caltrans and other agencies provide Park-and-Ride facilities, which are promoted by iCommute.
- Vanpool Program – iCommute operates and promotes the SANDAG Vanpool

Program. As of Fiscal Year 2017, 695 vanpools carrying over 5,100 passengers were operating in the San Diego County region, a 6% increase over 2008 levels, which were 585 vanpools carrying 4,800 passengers. The San Diego County region was temporarily limited to one vanpool vendor, however additional vanpools are anticipated as SANDAG is now under contract with three vanpool vendors.

- Bike Parking Program – Provides secure bike parking spaces at more than sixty transit stops and some Park and Ride lots throughout San Diego County, in addition to a Regional Bike Map which has been updated to show bike paths, lanes, and routes.
- Walk, Ride, and Roll to School –This service supports active transportation education for K-12 schools including biking, walking, skating, skateboarding, or riding a scooter to promote physical activity and healthier lifestyles for students.

TCM 9 – Road Surface Restrictions for Motor Vehicles in Metro Areas
Numerous examples of road surface restrictions exist in the San Diego region. In downtown San Diego, portions of C Street are limited to the Trolley and pedestrian use, and a block of B Street was closed and transformed into the Civic Center Concourse. In Old Town San Diego State Historic Park, portions of San Diego Avenue, Calhoun Street, and Mason Street have been restricted to pedestrian-only use. In Balboa Park, the eastern end of El Prado is also restricted to pedestrian-only use. North of Sorrento Valley, a segment of Sorrento Valley Road is closed to traffic and reserved for bicycle and pedestrian uses. Additionally, in downtown Escondido, a one-block section of Maple Street was reconfigured to create a pedestrian plaza between W. Grand Ave and W. Valley Parkway when needed. This measure is also implemented on a limited or recurring temporary basis for certain recreational areas, weekly farmer’s markets, and yearly festivals/street fairs.

TCM 10 – Bicycle Facilities
The Bicycling TCM commitments included in the 1982 SIP were fully implemented by 1995. However, further implementation of the Bicycling TCM continues. The bikeway system currently includes 1,644 miles of bikeways in the San Diego region, consisting of Class I (exclusive bicycle path separated from roadway), Class II (striped on-street bicycle lane), Class III (shared with motor vehicles), and Class IV (separated bikeways) facilities. Additionally, front-mounted bike racks are available on nearly all transit buses. Bikes are also allowed on all light rail cars in the County network.

In September 2013, the SANDAG Board of Directors approved a $200 million Regional Bike Plan Early Action Program that focuses on the region’s highest priority bicycle corridors. As of October 2019, SANDAG is implementing approximately 70 miles of regional bikeway projects that are in various phases of planning, preliminary engineering, design and construction, of which 8.8 miles have been constructed and are open to the public.

SANDAG also maintains bike parking at 70 locations, including one bike station, throughout the region at most Trolley stations, all COASTER stations, and select Park-and-Ride locations. Currently, 729 total spaces comprised of 447 electronic on-demand spaces and 282 conventional mechanical lockers. All mechanical locker spaces will be converted to electronic, on-demand spaces by the end of 2020. Unlike conventional lockers assigned to a single user, the converted spaces are available any time they are not in use to anyone participating in the bike locker program. Consequently, each converted space will serve three to five times as many commuters as a non-converted unit.

TCM 11 – Idling Controls
CARB has adopted several diesel-fueled vehicle idling limitation programs, which include but are not limited to:

- School buses;
- On-road trucks;
- Off-road equipment;
- Locomotives;

More information is available on the CARB website at the specified web addresses above.

Additionally, in 2016, the District signed a Memorandum of Understanding (MOU) with CARB to assist CARB in enforcing the statewide on-road truck and off-road equipment regulations in San Diego County.[175] These enhanced enforcement actions have helped improve air quality and protect public health across the region by ensuring equipment is compliant with State regulations.

TCM 12 – Vehicle Cold Start Emissions in Extreme Cold Conditions
This measure is not applicable due to the mild climate in the San Diego region.

TCM 13 – Flexible Work Schedules
This measure has been implemented by the iCommute program, as previously identified under TCM 8 (see iCommute website). Staff from iCommute work with employers and employees to create programs for offering alternative work arrangements (such as flex time and teleworking) to reduce commute trips and peak hour traffic congestion.

TCM 14 – Programs and Ordinances Facilitating Non-Automotive Travel
This measure has been implemented in San Diego County via the progressive iterations of the RTP, adopted by SANDAG, which includes investments in public transportation, bike paths, and pedestrian improvements. These include a greater reliance on non-automotive travel through increased development densities, more mass transit usage, and increased bicycling and walking for transportation. Pursuant to the Regional Plan, SANDAG has designated existing and potential Smart Growth Areas, and provides funding incentives for local jurisdictions to increase densities and provide for mixed uses and additional transit, bicycling and walking facilities in these areas. Most of the region's local jurisdictions have adopted general plans consistent with this approach. Developers in the region have responded to these policies, and to market forces, by initiating a number of large-scale smart growth developments. Thousands of new units have also been added to existing communities well-served by transit and amenable to non-motorized travel.

Additionally, in 2004, voters extended the region's half-cent sales tax ordinance for transportation ("*TransNet*") and added additional funding categories such as the Smart Growth Incentive Program, and improvements to transit, bicycling, and pedestrian facilities. The ordinance requires routine accommodation of these modes for all *TransNet*-funded local roadway projects.

TCM 15 – Paths or Areas Encouraging Non-Motorized Travel
The San Diego region has implemented an extensive network of bicycling facilities, many of which also serve pedestrians. Four regional, multi-use trails are still under development—the Bayshore Bikeway (26 miles around the San Diego Bay with 18 miles open to the public), the Inland Rail Trail (22 miles from the Escondido Transit Center to the Oceanside Transit Center with 11 miles open to the public), the Coastal Rail Trail (44 miles from northern Oceanside to downtown San Diego with 28 miles open to the public), and the San Diego River Trail (18 miles from Ocean Beach in the City of San Diego to the City of Santee with 6.5 miles open to the public). These four trails are expected to be used by commuters as well as recreational users. Additionally, due to land use plans, regional transportation funding formulas, and the nature of the housing market, a number of new smart growth developments have been built which include paths and trails that encourage non-motorized travel (see TCM 14).

TCM 16 – Removal of Older, Higher-Polluting Light Duty Vehicles
Under a program administered by the District using Vehicle Registration Fee funds, a total of 4,277 older vehicles were permanently retired through 2005, resulting in an estimated reduction of 470 tons of ozone-precursor emissions. Further, a state-run vehicle retirement program continues, administered by the California Department of Consumer Affairs' Bureau of Automotive Repair.

ATTACHMENT I
CARB ANALYSES OF POTENTIAL ADDITIONAL MOBILE SOURCE AND CONSUMER PRODUCTS CONTROL MEASURES

Prepared by
California Air Resources Board
San Diego County Air Pollution Control District

March 2020

I.1 Ozone Reasonable Available Control Measures Assessment

The CAA requires ozone SIPs to include a Reasonable Available Control Measures (RACM) demonstration. This section demonstrates that California's mobile source and consumer products measures meet RACM.

I.2 RACM Requirements

Section 172(c)(1) of the CAA requires SIPs to provide for the implementation of RACM as expeditiously as practicable. The EPA has interpreted RACM to be 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.

Given the severity of California's air quality challenges, CARB has implemented the most stringent mobile source emissions control program in the nation. CARB's comprehensive strategy to reduce emissions from mobile sources includes stringent emissions standards for new vehicles, in-use programs to reduce emissions from existing vehicle and equipment fleets, cleaner fuels that minimize emissions, and incentive programs to accelerate the penetration of the cleanest vehicles beyond that achieved by regulations alone. Taken together, California's mobile source program meets RACM requirements in the context of ozone nonattainment.

To meet RACM requirements and achieve its emissions reductions goals, California continues to develop new programs to strengthen its overall mobile source program and to achieve new emissions reductions from mobile sources. CARB developed its *2016 State Strategy for the State Implementation Plan*[176] (State SIP Strategy) through a multi-step measure development process, including extensive public consultation, to develop and evaluate potential strategies for mobile source categories under CARB's regulatory authority that could contribute to expeditious attainment of the standard.

First, CARB developed a series of technology assessments for heavy-duty mobile source applications and the fuels necessary to power them[177] along with ongoing review of advanced vehicle technologies for the light-duty sector in collaboration with the EPA and the National Highway Traffic Safety Administration. CARB staff then used a scenario planning tool to examine the magnitude of technology penetration necessary, as well as how quickly technologies need to be introduced to meet attainment of the standard.

CARB staff released a discussion draft Mobile Source Strategy[178] for public comment in October 2015. This strategy specifically outlined a coordinated suite of proposed actions to not only meet federal air quality standards, but also achieve greenhouse gas emission reduction targets, reduce petroleum consumption, and decrease health risk from transportation emissions over the next 15 years. CARB staff held a public workshop on October 16, 2015 in Sacramento, and on October 22, 2015, CARB held a public Board meeting to update the Board and solicit public comment on the Mobile Source Strategy in Diamond Bar.

Staff continued to work with stakeholders to refine the measure concepts for incorporation into related planning efforts including the 75 ppb eight-hour ozone SIPs. On May 16, 2016, CARB released an updated Mobile Source Strategy and on May 17, 2016 CARB released the proposed State SIP strategy for a 45-day public comment period. The mobile source emissions reductions commitments included in the San Diego ozone SIP represent the emissions reductions achieved through the measures in the State SIP Strategy that are relevant in San Diego.

The current mobile source program and proposed measures included in the State SIP Strategy provide attainment of the 75 ppb and 70 ppb eight-hour ozone standards as expeditiously as practicable and meet RFP requirements. Moving forward, CARB staff is working to evaluate further potential emission reduction strategies and is developing a 2020 Mobile Source Strategy.

I.3 RACM for Mobile Sources

I.3.1 Waiver Approvals

While the CAA preempts most states from adopting emission standards and other emission-related requirements for new motor vehicles and engines, it allows California to seek a waiver or authorization from the federal preemption to enact emission standards and other emission-related requirements for new motor vehicles and engines and new and in-use off-road vehicles and engines that are at least as protective as applicable federal standards, except for locomotives and engines used in farm and construction equipment which are less than 175 horsepower (hp).

Over the years, California has received waivers and authorizations for over 100 regulations. The most recent California standards and regulations that have received waivers and authorizations are Advanced Clean Cars (including ZEV and LEV III) for Light-Duty vehicles, and On-Board Diagnostics, Heavy-Duty Idling, Malfunction and Diagnostics System, In-Use Off-Road Diesel Fleets, Large Spark Ignition Fleet, and Mobile Cargo Handling Equipment for Heavy-Duty engines. Other Authorizations include Off-Highway Recreational Vehicles and the Portable Equipment Registration Program.

Finally, CARB obtained an authorization from the EPA to enforce adopted emission standards for off-road engines used in yard trucks and two-engine sweepers. CARB adopted the off-road emission standards as part of its “Regulation to Reduce Emissions of Diesel Particulate Matter, Oxides of Nitrogen and Other Criteria Pollutants from In-Use Heavy-Duty Diesel-Fueled Vehicles,” (Truck and Bus Regulation). The bulk of the regulation applies to in-use heavy-duty diesel on-road motor vehicles with a gross vehicle weight rating in excess of 14,000 pounds, which are not subject to preemption under Section 209(a) of the CAA and do not require a waiver under Section 209(b).

The waiver and authorizations California has received are integral to this successful mobile source program. However, recent EPA action threatens this success and California’s ability to meet RACM requirements. In September 2019, the U.S. Department of Transportation’s National Highway Traffic Safety Administration (NHTSA) and EPA took action to provide nationwide uniform fuel economy and greenhouse gas emission standards for automobile and light duty trucks and withdrew the waiver it granted to California in January 2013 as it relates to California's GHG and ZEV programs.[179]

I.3.2 Light and Medium-Duty Vehicles

Light- and medium-duty vehicles are currently regulated under California's Advanced Clean Cars program including the Low-Emission Vehicle III (LEV III) and Zero-Emission Vehicle (ZEV) programs. Other California programs such as the 2012 Governor's Executive Order to put 1.5 million zero-emission vehicles on the road by 2025,[180] and California's Reformulated Gasoline program (CaRFG) will produce substantial and cost-effective emission reductions from gasoline-powered vehicles.

CARB 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 provide monetary incentives to replace old vehicles with zero-emission vehicles. The Air Quality Improvement Program (AQIP), is a voluntary incentive program to fund clean vehicle.

Taken together, California's emission standards, fuel specifications, and incentive programs for on-road light- and medium-duty vehicles represent all measures that are technologically and economically feasible within California.

I.3.3 Heavy-Duty Vehicles

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. 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.

Most recently in the ongoing efforts to go beyond federal standards and achieve further reductions, CARB adopted the Optional Reduced Emissions Standards for Heavy-Duty Engines regulation in 2014 that establishes the new generation of optional NOx emission standards for heavy-duty engines.

The recent in-use control measures include On-Road Heavy-Duty Diesel Vehicle (In-Use) Regulation, Drayage (Port or Rail Yard) Regulation, Public Agency and Utilities Regulation, Solid Waste Collection Vehicle Regulation, Heavy-Duty (Tractor-Trailer) Greenhouse Gas Regulation, ATCM to Limit Diesel-Fueled Commercial Motor Vehicle Idling, Heavy-Duty Diesel Vehicle Inspection Program, Periodic Smoke Inspection Program, Fleet Rule for Transit Agencies, Lower-Emission School Bus Program, and Heavy-Duty Truck Idling Requirements. In addition, CARB's significant investment in incentive programs provides an additional mechanism to achieve maximum emission reductions from this source sector.

Taken together, California's emission standards, fuel specifications, and incentive programs for heavy-duty vehicles represent all measures that are technologically and economically feasible within California.

I.3.4 Off-Road Vehicles and Engines

California regulations for off-road equipment include not only increasingly stringent standards for new off-road diesel engines, but also in-use requirements and idling restrictions.

The Off-Road Regulation 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.

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.

Taken together, California's comprehensive suite of emission standards, fuel specifications, and incentive programs for off-road vehicles and engines represent all measures that are technologically and economically feasible within California and when considered in aggregate, would not advance the attainment date by at least one year.

I.3.5 Other Sources and Fuels

The emission limits established for other mobile source categories, coupled with EPA waivers and authorization of preemption establish that California's programs for motorcycles, recreational boats, off-road recreational vehicles, cargo handling equipment, and commercial harbor craft sources meet the requirements for RACM and BACM.

Cleaner burning fuels also play an important role in reducing emissions from motor vehicles and engines as CARB has adopted a number of more stringent standards for fuels sold in California, including the Reformulated Gasoline program, low sulfur diesel requirements, and the Low Carbon Fuel Standard. These fuel standards, in combination with engine technology requirements, ensure that California's transportation system achieves the most effective emission reductions possible.

Taken together, California's emission standards, fuel specifications, and incentive programs for other mobile sources and fuels represent all measures that are technologically and economically feasible within California.

I.3.6 Mobile Source Summary

California's long history of comprehensive and innovative emissions control has resulted in the most stringent mobile source control program in the nation. The EPA has previously acknowledged the strength of the program in their approval of CARB's regulations and through the waiver process. In its 2019 approval[181] of the South Coast's eight-hour ozone plan which included the State's current program and new measure commitments, the EPA found that there were no further reasonably available control measures that would advance attainment of the standard in South Coast.

In addition, the EPA has provided past determinations that CARB's mobile source control programs meet Best Available Control Measure (BACM) requirements, which are more stringent than RACM, as part of their 2019 approval of the South Coast's 24-hour PM2.5 Plan[182] and 2004 approval of the San Joaquin Valley's 2003 PM10 Plan:[183]

> *"Overall, we believe that the program developed and administered by CARB and SCAG provide for the implementation of BACM for PM2.5 and PM2.5 precursors in the South Coast nonattainment area."*
>
> *"We believe that the State's control programs constitute BACM at this time for the mobile source and fuels categories, since the State's measures reflect the most stringent emission control programs currently available, taking into account economic and technological feasibility."*

Since then, CARB has continued to substantially enhance and accelerate reductions from our mobile source control programs through the implementation of more stringent engine emissions standards, in-use requirements, incentive funding, and other policies and initiatives as described in the preceding sections.

The CARB process for developing the proposed State measures included an extensive public process and is consistent with EPA RACM guidance. Through this process CARB found that with the current mobile source control program and proposed measures, there are no additional reasonable available control measures that would advance attainment of the 2008 and 2015 eight-hour ozone standards in San Diego County. There are no reasonable regulatory control measures excluded from use in this plan; therefore, there are no emissions reductions associated with unused regulatory control measures. As a result, California's mobile source control programs fully meet the requirements for RACM.

I.4 <u>RACM for Consumer Products</u>

Consumer products are defined as chemically formulated products used by household and institutional consumers. For thirty years, CARB has taken actions pertaining to the regulation of consumer products. Three regulations have set VOC limits for 129 consumer product categories. These regulations, referred to as the Consumer Product Program, have been amended frequently, and progressively stringent VOC limits and reactivity limits have been established. These are Regulation for Reducing VOC Emissions from Antiperspirants and Deodorants; Regulation for Reducing Emissions from Consumer Products; and Regulation for Reducing the Ozone Formed from Aerosol Coating Product Emissions, and the Tables of Maximum Incremental Reactivity Values. Additionally, a voluntary regulation, the Alternative Control Plan has been adopted to provide compliance flexibility to companies. The program's most recent rulemaking occurred in 2018 with amends to Consumer Products Regulation and Method 310 to include an alternate compliance option and updated dates of test procedures.

The EPA also regulates consumer products. The EPA's consumer products regulation was promulgated in 1998, however, federal consumer products VOC limits have not been revised since their adoption. The EPA also promulgated reactivity limits for aerosol coatings. As with the general consumer products, California's requirements for aerosol coatings are more stringent than the EPA's requirements. Other jurisdictions, such as the Ozone Transport Commission states, have established VOC limits for consumer products which are modeled after the California program. However, the VOC limits typically lag those applicable in California.

In summary, California's Consumer Products Program, with the most stringent VOC requirements applicable to consumer products, meets RACM.

ATTACHMENT J

CALCULATION OF CUMULATIVE POTENTIAL EMISSION REDUCTIONS FOR POSSIBLE REASONABLY AVAILABLE CONTROL MEASURES (RACM)

Table J-1
Calculation of Cumulative Potential Emission Reductions for Possible Reasonably Available Control Measures (RACM)

Control Measure *(Further Control of Possible Control of)*	VOC Emission Reduction Potential (Tons/Day)	NOx Emission Reduction Potential (Tons/Day)
G.1 - Receiving and Storing VOC at Bulk Plants and Bulk Terminals	0.03	
G.2 - Transfer of Organic Compounds into Mobile Transport Tanks	0.01	
G.3 - Metal Parts and Product Coating Operations	0.003	
G.4 - Paper, Film, and Fabric Coatings	0.01	
G.5 - Aerospace Coating Operations	0.005	
G.6 - Graphic Arts Operations	0.05	
G.7 - Marine Coating Operations	0.01	
G.8 - Adhesive Materials Application Operations	0.09	
G.9 - Ind. & Comm. Boilers, Process Heaters & Steam Generators		0.1
G.10 - Natural Gas-Fired Fan-Type Central Furnaces		0.14
G.11 - Stationary Gas Turbine Engines		0.14
G.12 - Vacuum Truck Operations	0.04	
G.13 - Miscellaneous NOx Sources		0.015
G.14 - Equipment Leaks	0.01	
G.15 - Restaurant Cooking Operations	0.02	
G.16 - Food Products Manufacturing/Processing	0.03	
G.17 - Metalworking Fluids & Direct-Contact Lubricants	0.1	
Stationary Sources Subtotal (2008 & 2015 NAAQS)	*0.408*	*0.395*
Mobile Sources Subtotal (2008 & 2015 NAAQS) (See Sections 3.2.1.5 and 4.2.1.5)	*0.0*	*0.0*
Subtotal (Stationary and Mobile – 2008 & 2015 NAAQS)	***0.408***	***0.395***
Subtotal (Stationary and Mobile – 2008 NAAQS)	0.408	0.395
Subtotal (TCMs – 2008 NAAQS) *(See Section 3.2.1.4)*	0.245	0.351
Subtotal (VOC & NOx) (Stationary, Mobile, & TCMs - 2008 NAAQS)	0.653	0.746
TOTAL (VOC + NOx) (Stationary, Mobile, and TCMS – 2008 NAAQS)	***1.399***	
Subtotal (Stationary and Mobile – 2015 NAAQS)	0.408	0.395
Subtotal (TCMs – 2015 NAAQS) *(See Section 4.2.1.4)*	0.200	0.302
Subtotal (VOC & NOx) (Stationary, Mobile, & TCMs - 2015 NAAQS)	0.608	0.697
TOTAL (VOC + NOx) (Stationary, Mobile, and TCMs – 2015 NAAQS)	***1.305***	

ATTACHMENT K

MODELING PROTOCOL & ATTAINMENT DEMOSNTRATION FOR THE 2020 SAN DIEGO OZONE SIP

Prepared by
California Air Resources Board
San Diego County Air Pollution Control District

March 2020

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Acronyms

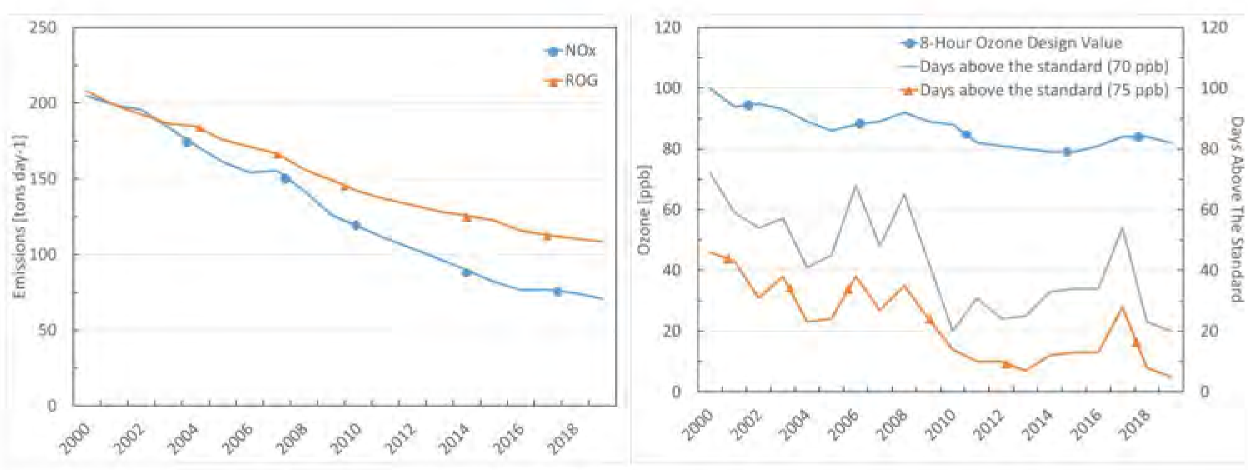
ACT – Advanced Clean Truck
AQMIS – Air Quality and Meteorological Information System
ARB – Air Resources Board
BCs – Boundary Conditions
CalNex – Research at the Nexus of Air Quality and Climate Change conducted in 2010
CAMx – Comprehensive Air quality Model with Extensions
CARES – Carbonaceous Aerosols and Radiative Effects Study in 2010
CMAQ Model – Community Multi-scale Air Quality Model
CTM – Chemical Transport Model
DV – Design Value
HNO_3 – Nitric Acid
ICs – Initial Conditions
IOA – Index Of Agreement
LAI – Leaf Area Index
MB – Mean Bias
MBL – Marine Boundary Layer
MCIP – Meteorology-Chemistry Interface Processor
MDA8 – Maximum Daily Average 8-hour
ME – Mean Error
MEGAN – Model of Emissions of Gases and Aerosols from Nature
MFB – Mean Fractional Bias
MFE – Mean Fractional Error
MM5 – Mesoscale Meteorological Model Version 5
MODIS – MODerate resolution Imaging Spectroradiometer
MOZART – Model for Ozone and Related chemical Tracers
NAAQS – National Ambient Air Quality Standard
NARR – North American Regional Reanalysis
NCAR – National Center for Atmospheric Research
NMB – Normalized Mean Bias
NME – Normalized Mean Error
NOAA - National Oceanic and Atmospheric Administration
NO_x – Oxides of nitrogen
PBL – Planetary Boundary Layer
$PM_{2.5}$ – Particulate Matter with aerodynamic diameter less than 2.5 micrometers
PM_{10} – Particulate Matter with aerodynamic diameter less than 10 micrometers
R2 – Correlation coefficient
RH – Relative Humidity
RMSE – Root Mean Square Error
ROG – Reactive Organic Gases
RRF – Relative Response Factor
RSAC – Reactivity Scientific Advisory Committee
SAFE – Federal Safer Affordable Fuel-Efficient
SAPRC – Statewide Air Pollution Research Center
SDAB – San Diego Air Basin
SDCAPCD – San Diego County Air Pollution Control District
SIP – State Implementation Plan
SOA – Secondary Organic Aerosol
SCAB – Southern California Air Basin
U.S. EPA – United States Environmental Protection Agency
VOC – Volatile Organic Compounds
WRF Model – Weather and Research Forecast Model

K.1. INTRODUCTION

The San Diego Air Basin (SDAB or Air Basin) is located in the southwest corner of California, approximately 100 miles south of Los Angeles, and shares the US-Mexico border with the city of Tijuana. The Air Basin covers roughly 4,200 square miles with a population of over 3.3 million people, and is home to numerous industrial and transportation facilities, a major border crossing, military installations, an international airport, and a shipping port. The topography of the Air Basin is highly varied with the Pacific Ocean to the west and mountains to the east. The regional climate in San Diego is dominated by the Pacific High pressure system, which generally produces onshore winds during the daytime and offshore flows at night. These onshore flows tend to result in an inversion layer that is created when the cooler air over the Pacific displaces the warmer air inland, creating a shallow layer of cooler air at the surface and warmer air aloft. When combined with the mountains to the east of the basin, this inversion layer serves to trap pollution within the basin and leads to a buildup of ozone during the summer months. Although much of the ozone (O_3) in the region is formed from local emissions, its proximity to the South Coast Air Basin to the north and Tijuana to the south, means that it is also regularly subject to influence by pollution generated from outside of the Air Basin (Bigler-Engler and Brown, 1995; Ault et al., 2009).

Over the past two decades, SDAB has seen a steady decline in both NOx and ROG emissions (Figure K-1), which has led to a roughly 20% reduction in the 8-hour ozone design value (Figure K-1), where the design value represents the three year average of 4th highest maximum daily average 8-hour (MDA8) ozone concentration at a monitor. Over the same time period, the number of days exceeding the 8-hour ozone standard declined by 90% and 70% for the 75 ppb standard (2008 standard) and the 70 ppb standard (2015 standard), respectively.

Figure K-1
San Diego Air Basin summer emissions trends (left) and
8-hour ozone trends (right)
Emissions estimates are from the 2019 Ozone SIP Version 1.00 with 2017 base year.
Note that ozone data for 2019 is preliminary



Despite the reduction in both peak 8-hour ozone (design value) and number of days which experience elevated levels of ozone, SDAB continues to exceed both the 2008 (75 ppb) and 2015 (70 ppb) ozone standards. In 2016, as part of the requirements under its moderate nonattainment area classification, the San Diego County Air Pollution Control District (SDCAPCD or District) submitted a State Implementation Plan identifying the emission reductions necessary to demonstrate attainment by July 20, 2018 (San Diego, 2016). The attainment demonstration for that plan utilized a 2012 base year for modeling and projected ozone design values to 2017. However, after 2012 the declining trend in 8-hour ozone design value slowed and then reversed in 2016, and attainment of the 2008 standard was not achieved. Failure to attain the 2008 standard by the July 20, 2018 deadline has resulted in a reclassification from a Moderate nonattainment designation to a Serious designation with an attainment year of 2020. However, recent ozone trends made it unlikely that attainment would be achieved in 2020 and the District asked CARB to model an alternate future year of 2026, which is consistent with a Severe designation. This document serves as the modeling protocol and attainment demonstration for the 2008 standard, as well as the 2015 standard, which has a designated model attainment year of 2032 for the Severe nonattainment designation.

K.2. METHODOLOGY

U.S. EPA modeling guidance (U.S. EPA, 2018) outlines the approach for utilizing regional chemical transport models (CTMs) to predict future attainment of the 2008 (0.075 ppm) and 2015 (0.070 ppm) 8-hour ozone standards. This model attainment demonstration requires that CTMs be used in a relative sense, where the relative change in ozone to a given set of emission reductions (i.e., predicted change in future anthropogenic emissions) is modeled, and this relative change is used to predict how current/present-day ozone levels would change under the future emissions scenario.

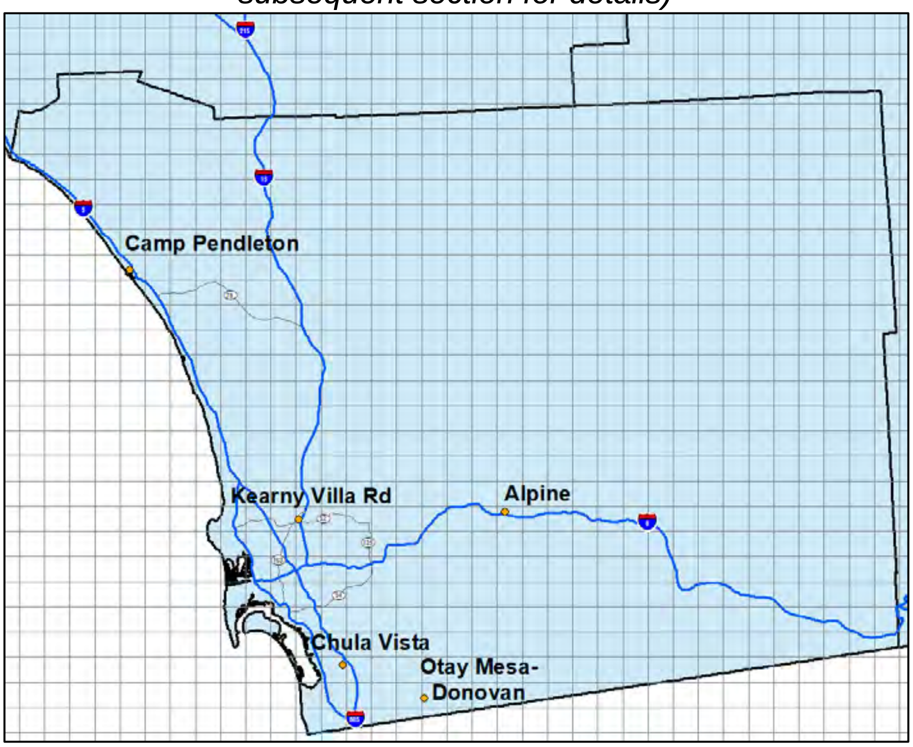
The starting point for the attainment demonstration is the observational based design value (DV), which is used to determine compliance with the ozone standards. The DV for a specific monitor and year represents the three-year average of the annual 4th highest 8-hour ozone mixing ratio observed at the monitor. For example, the 8-hour O_3 DV for 2017 is the average of the observed 4th highest 8-hour O_3 mixing ratio from 2015, 2016, and 2017. The U.S. EPA recommends using an average of three DVs to better account for the year-to-year variability in ozone levels due to meteorological variability. Since 2017 represents the base year for projecting DVs to the future, site-specific DVs should be calculated for the three-year periods ending in 2017, 2018, and 2019, and then these three DVs were averaged (herein referred to as the reference DV or DV_R). However, at the time the attainment demonstration modeling and analysis was conducted, the 2019 observations were not yet finalized. Therefore, two DV_R values were calculated. The first, represents official data and is an average of the official 2016, 2017, and 2018 design values, while the second DV_R represents an average of the 2017, 2018, and 2019 design values, where 2017 and 2018 are official numbers and the 2019 data is still preliminary. Table K-1 lists the 2016, 2017, 2018, and 2019 DVs for each monitor in the San Diego Nonattainment region, as well as the two reference design values. Figure K-2 shows the location of the five monitoring sites.

Table K-1
Ozone Design Values for each of the monitors within the San Diego Nonattainment Region
Where DV_R is the average of three design values

Site/Monitor	2016 8-hour Ozone Design Value [ppb]	2017 8-hour Ozone Design Value [ppb]	2018 8-hour Ozone Design Value [ppb]	2019* 8-hour Ozone Design Value [ppb]	DV_R [ppb] (2016-2018)	DV_R [ppb] (2017-2019*)
Alpine	81	84	84	82	83.0	83.3
Chula Vista	61	62	60	62	61.0	61.3
Camp Pendleton	70	70	64	63	68.0	65.7
Otay Mesa - Donovan	67	70	68	64	68.3	67.3
San Diego - Kearny	68	70	72	71	70.0	71.0

** At the time the modeling and analysis was conducted for this attainment demonstration, the 2019 design value was not yet finalized.*

Figure K-2
Location of the five ozone monitoring sites (orange circles).
The grey horizontal and vertical lines represent the modeling grid structure (see subsequent section for details)



Projecting the reference DVs to the future requires three photochemical model simulations, described below:

1. Base Year Simulation
The base year simulation for 2017 is used to assess model performance (i.e., to ensure that the model is reasonably able to reproduce the observed ozone mixing ratios). Since this simulation will be used to assess model performance, it is essential to include as much day-specific detail as possible in the emissions inventory, including, but not limited to hourly adjustments to the motor vehicle and biogenic inventories based on observed local meteorological conditions, known wildfire and agricultural burning events, and any exceptional events such as refinery fires.

2. Reference Year Simulation
The reference year simulation was identical to the base year simulation, except that certain emissions events which are either random and/or cannot be projected to the future are removed from the emissions inventory. For 2017, the only difference between the base and reference year simulations was that wildfires were excluded from the reference year simulation.

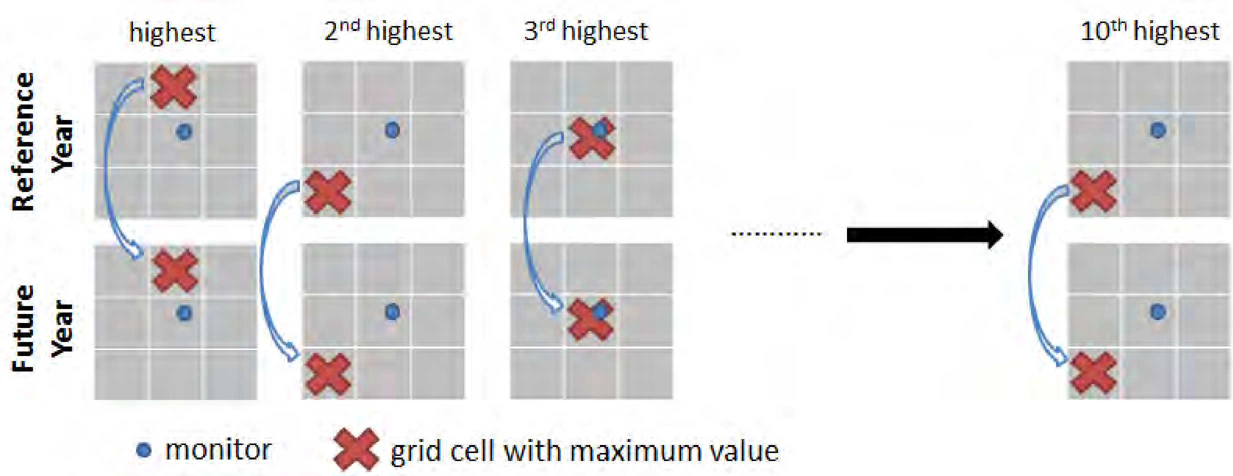
3. Future Year Simulation
The future year simulation (2026 or 2032) was identical to the reference year simulation, except that the projected future year anthropogenic emission levels were used rather than the reference year emission levels. All other model inputs (e.g., meteorology, chemical boundary conditions, biogenic emissions, and calendar for day-of-week specifications in the inventory) are the same as those used in the reference year simulation.

Projecting the reference DVs to the future is done by first calculating the fractional change in ozone between the modeled future and reference years for each monitor location. These ratios, called “relative response factors” or RRFs, are calculated based on the ratio of modeled future year ozone to the corresponding modeled reference year ozone (Equation 1).

$$\mathbf{RRF} = \frac{\frac{1}{N}\sum_{d=1}^{N}(MDA8\ O_3)_{future}^{d}}{\frac{1}{N}\sum_{d=1}^{N}(MDA8\ O_3)_{reference}^{d}} \qquad \mathbf{(1)}$$

Where, MDA8 O_3 refers to the maximum daily average 8-hour ozone, d refers to day (chosen from the reference year), and N is the total number of days used in the RRF calculation. These MDA8 ozone values are based on the maximum simulated ozone within a 3x3 array of cells surrounding the monitor (Figure K-3). Not all modeled days are used to calculate the average MDA8 ozone from the reference and future year simulations. The form of the 8-hour ozone NAAQS is such that it is focused on the days with the highest mixing rations in any ozone season (i.e., the 4^{th} highest MDA8 ozone). Therefore, the modeled days used in the RRF calculation also reflect days with the highest ozone levels. As a result, the current U.S. EPA modeling guidance (U.S. EPA, 2018) recommends using the 10 days with the highest modeled MDA8 ozone at each monitor location, where the 10 days are chosen from the reference year simulation and then the same corresponding days are selected from the future year simulation. Since the relative sensitivity to emissions changes (in both the model and real world) can vary from day-to-day due to meteorology and emissions (e.g., temperature dependent emissions or day-of-week variability) using the top 10 days ensures that the calculated RRF is not overly sensitive to any single day. Note that the MDA8 ozone from the reference and future year simulations are paired in both time (the same days are selected from each simulation) and space (the location of the peak MDA8 ozone within the 3x3 array of grid cells surrounding the monitor is selected from the reference year simulation and the same location is used when selecting the corresponding data from the future year simulation).

Figure K-3
Example Showing How the Location of the MDA8 Ozone for the Top Ten Days in the Reference and Future Years are Chosen



When choosing the top 10 days, the U.S. EPA recommends beginning with all days in which the simulated reference year MDA8 ozone is >= 60 ppb and then calculating RRFs based on the 10 days with the highest ozone in the reference simulation. If there are fewer than 10 days with MDA8 ozone >= 60 ppb then all days >= 60 ppb are used in the RRF calculation, as long as there are at least 5 days used in the calculation. If there are fewer than 5 days >= 60 ppb, an RRF cannot be calculated for that monitor. To ensure that only modeled days which are consistent with the observed ozone levels are used in the RRF calculation, the modeled days are further restricted to days in which the reference MDA8 ozone is within ± 20% of the observed value at the monitor location.

Future year DVs at each monitor are then calculated by multiplying the corresponding reference year DV by the site-specific RRF from Equation 1 (Equation 2).

$$DV_F = DV_R \times RRF \qquad (2)$$

where, DV_F is the future year design value, DV_R is the reference year design value, and RRF is the site-specific RRF from Equation 1. The resulting future year DVs are then compared to the 8-hour ozone NAAQS to demonstrate whether attainment will be reached under the emissions scenario utilized in the future year modeling. A monitor is considered to be in attainment of the 8-hour ozone standard if the estimated future year DV does not exceed the level of the standard.

K.2.1 Meteorological Modeling

California's proximity to the ocean, complex terrain, and diverse climate represent a unique challenge for developing meteorological fiends that adequately represent the synoptic and mesoscale features of the regional meteorology. The Weather Research and Forecast (WRF) model (Skaramock et al., 2005) version 3.9.1.1 was utilized to develop the gridded meteorological fields needed for the air quality simulations and for processing specific emissions categories, which respond to changes in meteorology (e.g., biogenic emissions, NH_3 emissions from certain agricultural sources, and residential wood burning activity). WRF has previously been applied in California to study meteorological phenomena unique to the region, including complex wind flows due to topographical features (e.g., marine air penetration and Santa Ana winds; Bao et al., 2008; Fosberg and Schroeder, 1966; Lu et al., 2012), atmospheric river events (Martin et al., 2018), as well as climate change (Zhao et al., 2011). In addition, WRF is commonly used to simulate meteorological fields for air quality modeling studies in California, including large scale field studies (Bao et al., 2008; Cai et al., 2016; Cai et al., 2019; Kelly et al., 2018) and regulatory modeling activities (South Coast, 2016; San Diego, 2016; SJV 2016b), and has been shown to accurately represent the meteorological phenomena relevant to air quality.

WRF model simulations were conducted on four two-way nested domains, with horizontal grid resolutions of 36-km (D01), 12-km (D02), 4-km (D03), and 2-km (D04; Figure K-4), and 30 vertical hybrid sigma-pressure levels (Table K-2), which stretched from the surface to 100 hPa and contained ten layers within the first kilometer above the surface. For the two-way nesting, the parent (outer) domain provided lateral boundary conditions to the next interior domain, while the interior domain provided higher resolution feedback to its parent domain. Initial and boundary conditions (IC/BCs) were based on North American Regional Reanalysis (NARR) data with 32-km horizontal resolution. The IC/BCs were further refined with surface and upper air observations obtained from the National Center for Atmospheric Research (NCAR).

Figure K-4
WRF modeling domains (D01- 36-km; D02- 12-km; D03- 4-km; D04- 2-km)

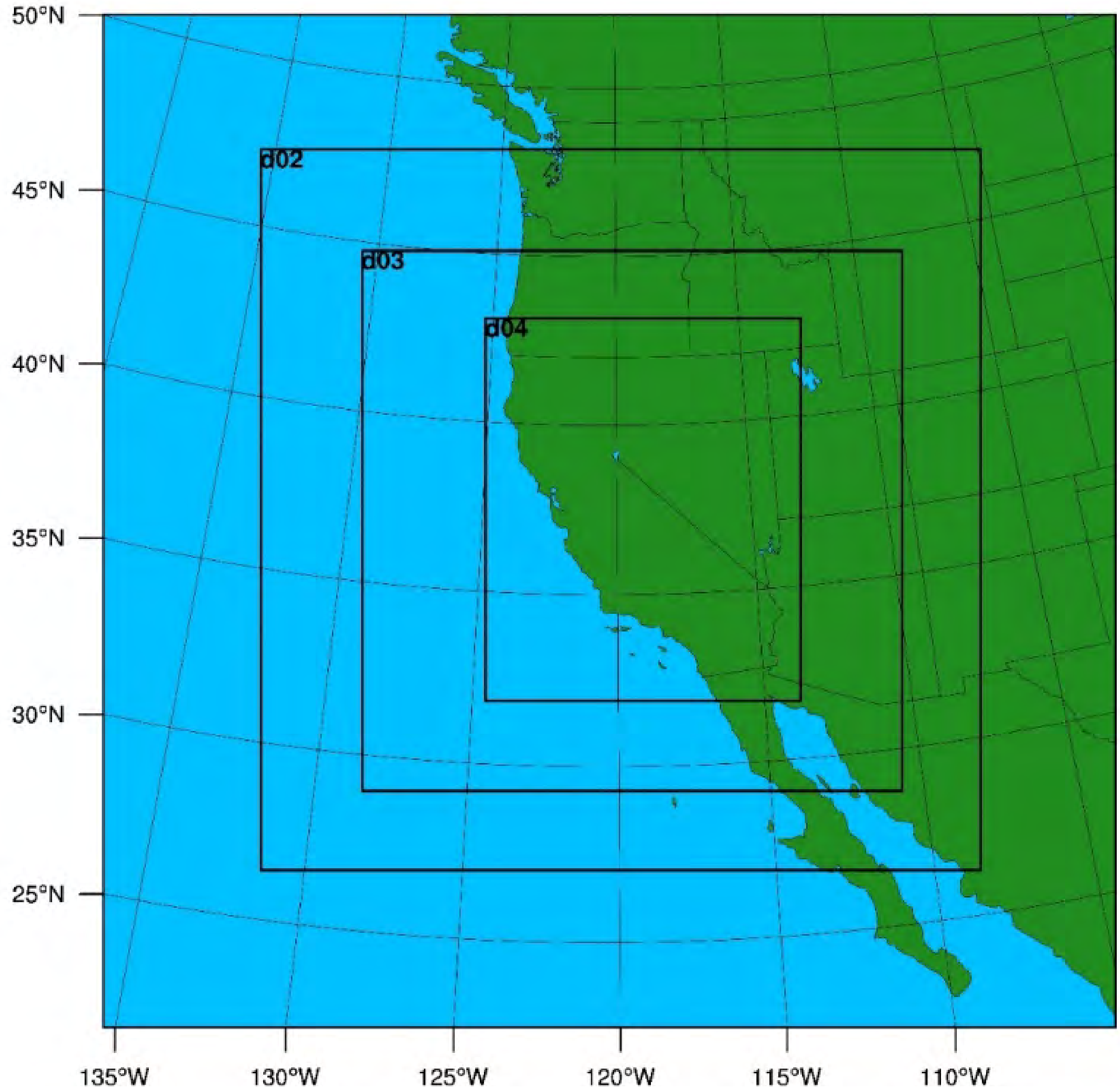


Table K-2
WRF Vertical Layer Structure

Layer Number	Height (m)	Layer Thickness (m)	Layer Number	Height (m)	Layer Thickness (m)
30	16082	1192	14	1859	334
29	14890	1134	13	1525	279
28	13756	1081	12	1246	233
27	12675	1032	11	1013	194
26	11643	996	10	819	162
25	10647	970	9	657	135
24	9677	959	8	522	113
23	8719	961	7	409	94
22	7757	978	6	315	79
21	6779	993	5	236	66
20	5786	967	4	170	55
19	4819	815	3	115	46
18	4004	685	2	69	38
17	3319	575	1	31	31
16	2744	482	0	0	0
15	2262	403			

To prevent any large deviations from the reanalysis data, analysis nudging was applied to the outermost domain (D01) above the planetary boundary layer (PBL) for moisture and above 2-km for wind and temperature. No nudging was used on the three inner domains to allow model physics to work fully without externally imposed forcing. Boundary conditions on the outermost domain were updated every 6 hours, while WRF was reinitialized every 6 days with one day overlap, where the first day after being reinitialized was discarded as model spin-up. The major physics options for each domain are listed in Table K-3. The Meteorology-Chemistry Interface Processor (MCIP) version 4.3, was used to process the 4-km (D03) WRF output for use in the CTM simulations.

Table K-3
WRF Physics Options

Physics Option	D01 (36-km)	D02 (12-km)	D03 (4-km)	D04 (2-km)
Microphysics	WSM 6-class	WSM 6-class	WSM 6-class	WSM 6-class
Longwave Radiation	RRTM	RRTM	RRTM	RRTM
Shortwave Radiation	Dudhia	Dudhia	Dudhia	Dudhia
Surface Layer	Revised MM5 Monin-Obukhov	Revised MM5 Monin-Obukhov	Revised MM5 Monin-Obukhov	Revised MM5 Monin-Obukhov
Land Surface	Pleim-Xiu LSM	Pleim-Xiu LSM	Pleim-Xiu LSM	Pleim-Xiu LSM
Planetary Boundary Layer	YSU	YSU	YSU	YSU
Cumulus Parameterization	Kain-Fritsch Scheme	Kain-Fritsch Scheme	Kain-Fritsch Scheme	Kain-Fritsch Scheme

K.2.2 Emissions

The emissions inventory used in this modeling was based on the 2019 SIP Baseline Emissions Inventory Version 1.00 with external adjustments. For a detailed description of the emissions inventory, updates to the inventory, and how it was processed from the planning totals to a gridded inventory for modeling, see the Modeling Emissions Inventory (Attachment L). Emissions for the San Diego air basin are summarized in Table K-4.

Overall, anthropogenic NO_x emissions were projected to decrease by ~31% from 2017 to 2026 and then a further 5%, relative to 2017 levels, between 2026 and 2032, with the bulk of the reductions coming from on-road mobile sources. In contrast, ROG emissions were projected to decrease by only ~12% between 2017 and 2026, and then an additional 2%, relative to 2017 levels, from 2026 to 2032, with the bulk of those reductions also coming from mobile sources (on-road and other mobile). Emissions of $PM_{2.5}$, SO_x, and NH_3 are shown for completeness, but since those species are not considered precursor species to ozone formation and changes in emissions of those species will have little to no impact on ozone formation. Note that the District and CARB commitments in 2032 include reductions from California's low NOx standard, the Advanced Clean Truck (ACT) Program, the Heavy-Duty Inspection and Maintenance Program, as well as District rules on stationary reciprocating internal combustion engines (Rule 69.4.1) and small/medium boilers process heaters and steam generators (Rules 69.2.1 and 69.2.2). In addition, adjustments to the mobile inventory based on the federal Safer Affordable Fuel-Efficient (SAFE) Vehicle Rule were also incorporated. Details on these rules/adjustments can be found in the modeling emissions inventory protocol.

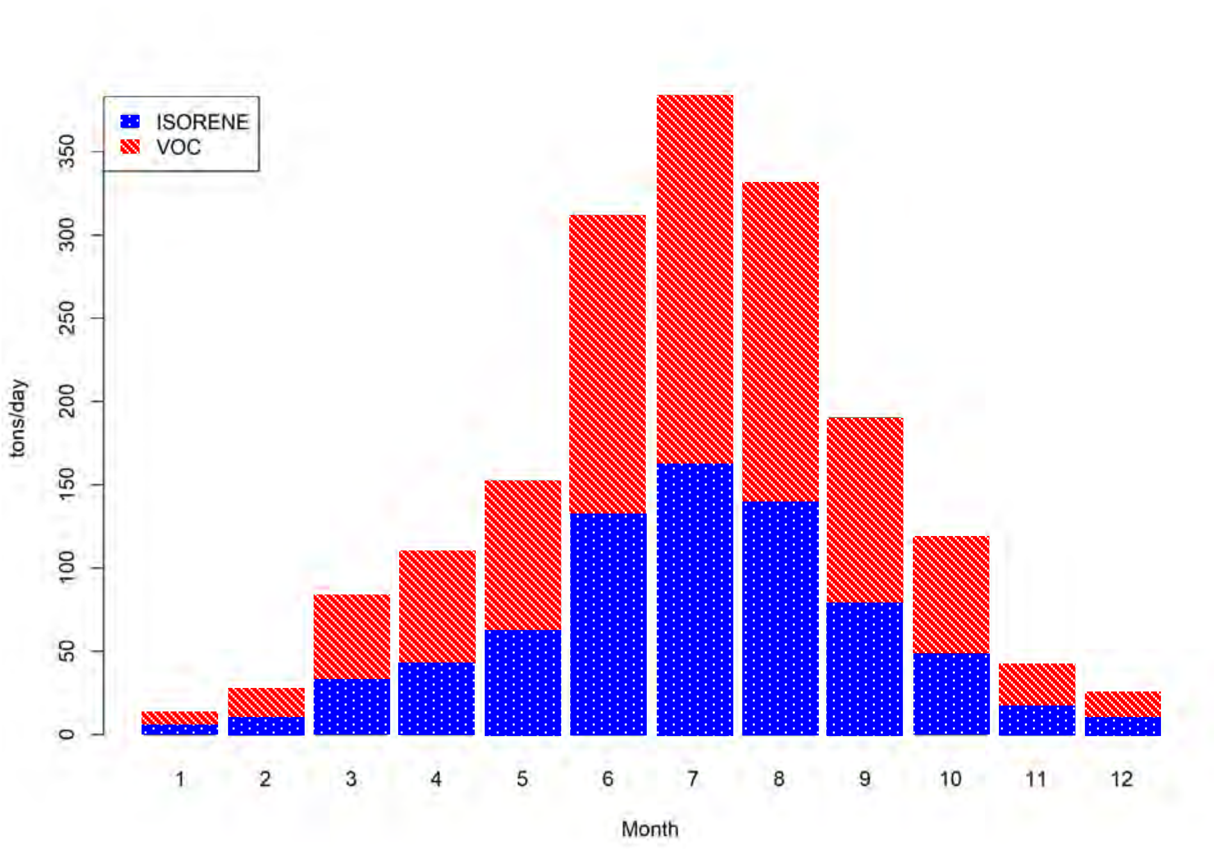
Table K-4
San Diego Summer Baseline Emissions for 2017, 2026, and 2032*

Category	NO_x	ROG	$PM_{2.5}$	SO_x	NH_3
2017 (tons/day)					
Stationary	4.1	27.6	2.5	0.2	1.2
Area	1.7	33.7	10.6	0.0	9.2
On-road Mobile	37.7	20.5	2.4	0.4	3.2
Other Mobile	33.5	31.1	3.3	0.5	0.0
Total	77.0	112.9	18.8	1.2	13.6
2026 (tons/day)					
Stationary	4.0	26.3	2.6	0.2	1.3
Area	1.2	35.2	10.8	0.0	9.2
On-road Mobile	17.5	12.3	2.2	0.3	2.7
Other Mobile	30.3	25.2	2.8	0.6	0.0
Total	53.0	99.0	18.3	1.2	13.2
2032 (tons/day)					
Stationary	4.1	27.2	2.7	0.2	1.3
Area	1.0	36.1	10.9	0.0	9.2
On-road Mobile	15.1	10.0	2.2	0.3	2.7
Other Mobile	28.9	23.2	2.6	0.7	0.0
Total	49.1	96.4	18.4	1.2	13.3
2032 with District and CARB commitments (tons/day)					
Stationary	2.6	27.2	2.7	0.2	1.3
Area	0.8	36.1	10.9	0.0	9.2
On-road Mobile	11.1	10.0	2.2	0.3	2.7
Other Mobile	28.9	23.2	2.6	0.7	0.0
Total	43.4	96.5	18.4	1.2	13.3

** Note that rounding errors may result in emissions totals that do not exactly match the sum of the individual categories.*

Biogenic emissions were generated using the MEGAN3.0 biogenics emissions model. MEGAN3.0 incorporates a new pre-processor (MEGAN-EFP) for estimating biogenic emission factors based on available landcover and emissions data. The MEGAN3.0 default datasets for plant growth form, ecotype, and emissions were utilized. Leaf Area Index (LAI) for non-urban grid cells was based on the 8-day 500-m resolution MODIS Terra/AQUA combined product (MCD15A2H) for 2017. The LAI data was converted to LAIv, which represents the LAI for the vegetated fraction within each grid cell, by dividing the gridded MODIS LAI values by the Maximum Green Vegetation Fraction (MGVF) for each grid cell. The MODIS LAI product does not provide information on LAI in urban regions, so urban LAIv was estimated from the US Forest Service's Forest Inventory and Analysis (FIA) urban tree plot data, processed through the i-Tree v6 software. Peak summertime urban LAIv for San Diego was estimated to be 4.6, and this peak value was adjusted for each 8-day MODIS period based on the relative change in non-urban MODIS LAI across the state. Hourly meteorology was provided by the 4-km WRF simulation described above, and all stress factor adjustments were turned off. Figure K-5 shows the monthly variation in biogenic isoprene and total ROG (VOC) within the San Diego basin for 2017. Basin wide biogenic ROG emissions are roughly 3-4 times the anthropogenic ROG emissions during summer months, peaking in July, with total ROG emissions nearing 400 tpd and remaining above 300 tpd for the peak summer months (June, July, August).

Figure K-5
Monthly Average Biogenic Isoprene and ROG (VOC) Emissions (tons/day) for the San Diego Air Basin in 2017



K.2.3 Air Quality Modeling

The CTM utilized in the attainment demonstration modeling was the Community Multiscale Air Quality (CMAQ) model version 5.2.1. CMAQ is U.S. EPA's open source regional CTM that is widely used in the regulatory and scientific communities, and represents the current state-of-the-science. CMAQ has been utilized for studying ozone and $PM_{2.5}$ formation in California for over a decade (e.g., Cai et al., 2016, 2019; Jin et al., 2008, 2010; Kelly et al., 2010, 2014; Livingstone et al., 2009; Pun et al., 2009; Tonse et al., 2008; Vijayaraghavan et al., 2006; Zhang et al., 2010), and has been the primary CTM used in California SIPs since 2008 (SJV, 2008), having been used in over a dozen ozone and $PM_{2.5}$ SIPs (Eastern Kern, 2017; Imperial 2017, 2018; Sacramento, 2017; SJV, 2012, 2013, 2016a,b, 2018; South Coast, 2012, 2016; Ventura, 2016; Western Mojave, 2016; Western Nevada, 2018).

The SAPRC07 chemical mechanism (Carter, 2010a,b) was chosen to represent the gas-phase photochemistry in the atmosphere, along with the aero6 aerosol mechanism for simulating aerosol dynamics and chemistry. Photolysis rates were calculated in-line to better represent changes in the photolysis rates due to cloud cover and particulate levels in the atmosphere. The CMAQ source code was modified so that the option for in-line plume rise calculations of elevated point sources could be used simultaneously with a 3D emissions file, as opposed to being restricted to a 2D emissions file for surface sources only. This was a necessary modification so that upper-air emissions sources, such as from aircraft taking off and landing at local airports, could be correctly allocated above the surface layer.

The CMAQ modeling domain covered the entire state at a 12-km horizontal resolution and included parts of Mexico, Oregon, Nevada and Arizona, and nested down to a higher 4-km resolution domain over Southern California (Figure K-6). The vertical layer structure in CMAQ adopted the same hybrid sigma-pressure coordinate system and number of vertical layers as WRF (Table K-2). Further details of the CMAQ configuration used in this work are summarized in Table K-5.

For each simulation, the entire ozone season (April – October) was modeled as one continuous simulation, with one week of model spin-up (last week of March) for the 12-km simulations and three days of model spin-up (last three days of March) for the 4-km simulations. Initial conditions (ICs) for the 12-km simulations utilized the default clean homogeneous conditions in CMAQ, while the ICs for the 4-km simulations were derived from the corresponding 12-km model output. Chemical boundary conditions (BCs) for the outer 12-km domain were derived from the global chemical transport model for Ozone and Related chemical Tracers, version 4 (MOZART-4; Emmons et al., 2010). The MOZART-4 output for 2017 was obtained from the National Center for Atmospheric Research (NCAR) and processed to CMAQ-ready format utilizing the mozart2camx-26feb19 software available as support software through the Comprehensive Air Quality Model with Extensions (CAMx) website.

Figure K-6
CMAQ modeling domains used in this study are represented by the black dashed line for the statewide 12-km domain and the Southern California 4-km domain outlined in red

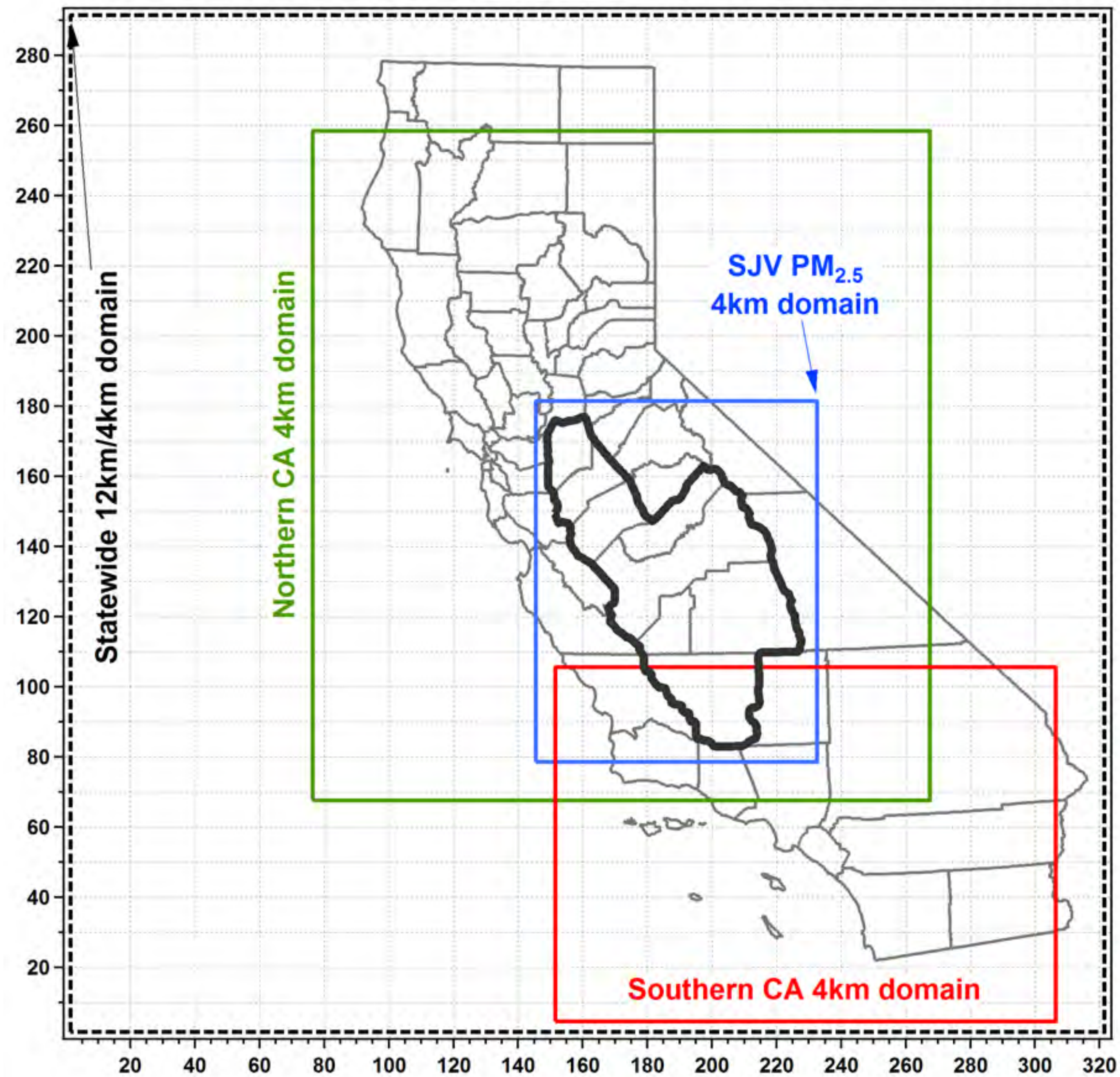


Table K-5
CMAQ Configuration and Settings

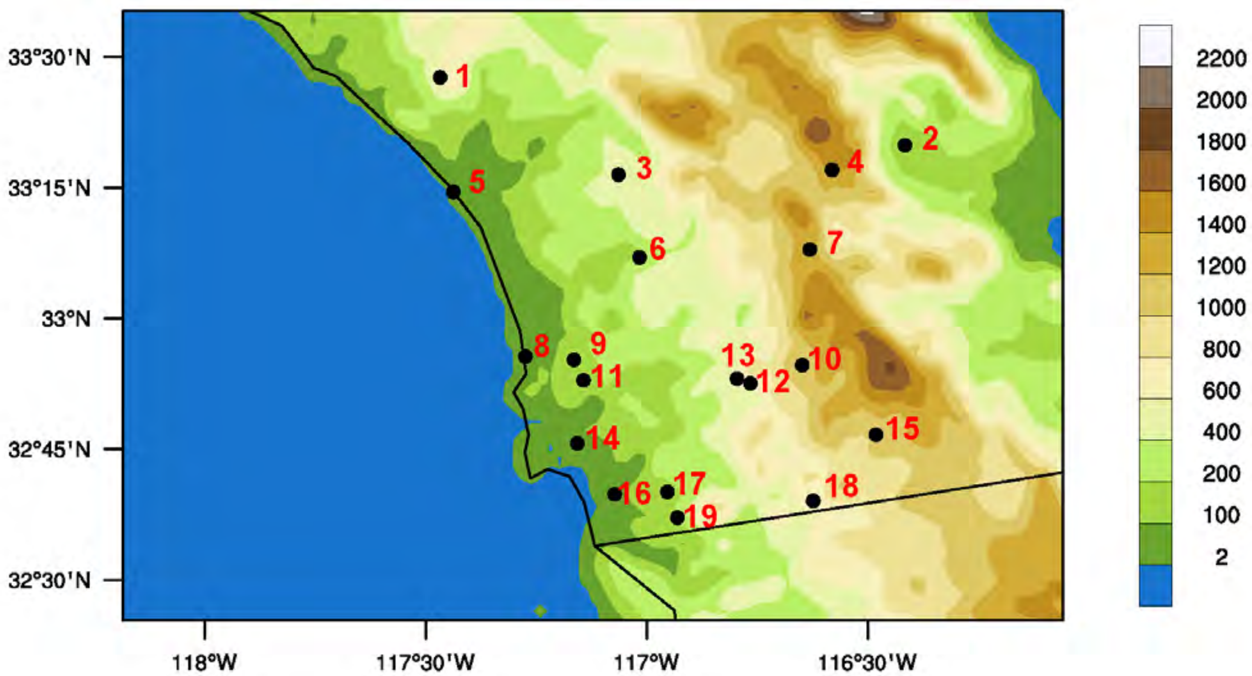
Process	Scheme
Horizontal advection	Yamo (Yamartino scheme for mass-conserving advection)
Vertical advection	WRF-based scheme for mass-conserving advection
Horizontal diffusion	Multi-scale
Vertical diffusion	ACM2 (Asymmetric Convective Model version 2)
Gas-phase chemical mechanism	SAPRC-07 gas-phase mechanism with version "C" toluene updates
Chemical solver	EBI (Euler Backward Iterative solver)
Aerosol module	Aero6 (the sixth generation CMAQ aerosol mechanism with extensions for sea salt emissions and thermodynamics; includes a new formulation for secondary organic aerosol yields)
Cloud module	ACM_AE6 (ACM cloud processor that uses the ACM methodology to compute convective mixing with heterogeneous chemistry for AERO6)
Photolysis rate	phot_inline (calculate photolysis rates in-line using simulated aerosols and ozone concentrations)

K.3. RESULTS

K.3.1 Meteorological Model Evaluation

Simulated surface wind speed, temperature, and relative humidity from the 4 km domain were validated against hourly observations at 19 surface stations in San Diego County (Figure K-7). The observational data for the surface stations were obtained from the ARB archived meteorological database. Table K-6 lists the monitoring stations and the meteorological parameters that are measured at each station, including wind speed and direction (wind), temperature (T) and relative humidity (RH).

Figure K-7
Meteorological monitoring stations utilized in the model evaluation.



Several quantitative performance metrics were used to compare hourly surface observations and modeled estimates: mean bias (MB), mean error (ME) and index of agreement (IOA) based on the recommendations from Simon et al. (2012). The model performance statistical metrics were calculated using the available data at all the sites. A summary of these statistics for the area is shown in Table K-7. The distribution of daily mean bias and mean error are shown in Figure K-8. The spatial distributions of the mean bias and mean error of the modeled surface wind, temperature and relatively humidity are shown in Figure K-9, while observed vs. modeled scatter plots are shown in Figure K-9. The average hourly wind speed bias for May-September 2017 is 0.73 m/s, while the average mean error is 0.81 m/s. The index of agreement for the wind speed over this period is 0.84. The model generally over-predicted the wind speed over most sites, and the magnitudes of the biases are generally higher inland than the coastal areas (top left panel of Figure K-9). Temperature is biased low with an average bias of -0.3 K. The model tends to overestimate temperature along the coast, and underestimates temperature further inland (middle left panel of Figure K-9). Temperature generally shows good agreement between the observations and simulation with IOA of 0.98. Consistent with the negative temperature bias, relative humidity has a positive bias of 5.69%. The IOA for relative humidity is also above 0.90.

These results are comparable to other recent WRF modeling efforts in California investigating ozone formation in Central California (e.g., Hu et al., 2012) and modeling analysis for the CalNex and CARES field studies (e.g., Fast et al., 2014; Baker et al., 2013, Kelly et al., 2014; Angevine et al., 2012). Detailed hourly time-series of surface temperature, relative humidity, and wind speed can be found in the supplementary material.

Table K-6
Meteorological Monitoring Site and Parameter(s) measured

Site Number	Site ID	Site Name	Parameter(s) Measured
1	3328	Case Springs	Wind, T, RH
2	7228	Borrego Springs	T, RH
3	3313	Valley Center	Wind, T, RH
4	3318	Ranchita	Wind, T, RH
5	3198	Camp Pendleton	Wind, T
6	5798	Escondido SPV	T, RH
7	3322	Julian	Wind, T, RH
8	5815	Torrey Pines #2	T
9	5795	Miramar	T, RH
10	3473	Decanso	Wind, T, RH
11	3766	Kearny Villa Road	Wind, T, RH
12	2460	Alpine-Victoria Drive	Wind, T, RH
13	3557	Alpine (RAWS)	Wind, T, RH
14	5825	San Diego #6	T, RH
15	3465	Cameron Fire Station	Wind, T, RH
16	2589	Chula Vista	Wind, T
17	5792	Otay Lake	T, RH
18	3317	Potrero	Wind, T, RH
19	3739	Otay Mesa-Donovan	Wind, T

Table K-7
Hourly surface wind speed, temperature and relative humidity statistics over the San Diego region for May through September, 2017.
IOA denotes index of agreement.

Observed Mean	Modeled Mean	Mean Bias	Mean Error	IOA
Wind Speed (m/s)				
2.00	2.72	0.73	0.81	0.84
Temperature (K)				
21.20	20.91	-0.30	1.02	0.98
Relative Humidity (%)				
59.33	65.01	5.69	7.62	0.92

Figure K-8
Distribution, over all monitors in San Diego, of daily mean bias (left) and mean error (right) from May – September, 2017.
Results are shown for wind speed (top), temperature (middle), and RH (bottom).

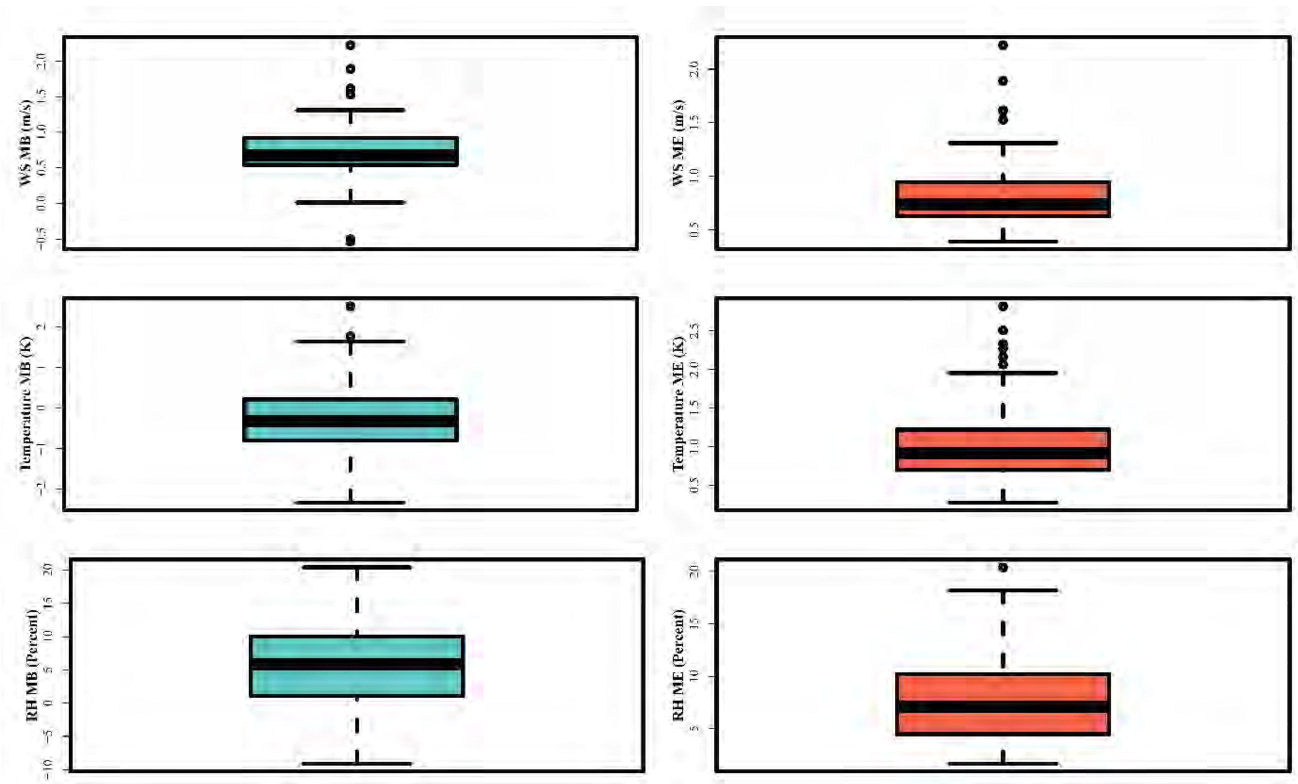


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Figure K-9
Spatial distribution of mean bias (left) and mean error (right) from May-September, 2017.
Results are shown for wind speed (top), temperature (middle), and RH (bottom). Negative biases are denoted with blue markers and positive biases are denoted with black markers. The color scale represents terrain height (in m) from the 4 km grid.

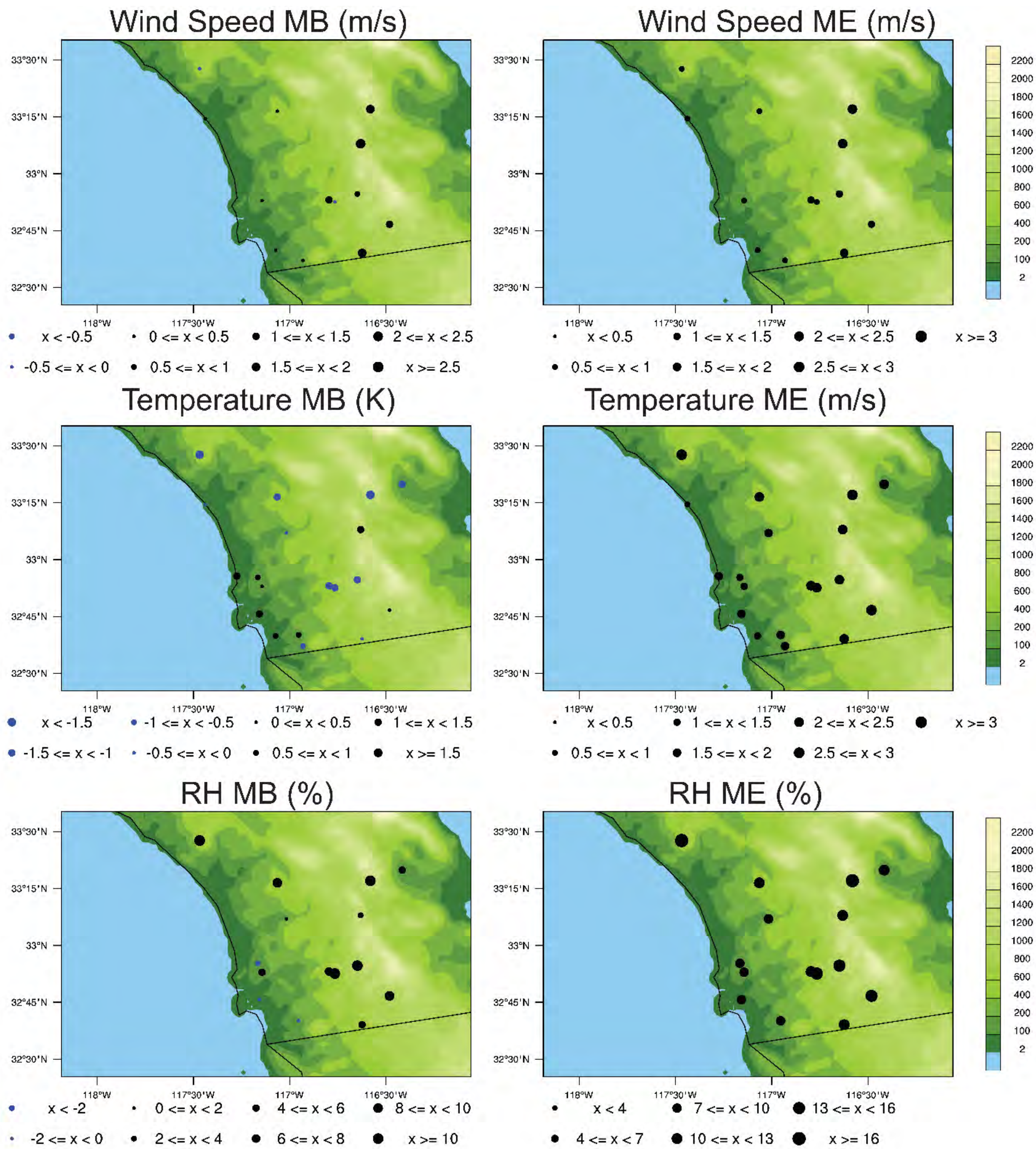
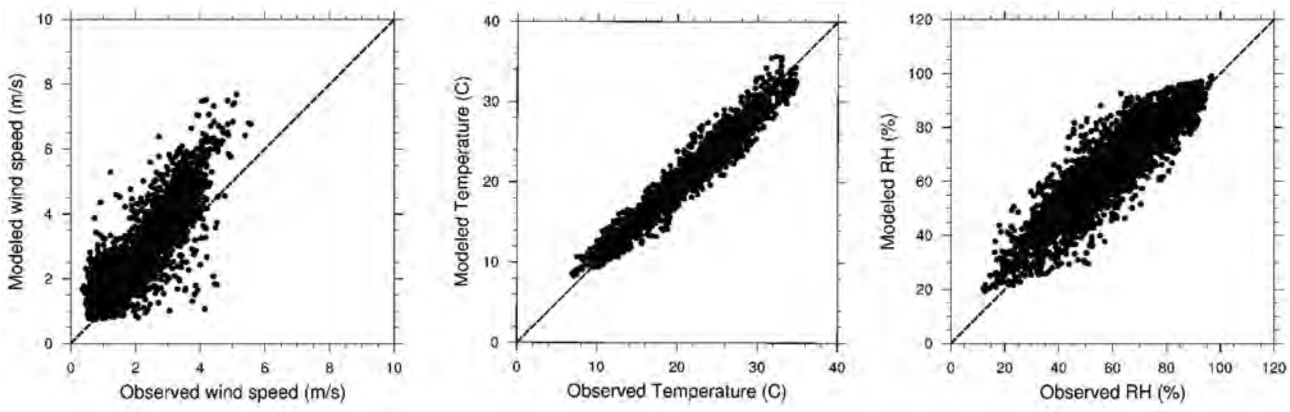


Figure K-10
Comparison of modeled and observed hourly wind speed (left), 2-meter temperature (center), and relative humidity (right), May-September 2017.



K.3.2 Air Quality Model Evaluation

Observations of ozone from the Air Quality and Meteorological Information System (AQMIS) database (www.arb.ca.gov/airqualitytoday/) were used to evaluate the accuracy of the 4 km CMAQ modeling for the monitors listed in Table K-1. The U.S. EPA modeling guidance (U.S. EPA, 2018) recommends using the simulated mixing ratio in the grid cell where the monitor is located to pair observations with simulated values in an operational evaluation of model predictions. However, the future year design value calculations (discussed in section Methodology) are based on peak simulated values > 60 ppb near the monitor (specifically, the maximum simulated ozone within a 3x3 array of cells centered on the grid cell containing the monitor). To maintain consistency between the model performance evaluation and the future design value calculation, model performance was evaluated at each monitor by comparing observations against the simulated values using only data above the 60 ppb threshold at the monitored grid cell, as well as the peak grid cell within the 3x3 grid array centered on the monitor (i.e., the 3x3 maximum). Performance statistics for data above 60 ppb were reported separately for different ozone metrics including 8-hour daily maximum ozone, 1-hour daily maximum ozone, and hourly ozone (all hours of the day). Due to distinct differences in geographical, meteorological and air quality patterns, model performance was further summarized separately for the one inland site (Alpine) and the four coastal sites (Chula Vista, Camp Pendleton, Otay Mesa-Donovan, San Diego-Kearny) in the basin.

As recommended by U.S. EPA, a number of statistical metrics were used to evaluate the model performance for ozone. These metrics include mean bias (MB), mean error (ME), mean fractional bias (MFB), mean fractional error (MFE), normalized mean bias (NMB), normalized mean error (NME), root mean square error (RMSE), and correlation coefficient (R2). In addition, the following plots were used in evaluating the modeling: time-series plots comparing the predictions and observations, scatter plots for comparing the magnitude of the simulated and observed mixing ratios, box plots to summarize the time series data across different regions and averaging times, as well as frequency distributions.

The EPA recommended statistical metrics are defined below:

$$\mathrm{MB} = \frac{1}{\mathrm{N}}\sum_{1}^{\mathrm{N}}(\mathrm{Model} - \mathrm{Obs}) \qquad \textbf{(3)}$$

$$\mathrm{ME} = \frac{1}{\mathrm{N}}\sum_{1}^{\mathrm{N}}\left|\mathrm{Model} - \mathrm{Obs}\right| \qquad \textbf{(4)}$$

$$\mathrm{MFB} = \frac{2}{\mathrm{N}}\sum_{1}^{\mathrm{N}}\left(\frac{\mathrm{Model} - \mathrm{Obs}}{\mathrm{Model} + \mathrm{Obs}}\right)\times 100\%, \qquad \textbf{(5)}$$

$$\mathrm{MFE} = \frac{2}{\mathrm{N}}\sum_{1}^{\mathrm{N}}\left(\frac{\left|\mathrm{Model} - \mathrm{Obs}\right|}{\mathrm{Model} + \mathrm{Obs}}\right)\times 100\%, \qquad \textbf{(6)}$$

$$\mathrm{NMB} = \frac{\sum_{1}^{\mathrm{N}}(\mathrm{Model} - \mathrm{Obs})}{\sum_{1}^{\mathrm{N}}\mathrm{Obs}}\times 100\%, \qquad \textbf{(7)}$$

$$\mathrm{NME} = \frac{\sum_{1}^{\mathrm{N}}\left|\,\mathrm{Model} - \mathrm{Obs}\,\right|}{\sum_{1}^{\mathrm{N}}\mathrm{Obs}}\times 100\%, \qquad \textbf{(8)}$$

$$\mathrm{RMSE} = \sqrt{\frac{\sum_{1}^{\mathrm{N}}(\mathrm{Model} - \mathrm{Obs})^2}{\mathrm{N}}} \qquad \textbf{(9)}$$

$$\mathrm{R}^2 = \left(\frac{\sum_{1}^{\mathrm{N}}((\mathrm{Model} - \overline{\mathrm{Model}})\times(\mathrm{Obs} - \overline{\mathrm{Obs}}))}{\sqrt{\sum_{1}^{\mathrm{N}}(\mathrm{Model} - \overline{\mathrm{Model}})^2\sum_{1}^{\mathrm{N}}(\mathrm{Obs} - \overline{\mathrm{Obs}})^2}}\right)^2 \qquad \textbf{(10)}$$

where, “Model” is the simulated mixing ratio, “$\overline{\mathrm{Model}}$” is the simulated mean mixing ratio, “Obs” is the observed value, “$\overline{\mathrm{Obs}}$” is the mean observed value, and “N” is the number of observations.

Performance statistics for Maximum Daily Average 8-hour (MDA8) ozone are shown in Table K-8 for the grid cell corresponding to the monitor location. Overall, the modeling system shows a slight over-prediction of ozone compared to the observations at the inland site (1.49 ppb) with a slightly lower positive bias at the coastal sites (0.85 ppb). When the 3x3 maximum is used, the inland site at Alpine exhibits a larger positive bias (3.24 ppb), while the coastal sites show an even greater positive bias (3.55 ppb). Similar positive biases are seen for both maximum daily 1-hour ozone (Table K-9) and hourly ozone (Table K-10).

Model performance statistics within the range of values shown in Table K-8, Table K-9, and Table K-10 are consistent with previous regulatory modeling studies in the San Diego and South Coast Air Basins. In the most recent 8-hour ozone SIP for San Diego (San Diego, 2016), modeling for the 2012 base year exhibited MDA8 ozone biases that ranged from 0.0 to 9.7 ppb, and normalized biases between -4.3 and 14.3 ppb. In comparison, the mean bias in this model attainment demonstration are 1.49 and 0.85 ppb for the inland and coastal sites, respectively. In the South Coast 2016 8-hour SIP (South Coast, 2016), the 2012 base year modeling had MDA8 ozone normalized biases that ranged from -4.2 to 11.5 ppb at coastal sites, while normalized bias at foothills sites ranged from -23.3 to 6.6 ppb. Non-regulatory modeling in southern California has also shown similar model performance. Venecek et al. (2018) compared the UCD/CIT model performance in Los Angeles region during episode September 23 – 26, 2010 for two different chemical mechanisms and found that RMSEs between observed hourly ozone concentration and model predictions were around 12 ppb and 23 ppb, respectively. The RMSE numbers for hourly ozone at Alpine and other coastal sites from this model attainment demonstration are smaller than those from Venecek et al. (2018) at around 10%. Hu J. (2014) conducted a long-term model simulation across California and compared the model performance of daily averaged ozone concentration based on daily, monthly, and annually. Their results show that MFB ranged between +-10% and MFE is less than 15%. In comparison, our model predictions here show greater performance as shown in Figure K-11.

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Table K-8
Daily Maximum 8-hour ozone performance statistics for April – October 2017

Daily maximum 8-hour ozone > 60 ppb with simulated ozone extracted from the grid cell in which the monitor is located		
Parameter	**Alpine**	**Coastal Sites**
Number of data points	89	58
Mean obs (ppb)	71.85	66.53
Mean bias (ppb)	1.49	0.85
Mean error (ppb)	6.45	5.30
RMSE (ppb)	8.49	6.72
Mean fractional bias (%)	1.95	1.44
Mean fractional error (%)	8.81	7.74
Normalized mean bias (%)	2.07	1.28
Normalized mean error (%)	8.98	7.97
R-squared	0.26	0.07

Daily maximum 8-hour ozone > 60 ppb with simulated ozone extracted from the maximum of the 3x3 grid cells array centered at the monitor		
Parameter	**Alpine**	**Coastal Sites**
Number of data points	99	63
Mean obs (ppb)	71.19	66.52
Mean bias (ppb)	3.24	3.55
Mean error (ppb)	6.97	6.52
RMSE (ppb)	9.33	8.02
Mean fractional bias (%)	4.18	5.21
Mean fractional error (%)	9.43	9.41
Normalized mean bias (%)	4.55	5.34
Normalized mean error (%)	9.79	9.80
R-squared	0.29	0.08

Table K-9
Daily Maximum 1-hour ozone performance statistics for April – October 2017

Daily maximum 1-hour ozone > 60 ppb with simulated ozone extracted from the grid cell in which the monitor is located		
Parameter	**Alpine**	**Coastal Sites**
Number of data points	152	147
Mean obs (ppb)	76.57	70.44
Mean bias (ppb)	1.68	1.34
Mean error (ppb)	9.03	7.89
RMSE (ppb)	11.58	10.48
Mean fractional bias (%)	2.05	1.96
Mean fractional error (%)	11.58	10.80
Normalized mean bias (%)	2.19	1.90
Normalized mean error (%)	11.79	11.20
R-squared	0.25	0.05

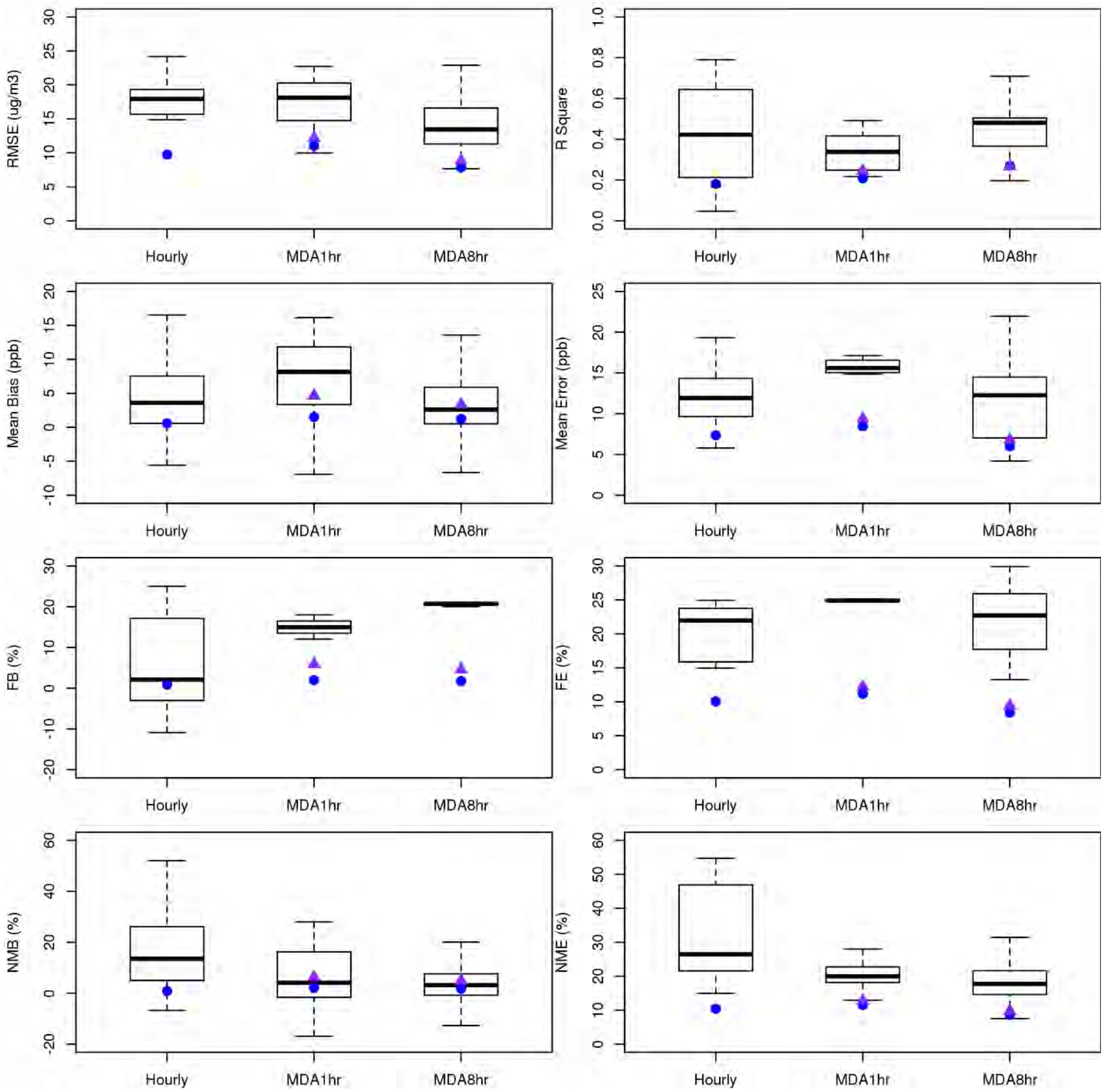
Daily maximum 1-hour ozone > 60 ppb with simulated ozone extracted from the maximum of the 3x3 grid cells array centered at the monitor		
Parameter	**Alpine**	**Coastal Sites**
Number of data points	155	169
Mean obs (ppb)	76.49	70.06
Mean bias (ppb)	5.22	4.10
Mean error (ppb)	9.70	9.09
RMSE (ppb)	12.80	11.63
Mean fractional bias (%)	6.32	5.49
Mean fractional error (%)	12.12	12.28
Normalized mean bias (%)	6.82	5.86
Normalized mean error (%)	12.68	12.97
R-squared	0.29	0.07

Table K-10
Hourly ozone performance statistics for April – October 2017

Hourly ozone > 60 ppb with simulated ozone extracted from the grid cell in which the monitor is located		
Parameter	**Alpine**	**Coastal Sites**
Number of data points	857	493
Mean obs (ppb)	71.95	68.45
Mean bias (ppb)	0.39	0.96
Mean error (ppb)	7.58	6.96
RMSE (ppb)	10.04	9.23
Mean fractional bias (%)	0.45	1.52
Mean fractional error (%)	10.19	9.83
Normalized mean bias (%)	0.54	1.40
Normalized mean error (%)	10.53	10.17
R-squared	0.23	0.04

Simon et al. (Simon et al., 2012) conducted a review of photochemical model performance statistics published between 2006 and 2012 for North America (from 69 peer-reviewed articles). In Figure K-11, the statistical evaluation of this model attainment demonstration is compared to the model performance summary presented in Simon et al. (2012) by overlaying the various statistical measures from the attainment demonstration onto the Simon et al. (2012) model performance summary. Note that the box-whisker plot (colored in black) shown in Figure K-11 was reproduced using data from Figure K-4 of Simon et al. (2012). The blue (circular) and purple (triangular) markers in each of the panels in Figure K-11 denote the model performance statistics calculated using simulated ozone at the grid cell in which the monitor is located and the 3x3 maximum centered on the monitor from the current modeling work, respectively Figure K-11 clearly shows that the model performance statistical metrics for hourly, DMA8 and DMA1 ozone from this attainment demonstration are well within the range of values reported by other studies in the scientific literature.

Figure K-11
Comparison of various statistical metrics from the model attainment demonstration modeling to the range of statistics from the 69 peer-reviewed studies summarized in Simon et al (2012).
(MDA denotes Maximum Daily Average). Blue circular markers show statistics calculated from modeled ozone at the monitor location, while purple triangular markers show statistics calculate from the maximum ozone in the 3x3 array of grid cells surrounding the monitor. Statistics were only calculated from modeled ozone over 60 ppb.



The scatter plots of daily maximum 8-hour ozone concentration between observations and modeled predictions for the five sites in the San Diego air basin are shown in Figure K-12. The plots show that the one inland site (Alpine) shows the best correspondence between the observed and predicted ozone concentrations, with the majority of points falling along the 1:1 line. In contrast, at the coastal sites (Chula Vista, Camp Pendleton, and Kearny Villa Rd), the model tends to over-predict the MDA8 ozone with a greater number of points falling above the 1:1 line).

Figure K-12
Scatter plots between observed and predicted daily maximum 8-hour ozone.

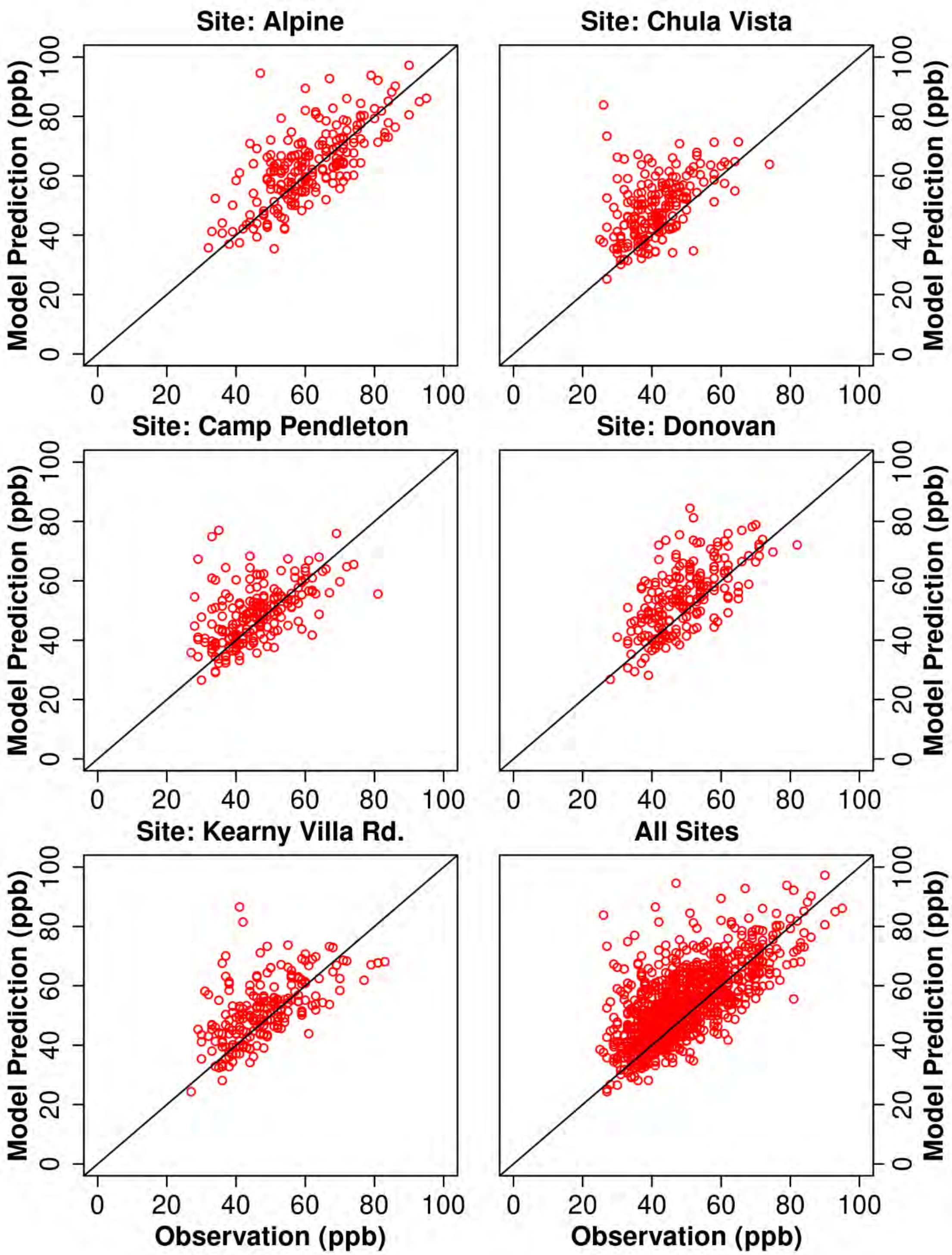


Figure K-13 shows the daily trends of observed and model predicted MDA8 ozone April 1st through October 30th, 2017 for all sites in the San Diego air basin. The time series plots clearly show that the modeling system does a reasonable job at capturing the daily variability in MDA8 ozone at the Alpine site. At the four coastal sites, the modeling system does a reasonable job at capturing the daily variability in MDA8 ozone for most of the months, however, from mid-June through mid-July MDA8 ozone is significantly over-predicted at all coastal sites.

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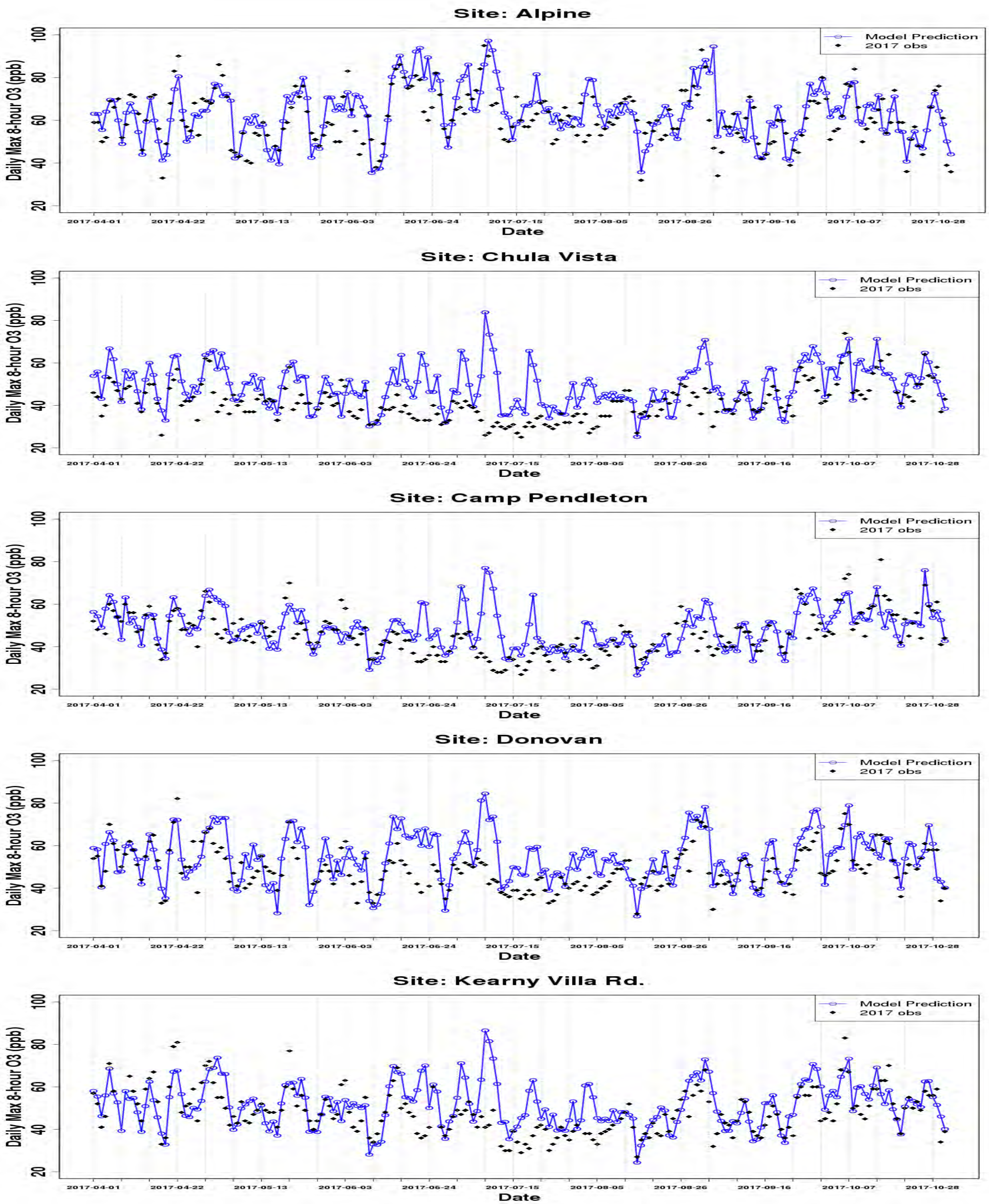
Figure K-13
Time series plots of MDA8 ozone at the five monitoring sites in the San Diego Air Basin.
Black dots represent observations, while the blue lines and markers indicate model predictions.



Due to the discrepancy between the observed ozone concentrations and model predictions at the coastal sites from mid-June through mid-July 2017 at the coastal sites, a model sensitivity simulation was conducted to determine whether the model over-prediction was due to influence from the model's southern boundary conditions. The sensitivity simulation amounted to reducing the ozone mixing ratio of the bottom 7 layers in boundary grid cells (cells 80 to 95) to the south of San Diego by 30 ppb. Time series of the modeled hourly ozone values for each site are shown in Figure K-14. As shown in the plots, although reducing the ozone mixing ratios along the boundary to the south of San Diego did impact the simulated ozone at the coastal sites, the large over-predictions still remained, which suggests the over-prediction was due to some other factor besides the boundary conditions.

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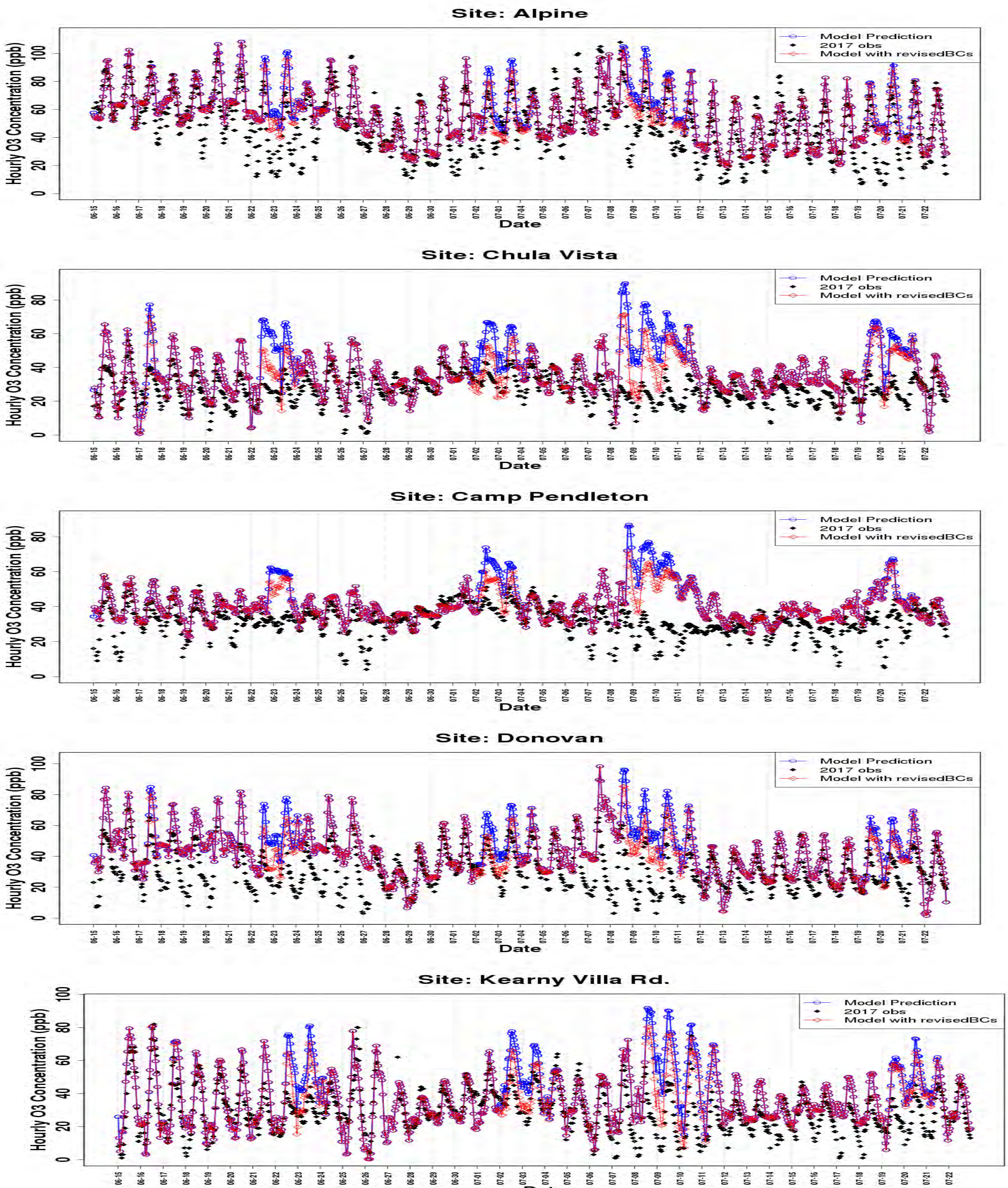
Figure K-14

Comparison of hourly Ozone concentration between observation and model prediction in 2017-06-15 – 2017-07-22 range.

Black dots represent observations, blue line shows model output, and red line shows model output with partially revised boundary conditions.



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To further investigate the cause of the over-prediction at the coastal sites, an analysis of the meteorological conditions during the time period in which the over-prediction occurred was conducted. Transport and diurnal variation of ozone in coastal regions are profoundly affected by the marine boundary layer (MBL; Bremaud et al., 1998; Boylan et al., 2015). The coastal region of Southern California is influenced by the MBL, which is significantly lower than the planetary boundary layer (PBL) inland (Figure K-15a and Figure K-15b). Figure K-15 shows that daily maximum PBL heights (PBLHmax) averaged during the ozone over-prediction period are lower than that averaged for the rest of June and July 2017 by up to 100 m over the coastal region, which is substantial considering that PBLHmax is ~500m during this period. Though PBLH observations are not available for model verification over this region, it is possible that the MBL is under-estimated during the ozone over-prediction period, which could contribute to the over-prediction of ozone in the CMAQ modeling. It should be noted that although lower maximum PBL heights are modeled at the Alpine site during the mid-June to mid-July period, the values are not nearly as low as they are at the coastal sites. Table K-11 and Table K-12 show that the model performance is slightly better over coastal than foothills areas for wind and relative humidity during both periods. Both observed and modeled surface temperature (relative humidity) are higher (lower) during the ozone over-prediction period compared to the rest of June and July, 2017; however, the model performance on the three surface variables is not significantly different between the ozone over-prediction period and the rest of June and July, 2017.

The cause of the lower maximum PBL heights during the period of ozone over-prediction is likely the result of large-scale anticyclonic circulation during that time. Figure K-16 illustrates that an upper-air (500 mb and 700 mb) anticyclonic circulation centered around San Diego was present during the ozone over-prediction period. The sinking motion associated with this upper-air anticyclonic circulation might be a major cause for the lower MBL along the coast during this period. The northwesterly wind at 850 mb off the coast of Southern California associated with the North Pacific High is stronger for the rest of June and July (Figure K-16f) than during the ozone over-prediction period (Figure K-16e). This wind pattern enhanced the sea breeze around San Diego, leading to stronger sea breeze at the surface for the rest of June and July comparing to the ozone over-prediction period (Figure K-17). The lower sea breeze during the ozone over-prediction period is another favorable condition for higher ozone levels.

Table K-11
Hourly surface wind speed, temperature and relative humidity statistics for coastal and foothill regions for ozone over-prediction period (June 15 through July 15, 2017).
IOA denotes index of agreement. Observational sites include 1, 5, 8, 9, 11, 14, 16, 17 and 19 for the coastal region and 3, 6, 12, 13 and 18 for foothill region in Figure K-7.

Region	Observed Mean	Modeled Mean	Mean Bias	Mean Error	IOA
		Wind Speed (m/s)			
Coast	1.99	2.09	0.10	0.39	0.95
Foothill	1.50	2.11	0.61	0.72	0.84
		Temperature (C)			
Coast	21.28	21.41	0.13	1.08	0.96
Foothill	24.75	23.25	-1.5	1.98	0.96
		Relative Humidity (%)			
Coast	70.50	72.59	2.09	6.59	0.92
Foothill	51.10	61.09	9.98	11.27	0.86

.

Table K-12
Same as Table K-11, but for the rest of June and July 2017

Region	Observed Mean	Modeled Mean	Mean Bias	Mean Error	IOA
		Wind Speed (m/s)			
Coast	2.08	2.24	0.16	0.41	0.95
Foothill	1.48	2.12	0.64	0.70	0.88
		Temperature (C)			
Coast	19.82	20.23	0.41	0.83	0.97
Foothill	21.02	20.31	-0.71	1.34	0.97
		Relative Humidity (%)			
Coast	77.43	77.07	-0.36	5.53	0.90
Foothill	67.56	74.48	6.92	9.26	0.89

Figure K-15
Daily maximum PBLH (a) during the ozone over-prediction period; (b) during the rest of June and July; and (c) differences between (b) and (a).
Stations 1 to 5 in panel (c) are the ozone monitoring sites at Camp Pendleton, Alpine-Victoria Drive, San Diego-Kearny Villa Road, Chula Vista, and Otay Mesa-Donovan, respectively.

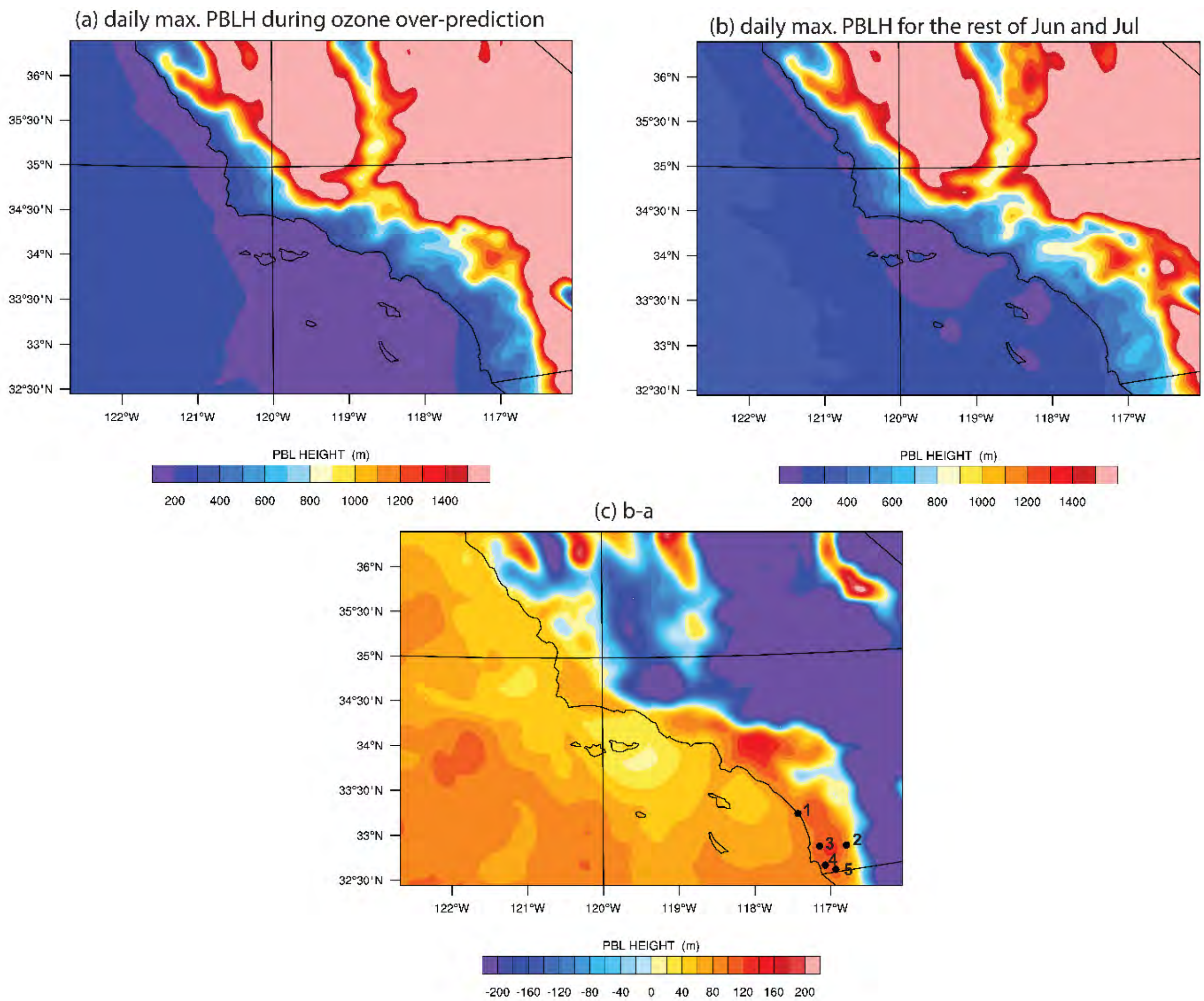


Figure K-16
Geopotential height (filled colors) and wind fields for the ozone over-prediction period (left panels) and the rest of June/July (right panels) for 500mb (top panels), 700mb (middle panels) and 850mb (lower panels).

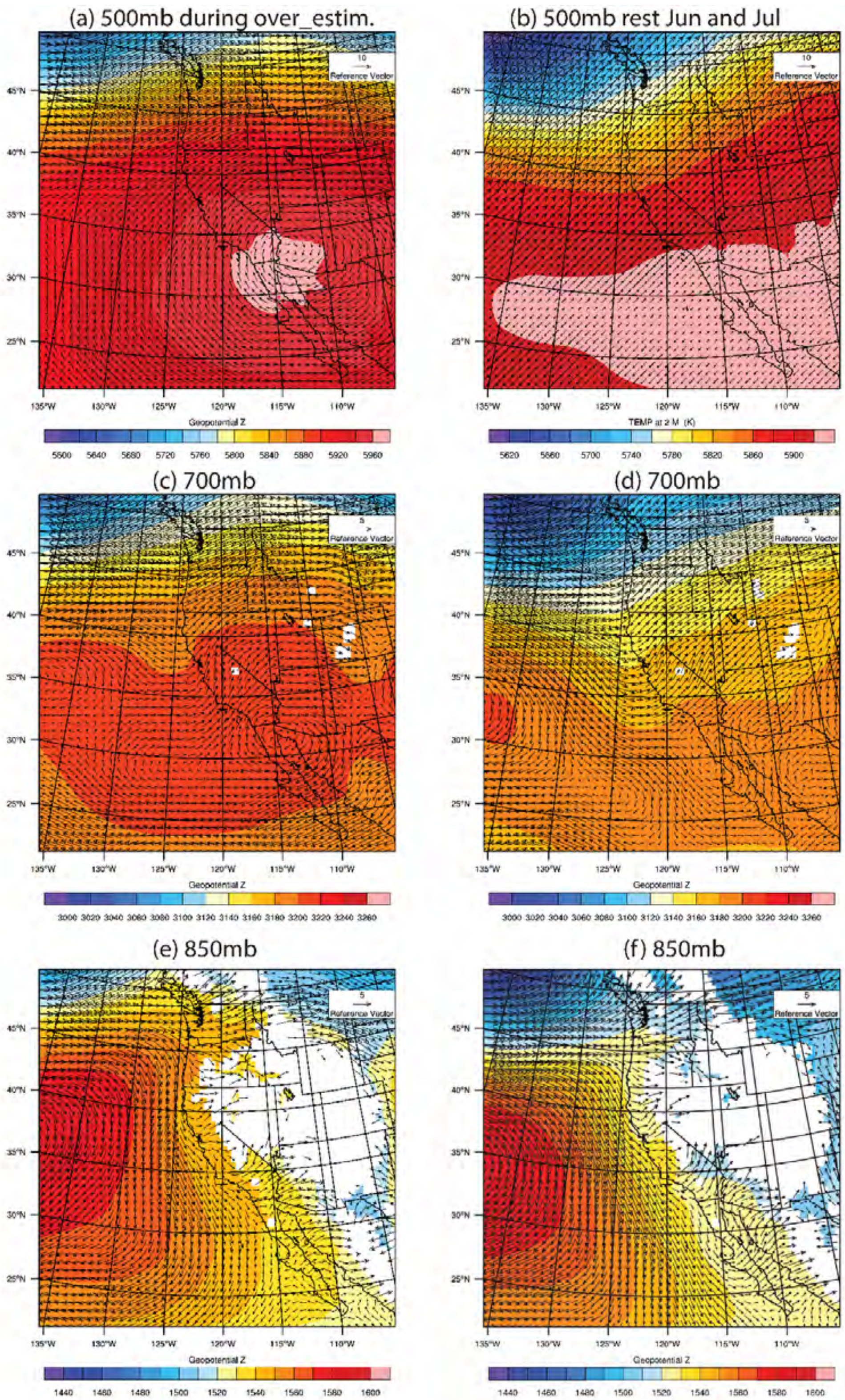
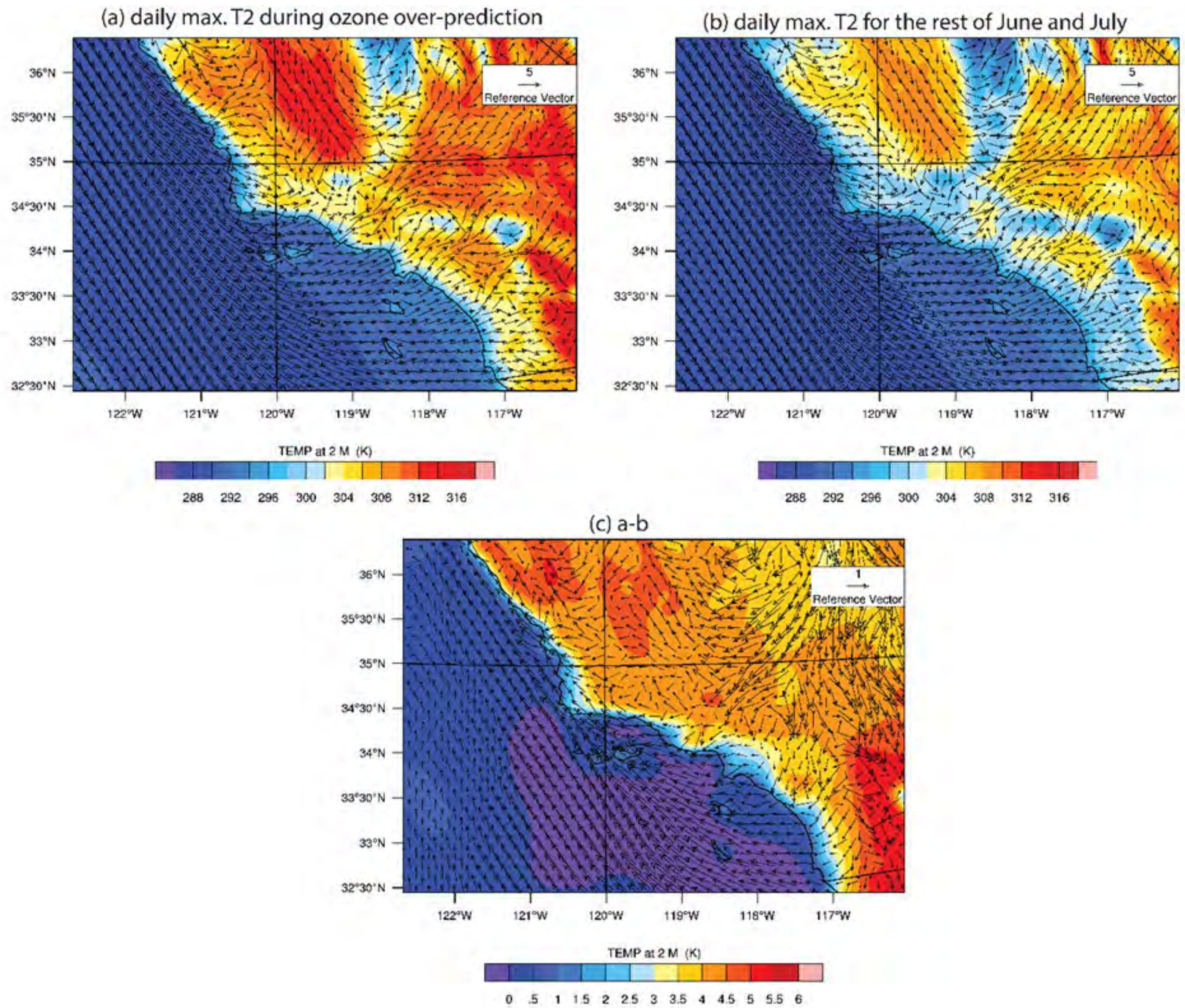


Figure K-17
Daily maximum temperature at 2 meters above ground level (T2; filled color), and wind field (vectors) (a) during the ozone over-prediction period; (b) during the rest of June/July; and (c) differences between (a) and (b).



K.3.3 Sensitivity to Emissions from South Coast and Mexico

As San Diego County is located in relatively close proximity to large emissions source regions to the north in the South Coast Air Basin (SCAB) and to the south in Tijuana, Mexico, the impact of emissions from both regions on ozone in San Diego was investigated. Two brute force sensitivity simulations were performed, where the anthropogenic emissions from within the SCAB or Mexico were removed (zeroed out) from the base year 2017 emission inventories. The simulated MDA8 ozone mixing ratios from these sensitivity simulations are shown in Figure K-18 for all sites. The observations are shown as black markers (circles), while the base model prediction (including all emissions) is shown in blue, the zero out Mexico emissions case is shown in red, and the zero out SCAB emissions case is shown in green.

As shown in Figure K-18, the anthropogenic emissions from both South Coast and Mexico have a limited impact on peak simulated ozone at Alpine. At the coastal sites, the impact from South Coast emissions is generally small, but emissions from Mexico can be significant on some days. However, during the mid-June to mid-July time period, when ozone was over-predicted along the coast, the impact from Mexico emissions is generally small on days with the highest ozone.

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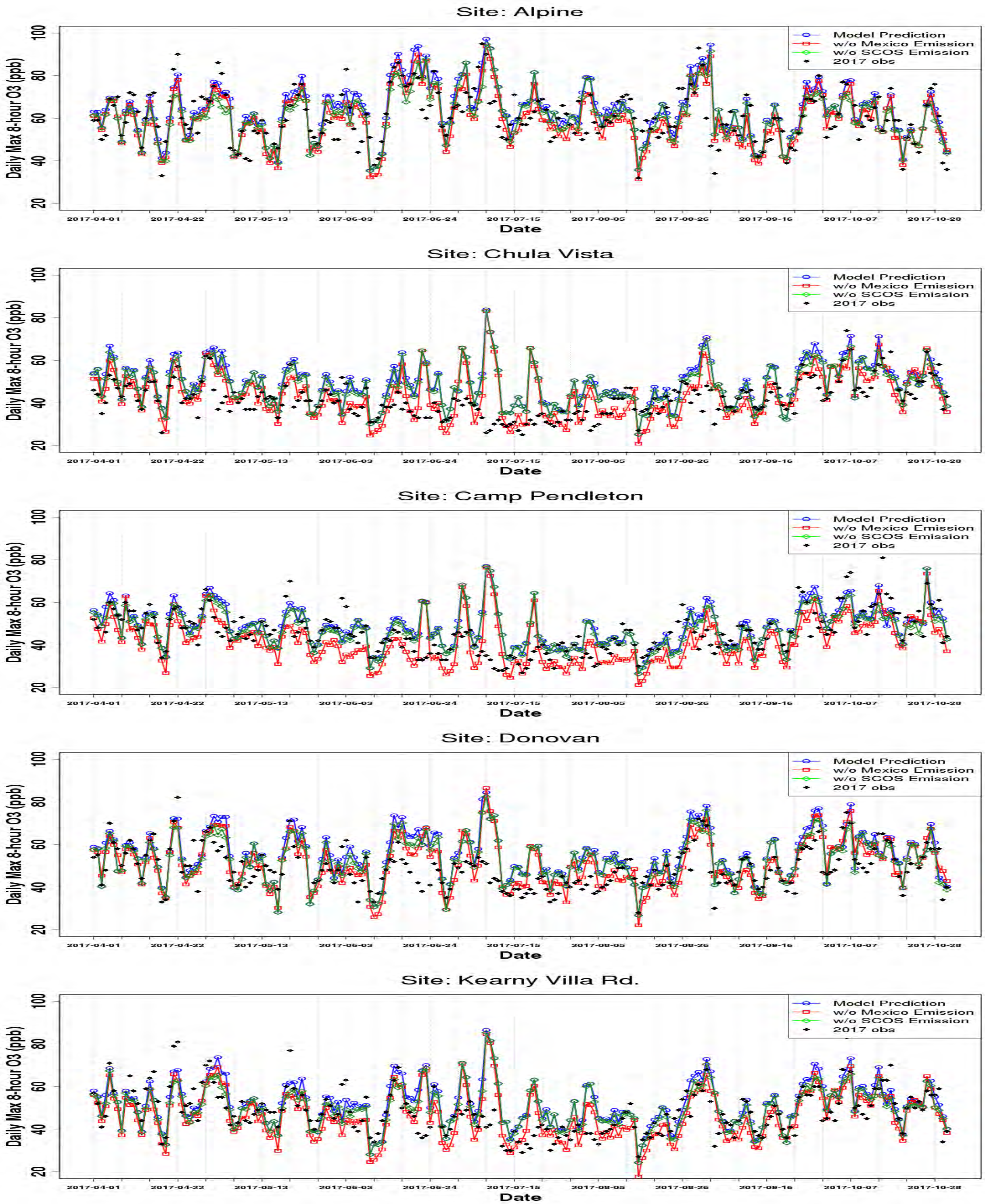
Figure K-18
Comparison between observation, simulated MDA8 ozone, and MDA8 ozone from sensitivity runs at the five sites in the San Diego Air Basin.
Observed values are shown in black, while the base case modeling (all emissions) is shown in blue, the zero out Mexico emissions case is shown in red, and the zero out SCAB emissions is shown in green.



K.3.4 Future Design Values

The RRFs and the future year 2026 and 2032 design values for the five sites in the San Diego air basin are summarized in Table K-13 and Table K-14, respectively. Since two different reference design values were calculated, one representing the average of design values from 2016, 2017, and 2018, and the other representing the average of design values from 2017, 2018, and 2019, two sets of future year design values were calculated for both year 2026 and year 2032. Note that the approach to calculate two reference design values was chosen because at the time of this analysis, the 2019 ozone monitoring data was not yet finalized and could not be used in official design value calculations. However, it was likely that the 2019 data would be finalized as is and that the data would be finalized by the time the SIP was submitted to US EPA. Since the 2019 design value is slightly higher than the 2016 design value, it was important to show that the model attainment demonstration would show attainment for the higher reference design value, which is why both reference design values are shown.

For future year 2026, as shown in Table K-13, all the monitoring sites in the San Diego air basin have predicted design values below the 75 ppb (0.075 ppm) standard, regardless of which reference design value is utilized. The design site at Alpine, exhibits the highest future design value of 74 ppb. Therefore, the attainment demonstration predicts that all sites within the San Diego air basin will attain the 75 ppb 8-hour ozone standard by 2026.

The results in Table K-14 further show that the predicted design values of all the monitoring sites in the San Diego air basin are below the 70 ppb standard, with the highest value of 70 ppb at the Alpine design site, regardless of which reference design value is used (note that the form of the standard allows the future year design value to be as high as 70.9 ppb and still be in attainment of the standard). Therefore, the attainment demonstration predicts that all sites within the San Diego air basin will attain the 70 ppb 8-hour ozone standard by 2032.

Table K-13
Summary of reference year design values (DV_R), RRFs, and future year 2026 design values DV_F for each site in the San Diego air basin.

Site/Monitor	DV_R [ppb]		RRF	DV_F [ppb] 2026	
	(2016-2018)	(2017-2019)		DV_R (2016-2018)	DV_R (2017-2019)
Alpine	83.0	83.3	0.8953	74	74
Chula Vista	61.0	61.3	0.9946	60	61
Camp Pendleton	68.0	65.7	0.9791	67	65
Otay Mesa - Donovan	68.3	67.3	0.9682	66	65
San Diego – Kearny	70.0	71.0	0.9581	67	68

Table K-14
Summary of reference year design values (DV_R), RRFs, and future year 2032 design values DV_F for each site in the San Diego air basin.

Site/Monitor	DV_R [ppb]		RRF	DV_F [ppb] 2032	
	(2016-2018)	(2017-2019)		DV_R (2016-2018)	DV_R (2017-2019)
Alpine	83.0	83.3	0.8509	70	70
Chula Vista	61.0	61.3	0.997	60	61
Camp Pendleton	68.0	65.7	0.9726	67	64
Otay Mesa - Donovan	68.3	67.3	0.9537	65	64
San Diego – Kearny	70.0	71.0	0.9351	65	66

K.3.5 NOx Sensitivity Analysis

To help define the magnitude of additional emissions reductions off the 2032 future base year inventory (without District and CARB commitments) needed to attain the 70 ppb standard, a sensitivity simulation was conducted, where NO_x emissions in the San Diego air basin were reduced by 10% and the model response to those reductions was calculated. Table K-15 shows the results of that sensitivity simulation.

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Table K-15
Summary of reference year design values (DV_R), future year 2032 design values DV_F^*, and future year 2032 design values DV_F^* with 10% NOx reduction for each site in the San Diego air basin.

Site	DV_R [ppb] (2016-2018)	DV_F^* [ppb]	DV_F^* [ppb] w/10% NO_x reduction
Alpine	83.0	71.1	69.9
Chula Vista	61.0	60.7	60.8
Camp Pendleton	68.0	67.2	67.1
Otay Mesa - Donovan	68.3	65.3	65.0
San Diego – Kearny	70.0	65.6	65.3

** The 2032 design value calculation is based on future year base emission inventory, where there is no district and CARB commitments, as shown in Table K-4.*

K.3.6 Unmonitored Area Analysis

The unmonitored area analysis was conducted to estimate the design values at unmonitored locations. U.S. EPA recommends combining spatially interpolated design value fields with modeled ozone gradients and grid-specific RRFs in order to generate gridded future year gradient adjusted design values. Under U.S. EPA's modeling guidance ARB in-house R codes were developed and were utilized in this analysis.

The unmonitored area analysis was conducted using the 8-hr O_3 reference DVs (2016-2018) from all the available sites that fall within the 4 km inner modeling domain along with the reference year 2017 and future year 2026 (2032) 4 km CMAQ model output. The steps followed in the unmonitored area analysis are as follows:

Step 1: For each grid cell, calculate the average of the top-10 modeled maximum daily average 8-hour ozone concentrations from the reference year simulation.

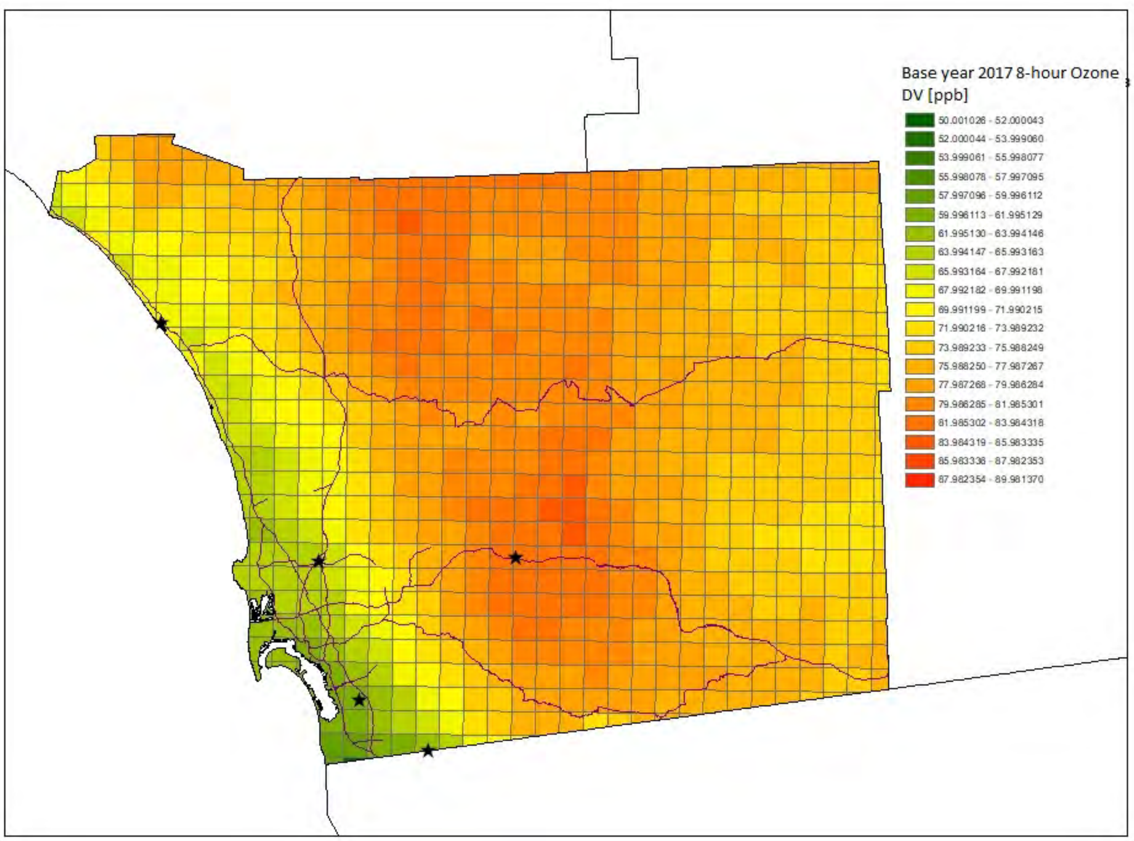
Step 2: Interpolate the monitor-specific weighted base-year DVs to an unmonitored grid cell using normalized inverse distance squared weightings for all monitors within a grid cell's Voronoi Region (calculated with the R tripack library), and adjusted based on the ozone gradient between the grid cell and the corresponding monitor from Step 1.

Step 3: For each grid cell, calculate an RRF based on the reference- and future year modeling following the same approach outlined in Section 2.5, except that the +/- 20% limitation on the simulated and observed maximum daily average 8-hour ozone is not applicable because observed data do not exist for grid cells in unmonitored areas.

Step 4: Multiply the gradient-adjusted interpolated DVs from Step 2 by the gridded RRFs from Step 3 to calculated future-year gridded DVs.

Figure K-19 illustrates the spatial distribution of the 2016-2018 DV_R values. The monitor locations of the five ozone sites in the San Diego air basin are depicted with black stars. The peak ozone values are shown to occur in the center (surrounding the Alpine monitor) and northern parts of basin.

Figure K-19
Interpolated 2016-2018 reference design values.
Monitoring stations are notated with black stars.



The county wide relative response factors (RRFs) for the 2026 and 2032 model simulations are presented in Figure K-20 and Figure K-21, respectively. The RRF plots suggest that ozone in both future years will decrease faster in the inland areas of San Diego compared to the coastal region and the region bordering Imperial County to the east.

The predicted future ozone levels for 2026 and 2032 are shown in Figure K-22 and Figure K-23, respectively. The unmonitored area analyses show that peak ozone tends to occur in the region surrounding the Alpine monitor and therefore the location of the Alpine monitor accurately represents the regional peak ozone. For the 2026 analysis, there are higher ozone levels to the north of the air basin, which are not seen in the 2032 analysis. This is likely due to the fact that the 2026 emissions do not reflect CARB commitments to on-road mobile sources, while those commitments are reflected in the 2032 analysis.

Figure K-20
2026 RRF fields.
Monitoring stations are notated with black stars.

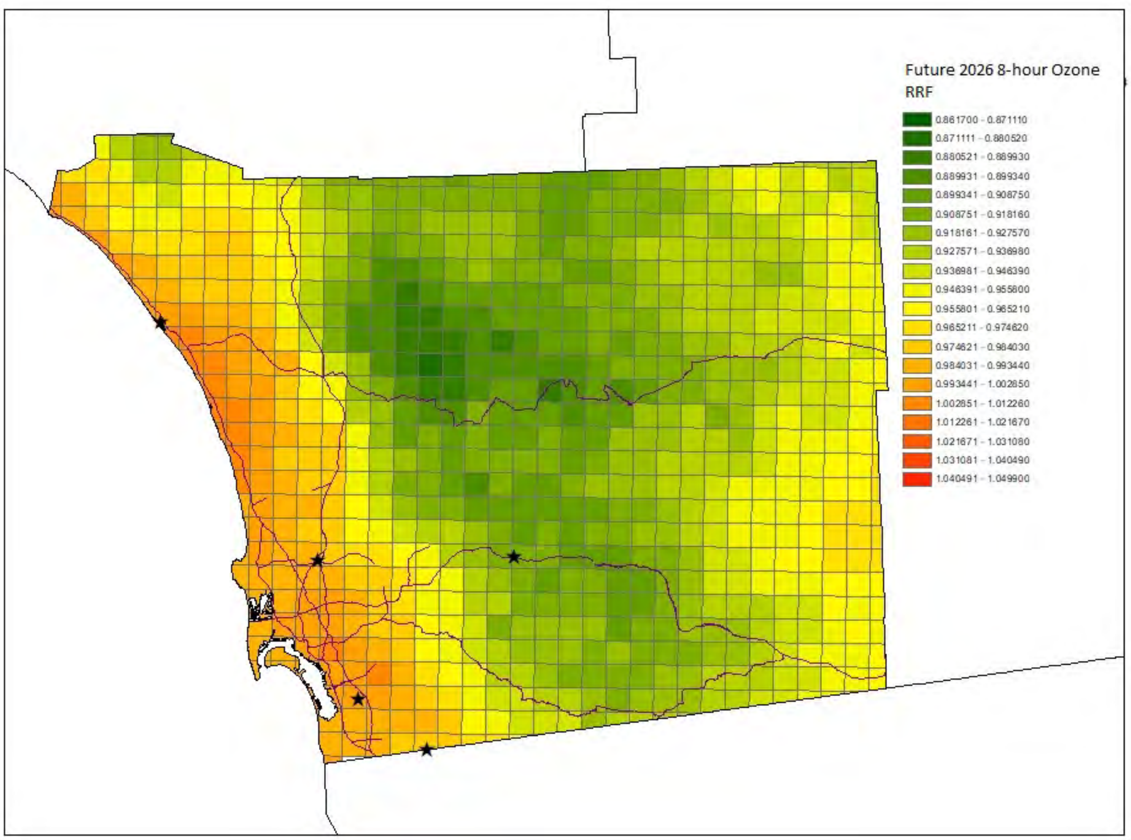


Figure K-21
2032 RRF fields.
Monitoring stations are notated with black stars.

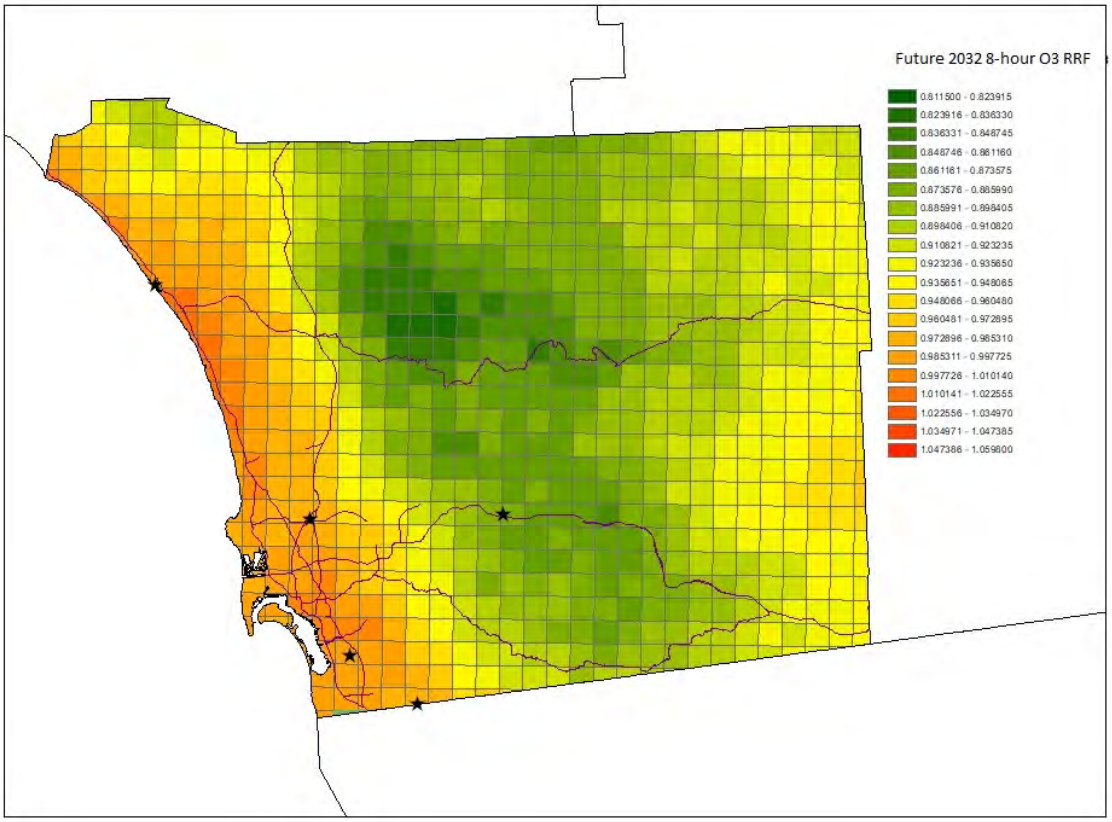


Figure K-22
2026 predicted 8-hour ozone design values.
Monitoring stations are notated with black stars.

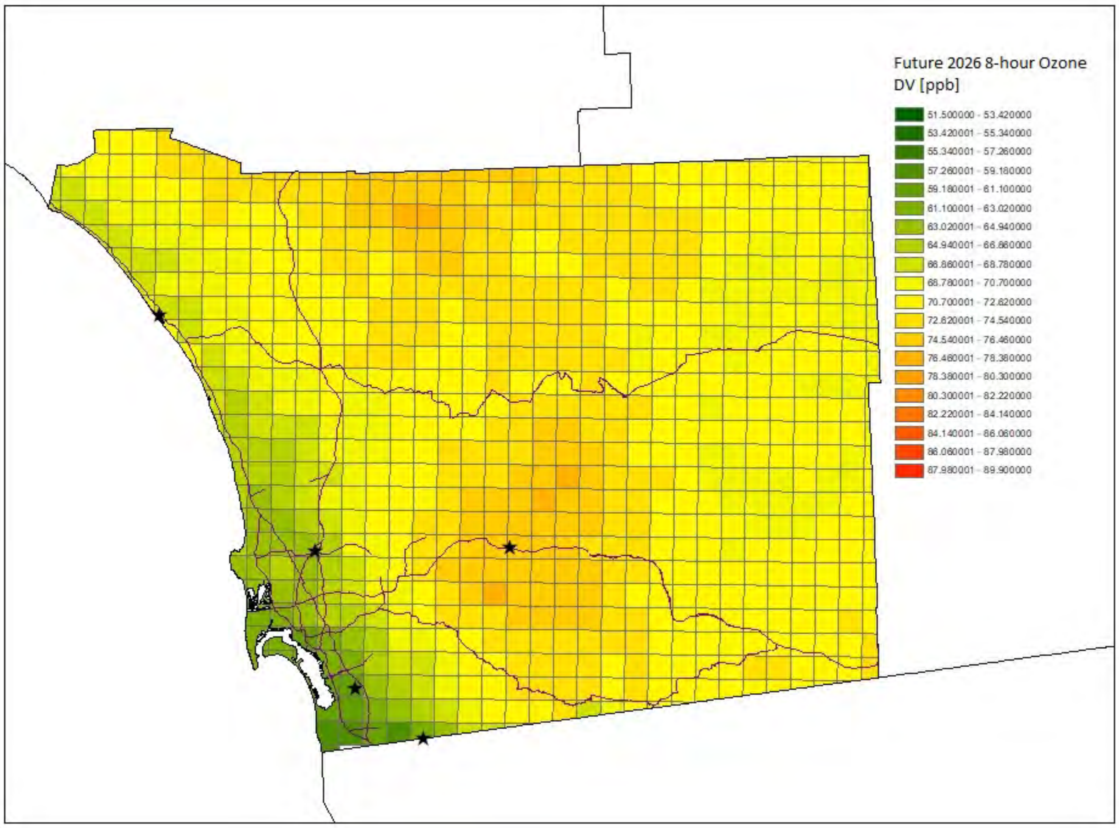
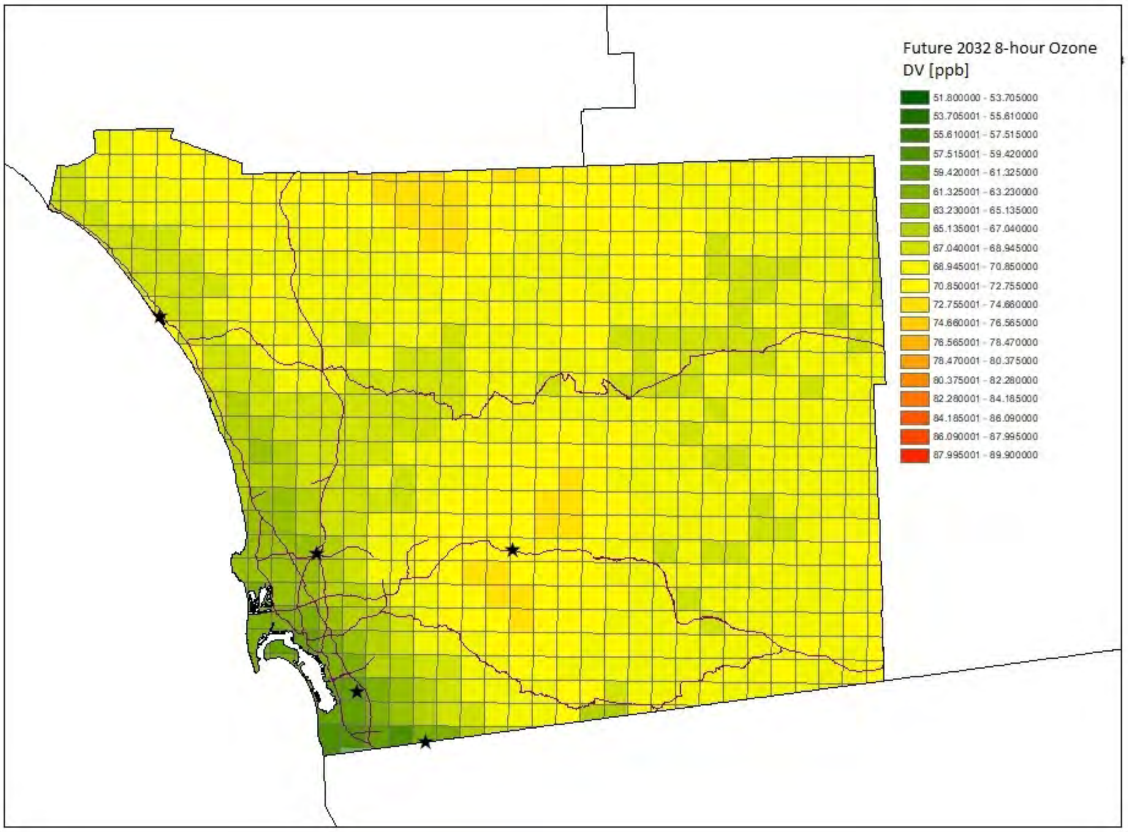


Figure K-23
2032 predicted 8-hour ozone design values.
Monitoring stations are notated with black stars.



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SUPPLEMENTS

Figure K-S.1
Time series of average temperature, relative humidity and wind speed of all sites in April 2017.

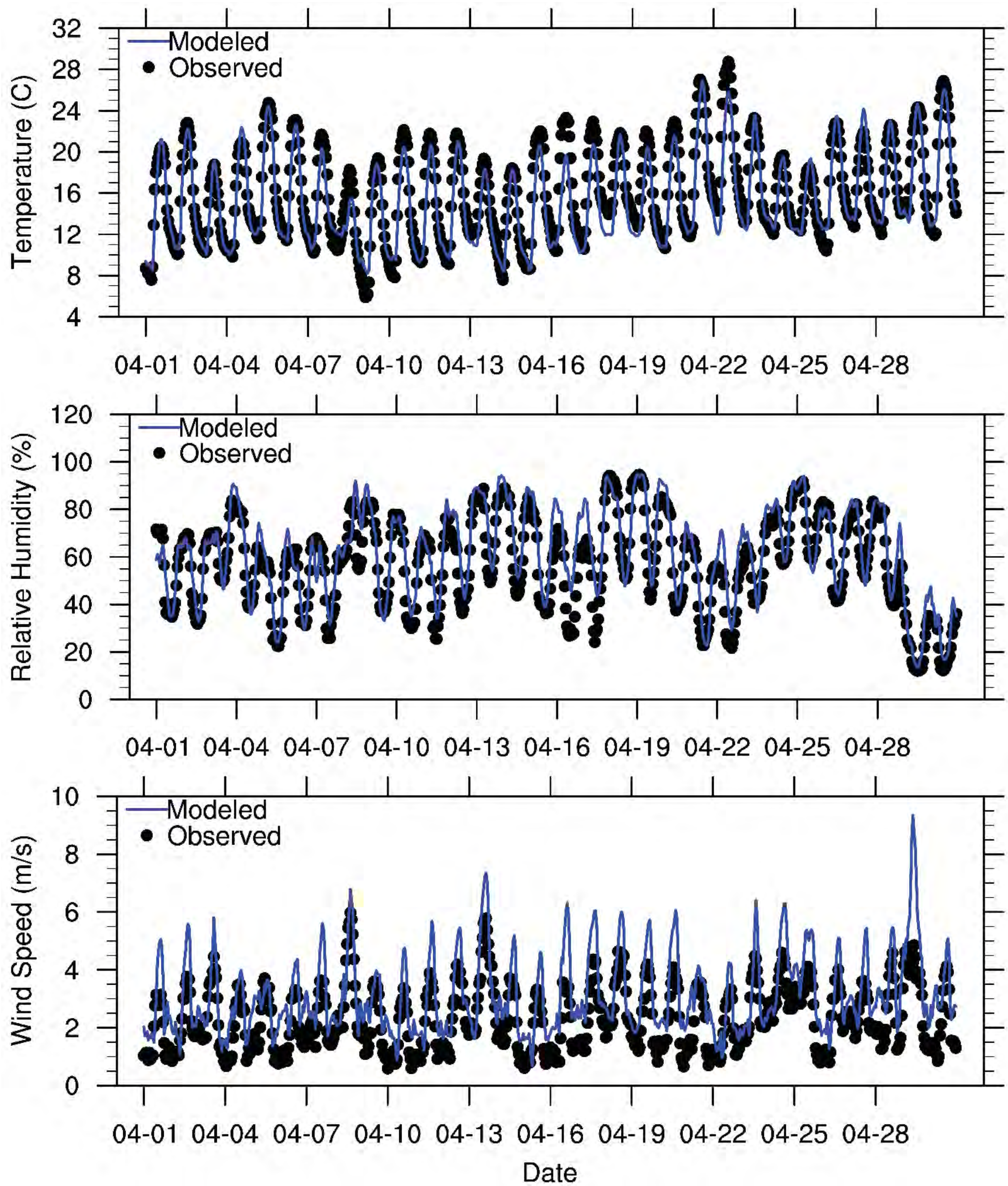

Figure K-S.2
Time series of average temperature, relative humidity and wind speed of all sites in May 2017.

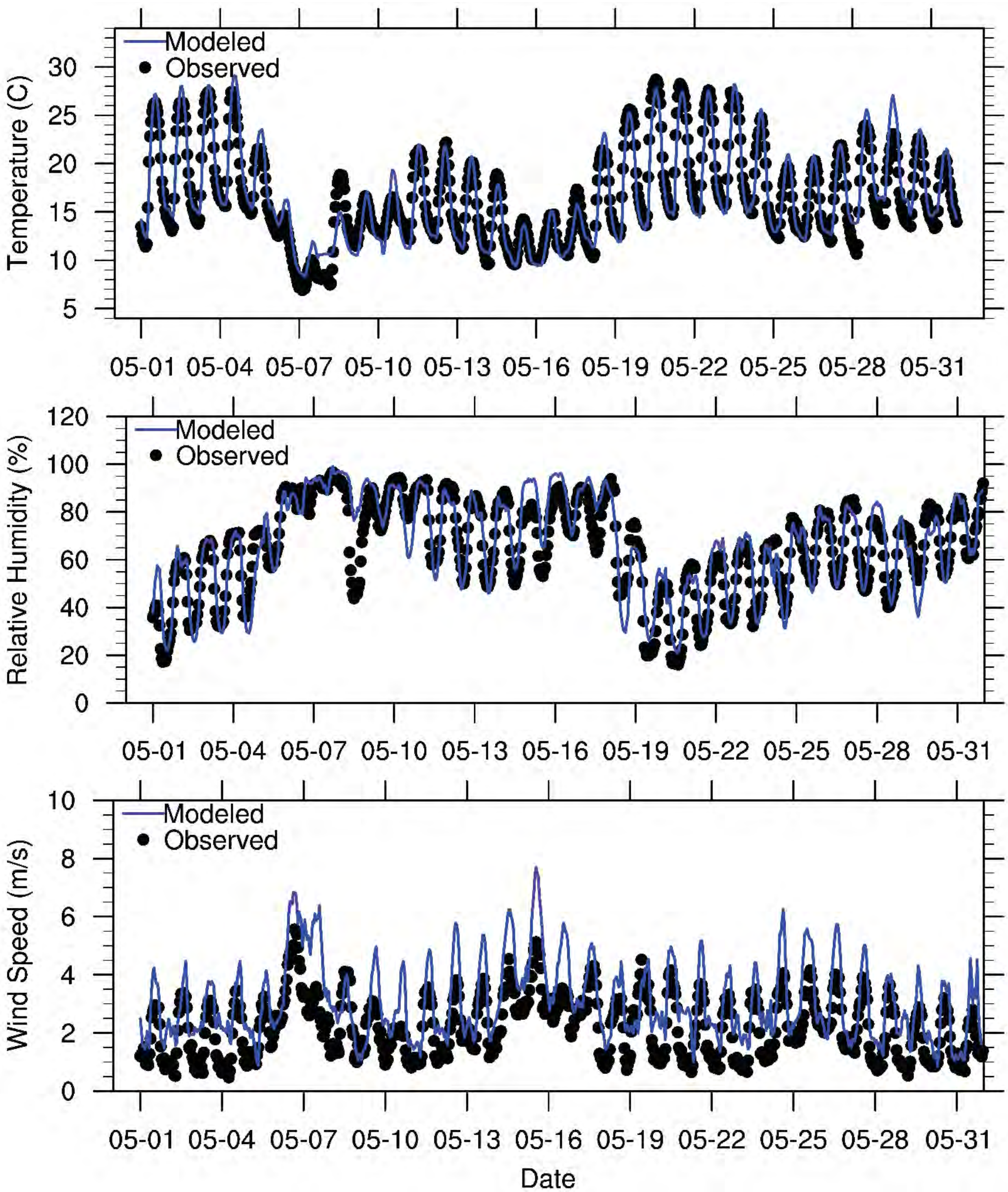

Figure K-S.3
Time series of average temperature, relative humidity and wind speed of all sites in June 2017.

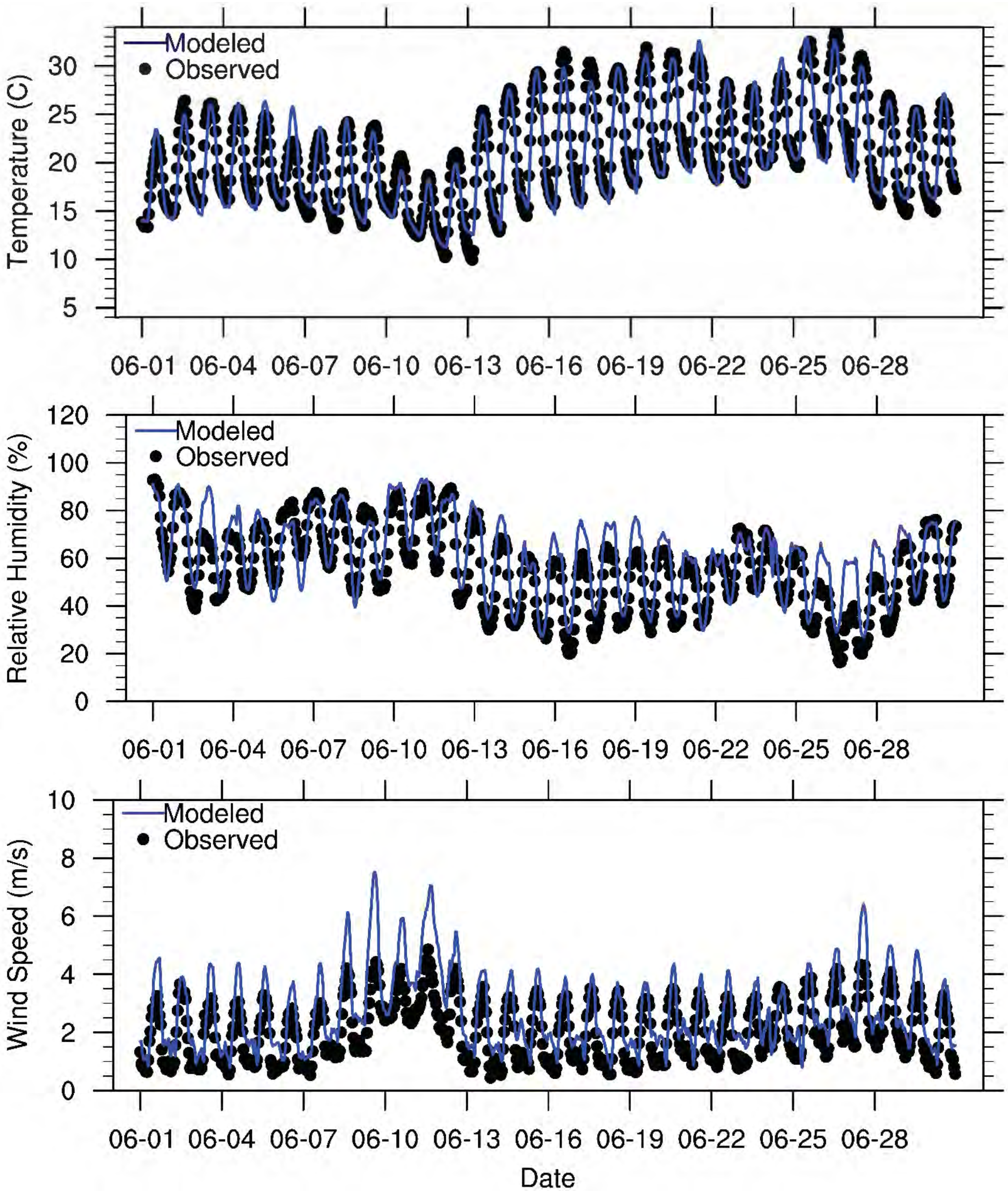

Figure K-S.4
Time series of average temperature, relative humidity and wind speed of all sites in July 2017.

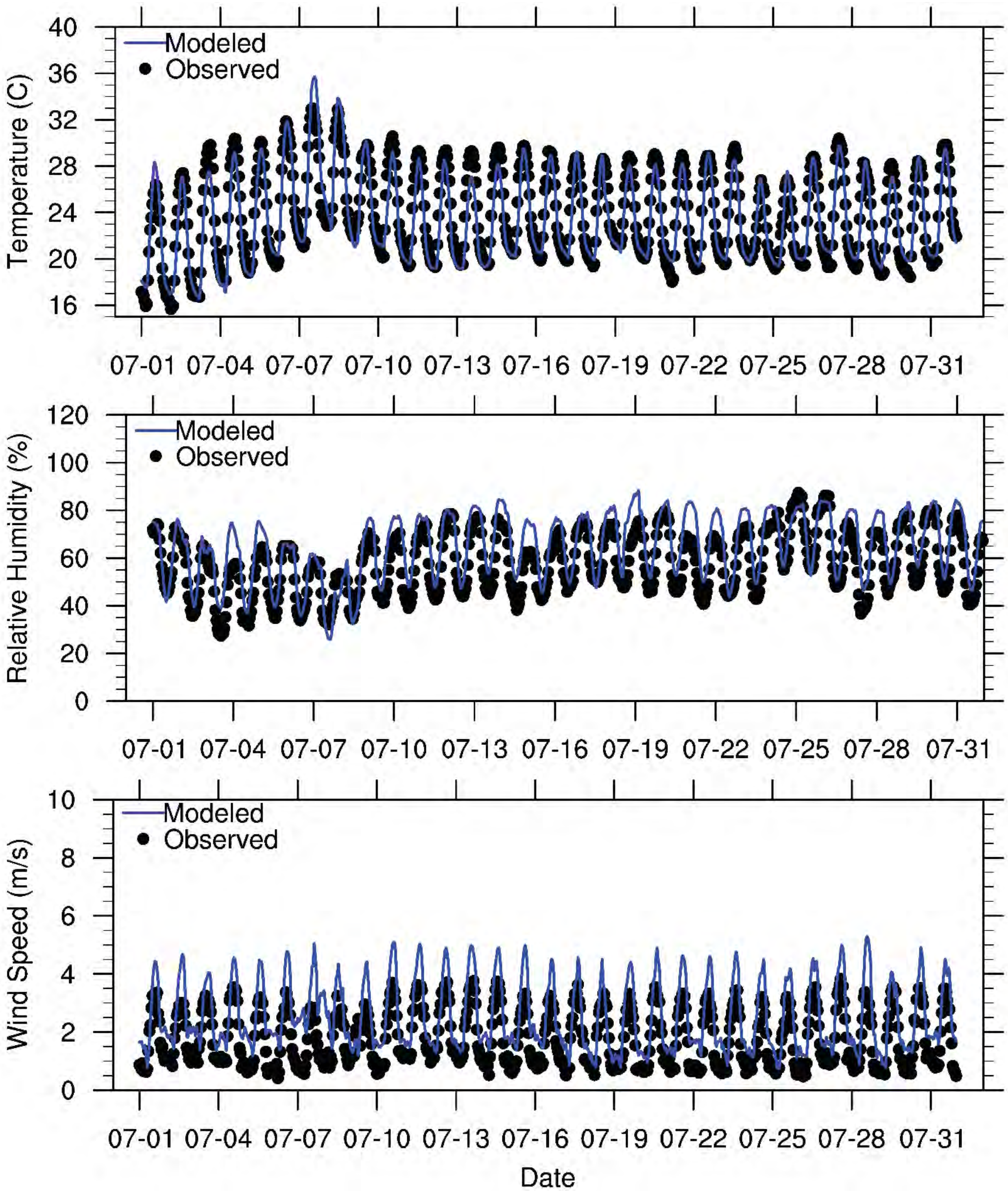

Figure K-S.5
Time series of average temperature, relative humidity and wind speed of all sites in August 2017.

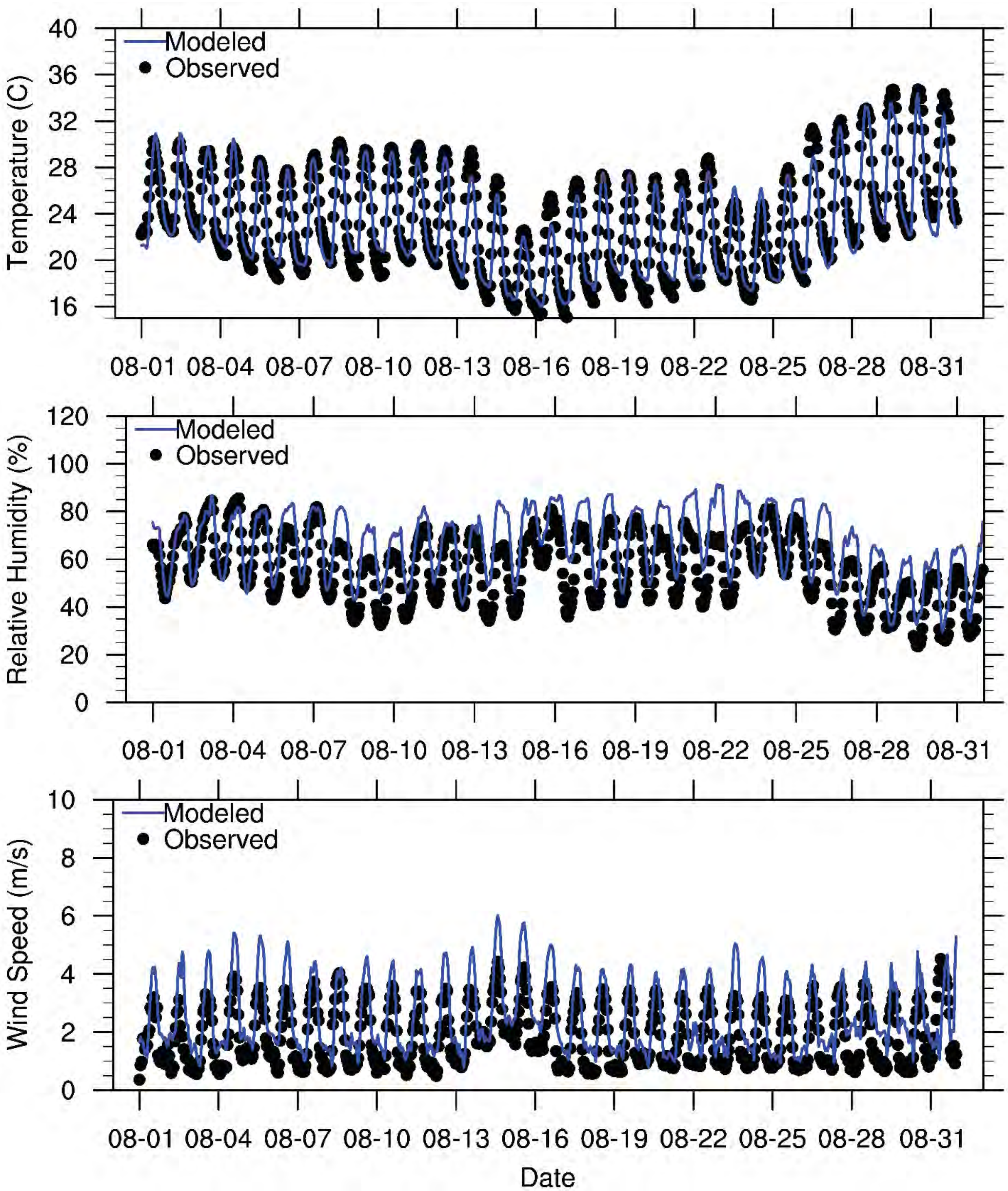

Figure K-S.6
Time series of average temperature, relative humidity and wind speed of all sites in September 2017

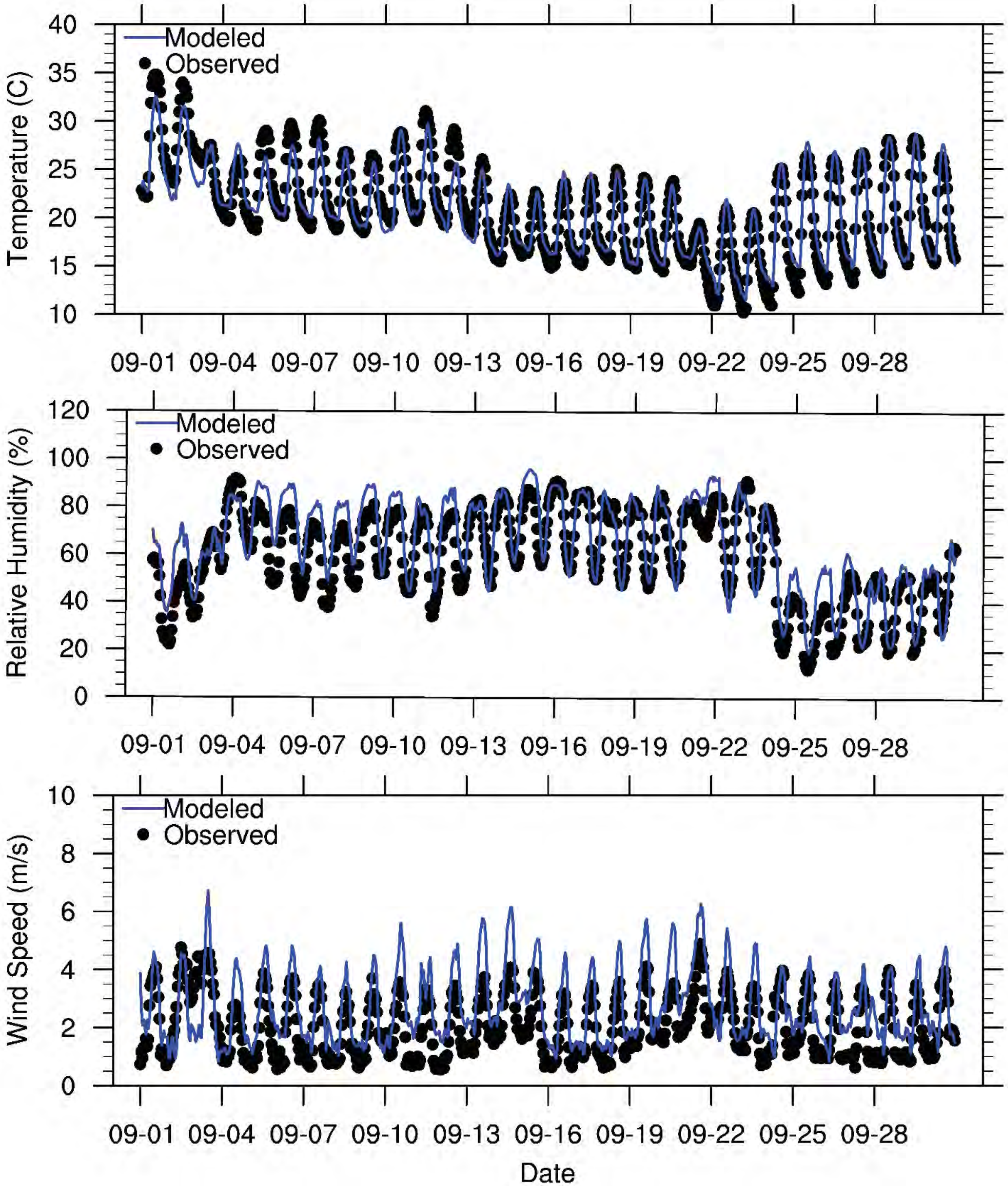

Figure K-S.7
Time series of average temperature, relative humidity and wind speed of all sites in October 2017.

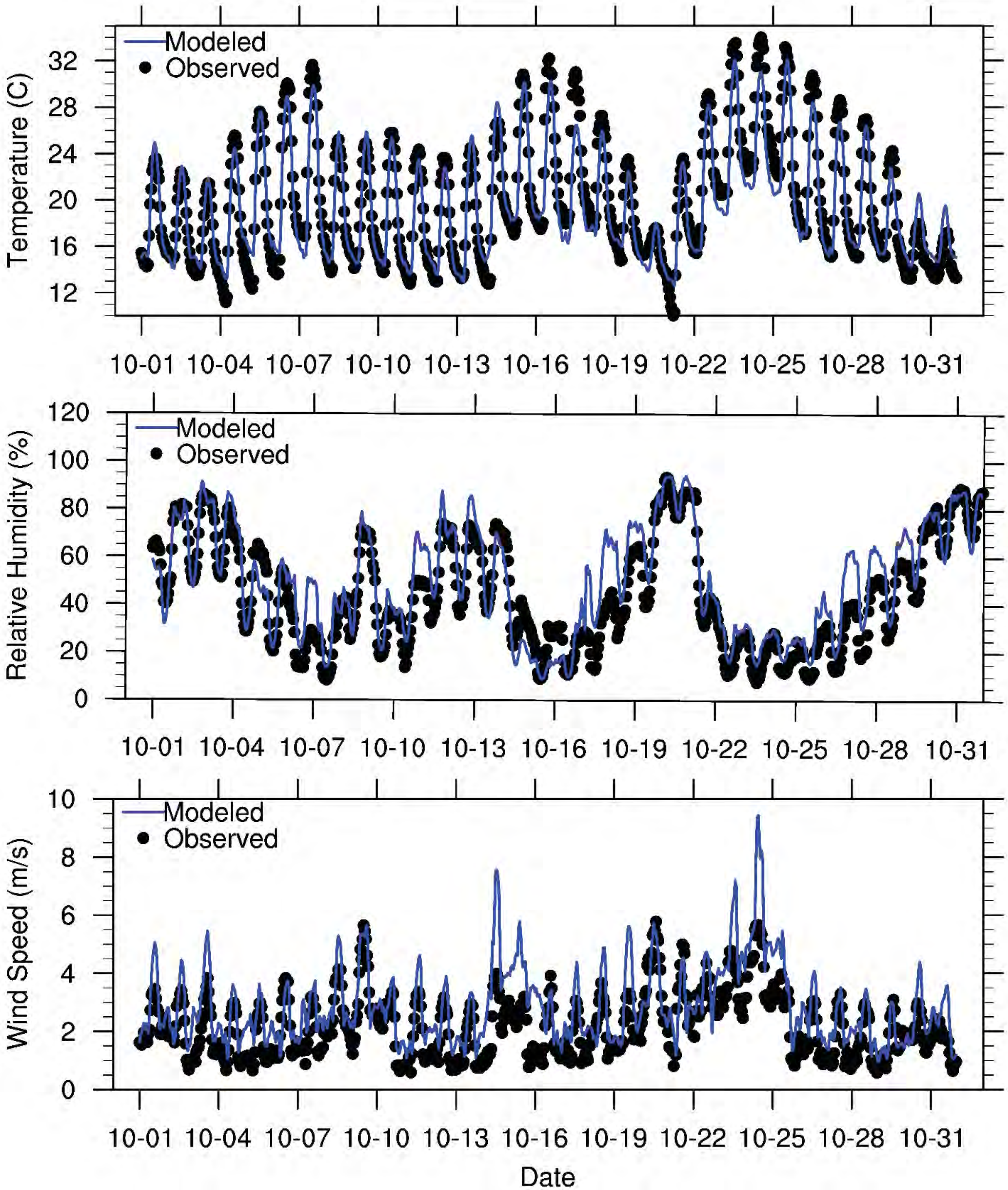

Figure K-S.8
Time series plots of hourly NO2 concentration [ppb] of April 2017 at all 5 sites in San Diego Air District.
Blue dots and lines represent model outputs, and red dots represent observations.

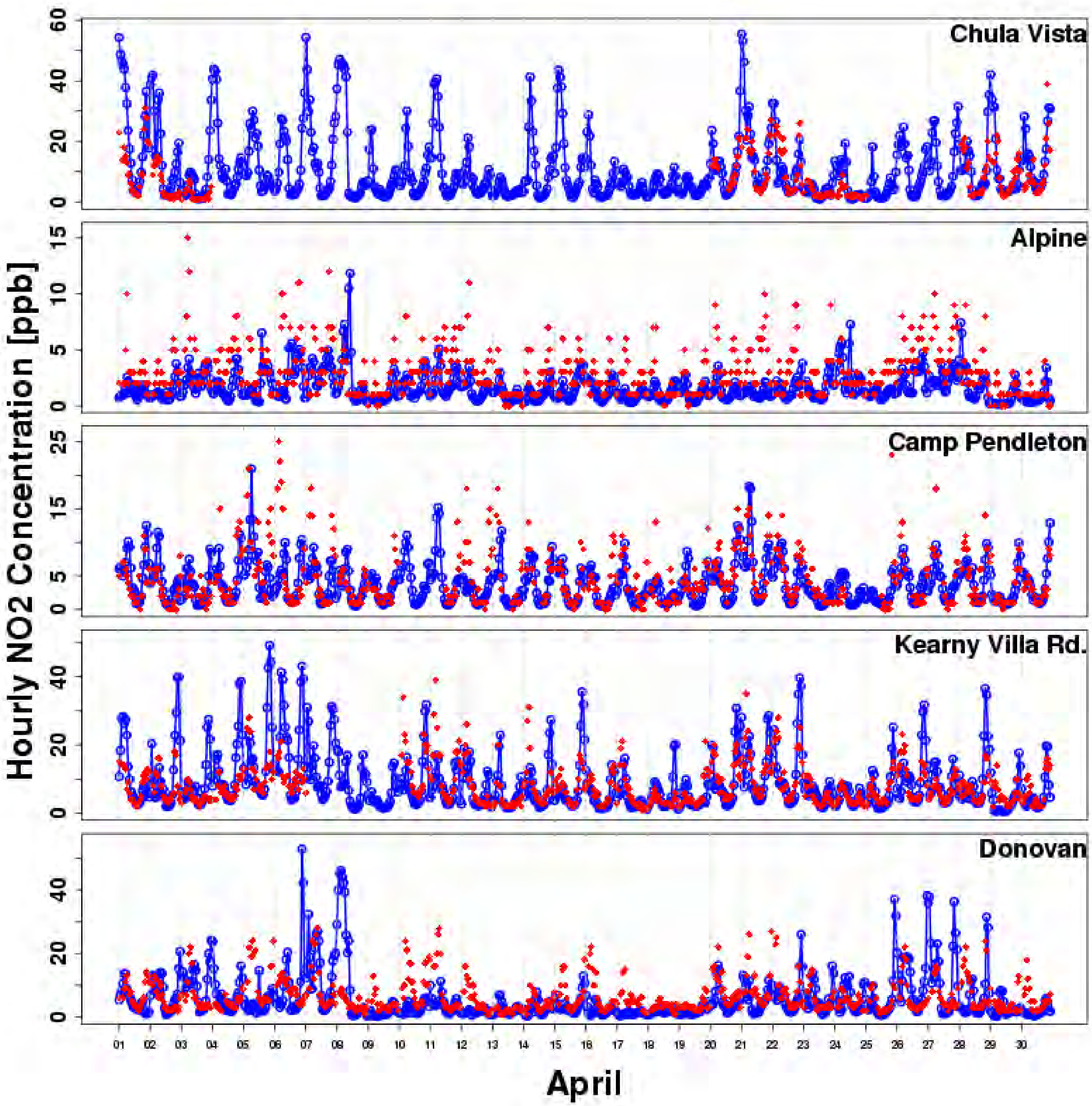

Figure K-S.9
Time series plots of hourly NO2 concentration [ppb] of May 2017 at all 5 sites in San Diego Air District.
Blue dots and lines represent model outputs, and red dots represent observations.

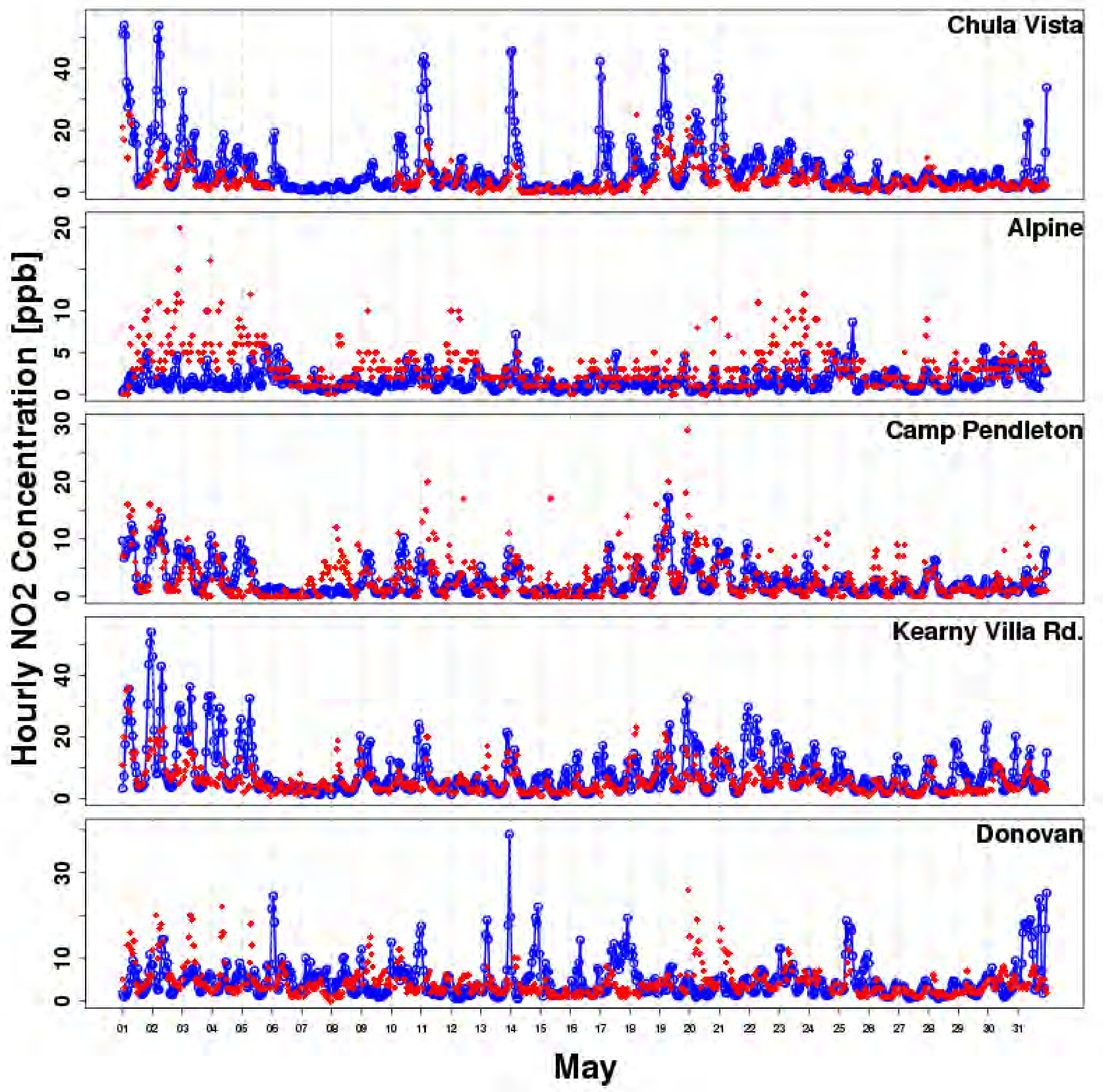

Figure K-S.10
Time series plots of hourly NO2 concentration [ppb] of June 2017 at all 5 sites in San Diego Air District.
Blue dots and lines represent model outputs, and red dots represent observations.

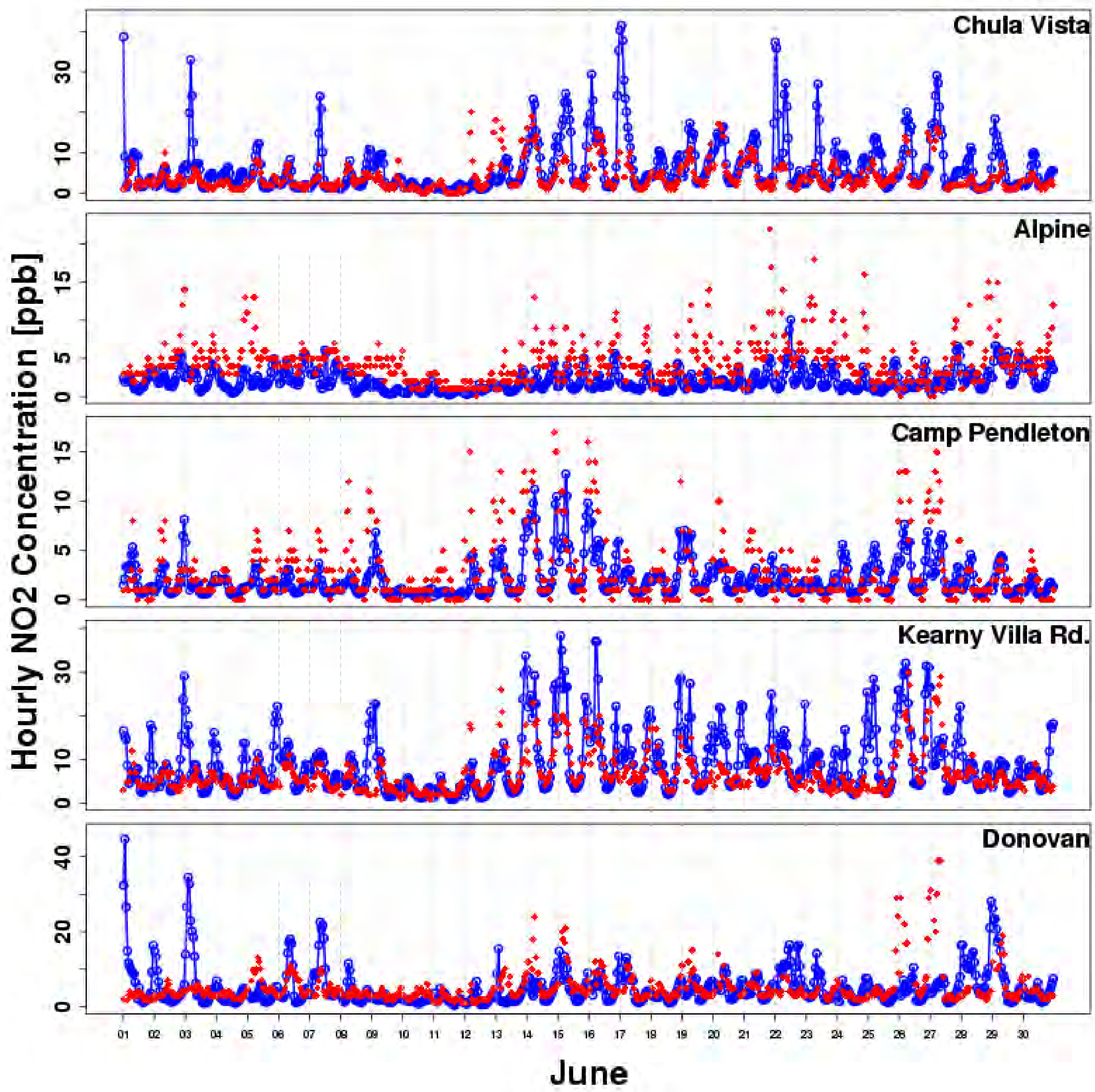

Figure K-S.11
Time series plots of hourly NO2 concentration [ppb] of July 2017 at all 5 sites in San Diego Air District[184]
Blue dots and lines represent model outputs, and red dots represent observations.

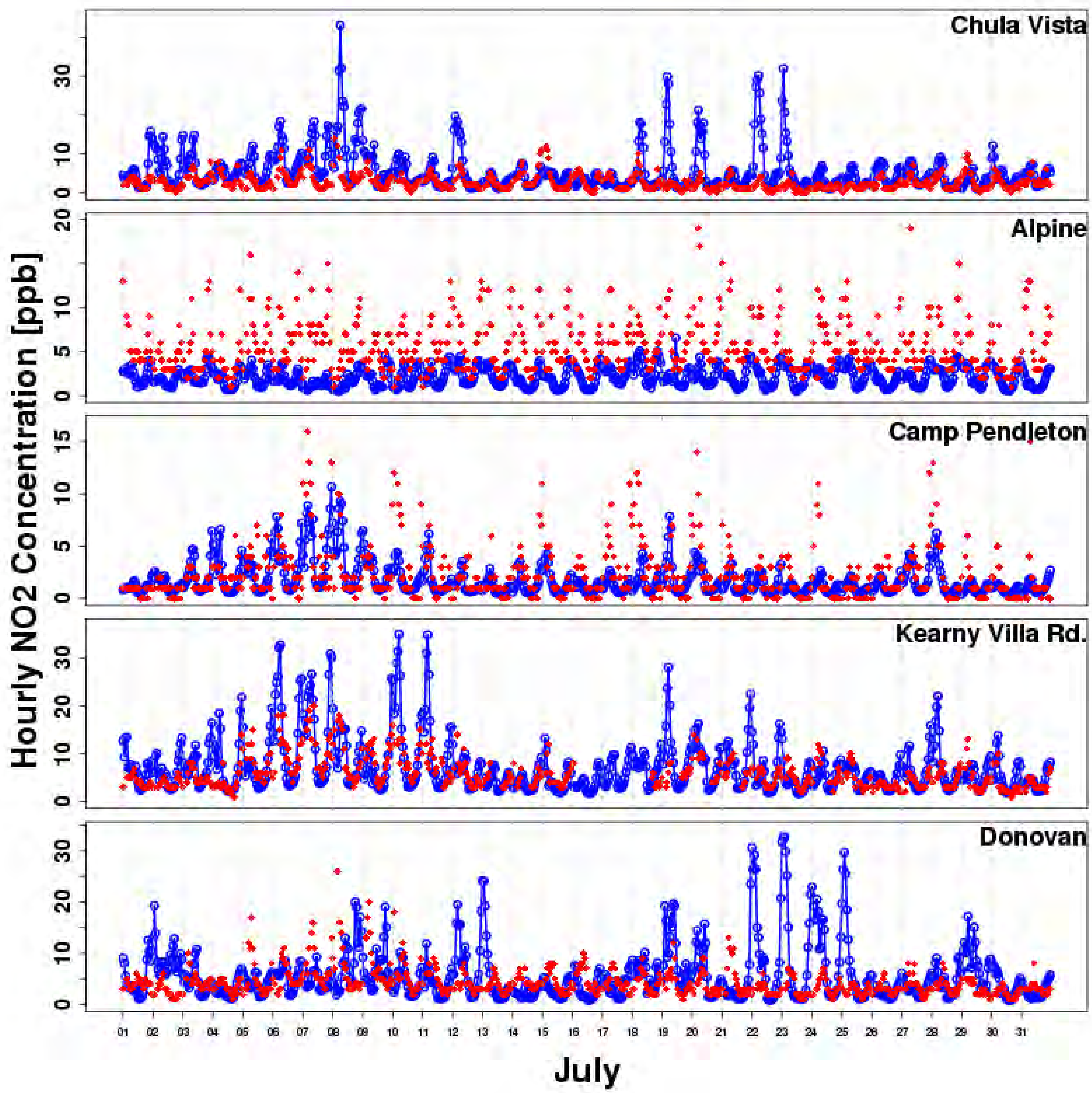

Figure K-S.12
Time series plots of hourly NO2 concentration [ppb] of August 2017 at all 5 sites in San Diego Air District.
Blue dots and lines represent model outputs, and red dots represent observations.

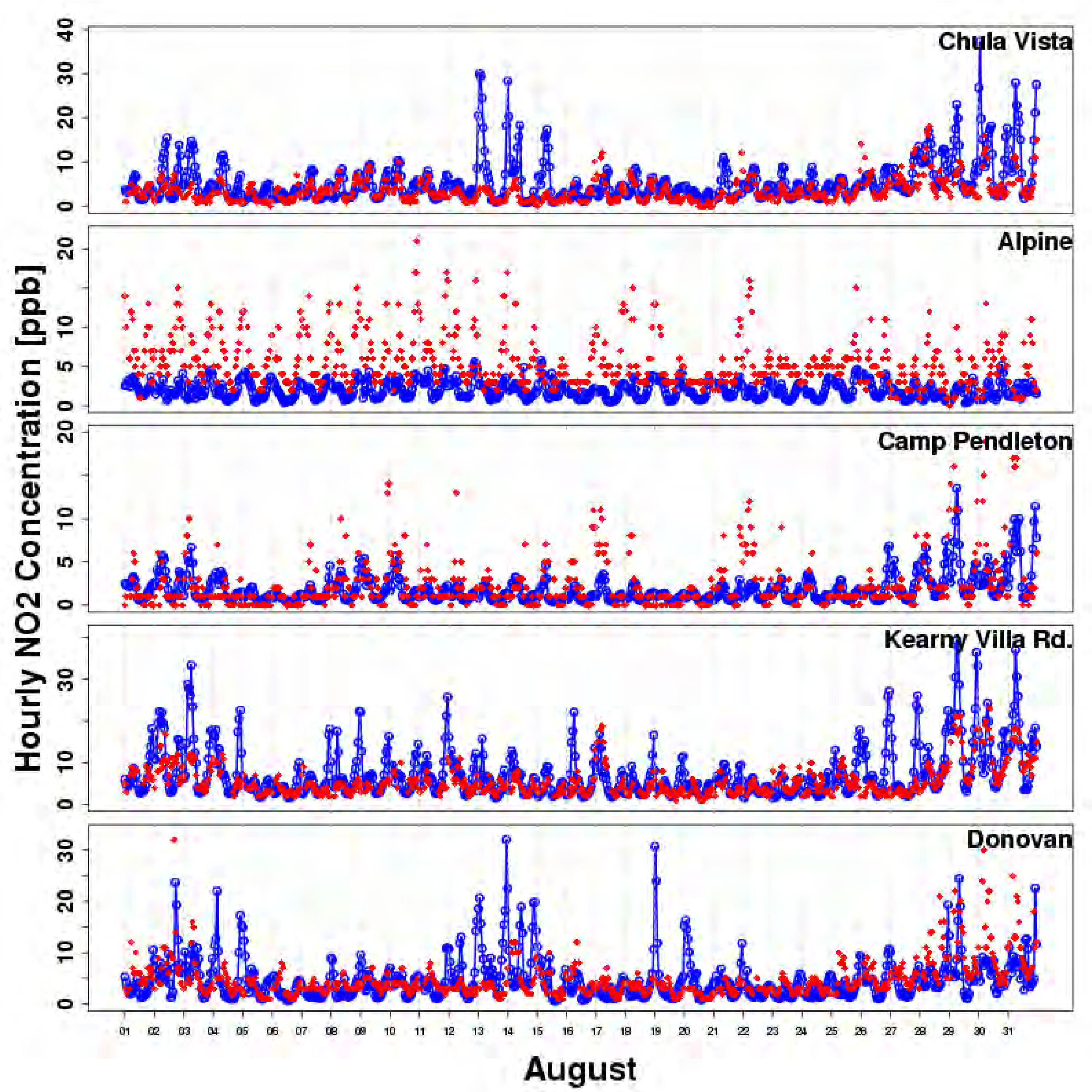

Figure K-S.13
Time series plots of hourly NO2 concentration [ppb] of September 2017 at all 5 sites in San Diego Air District.
Blue dots and lines represent model outputs, and red dots represent observations.

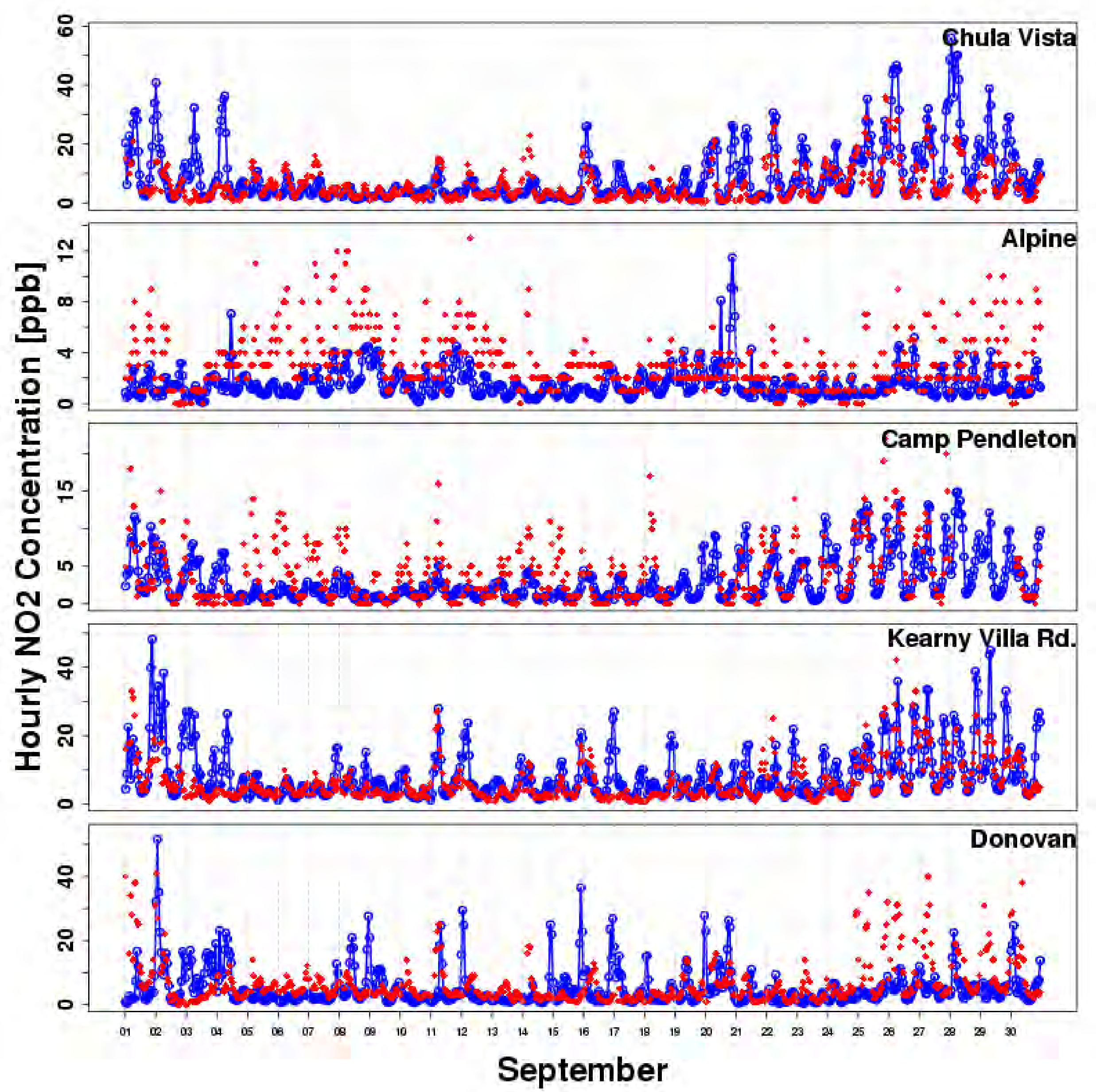

Figure K-S.14
Time series plots of hourly NO2 concentration [ppb] of October 2017 at all 5 sites in San Diego Air District.
Blue dots and lines represent model outputs, and red dots represent observations.

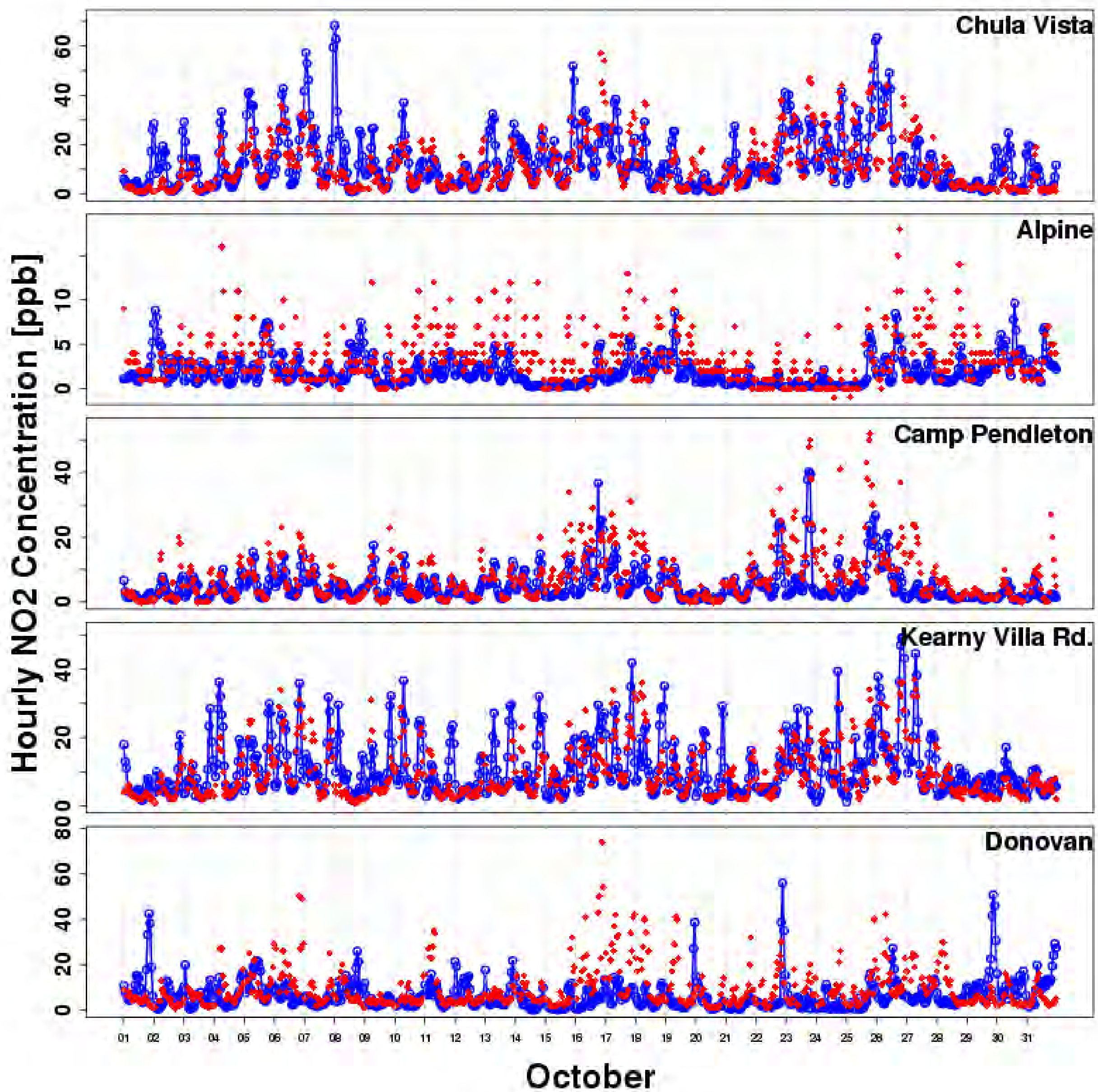

Figure K-S.15
Time series plots of hourly NOx concentration [ppb] of April 2017 at all 5 sites in San Diego Air District.
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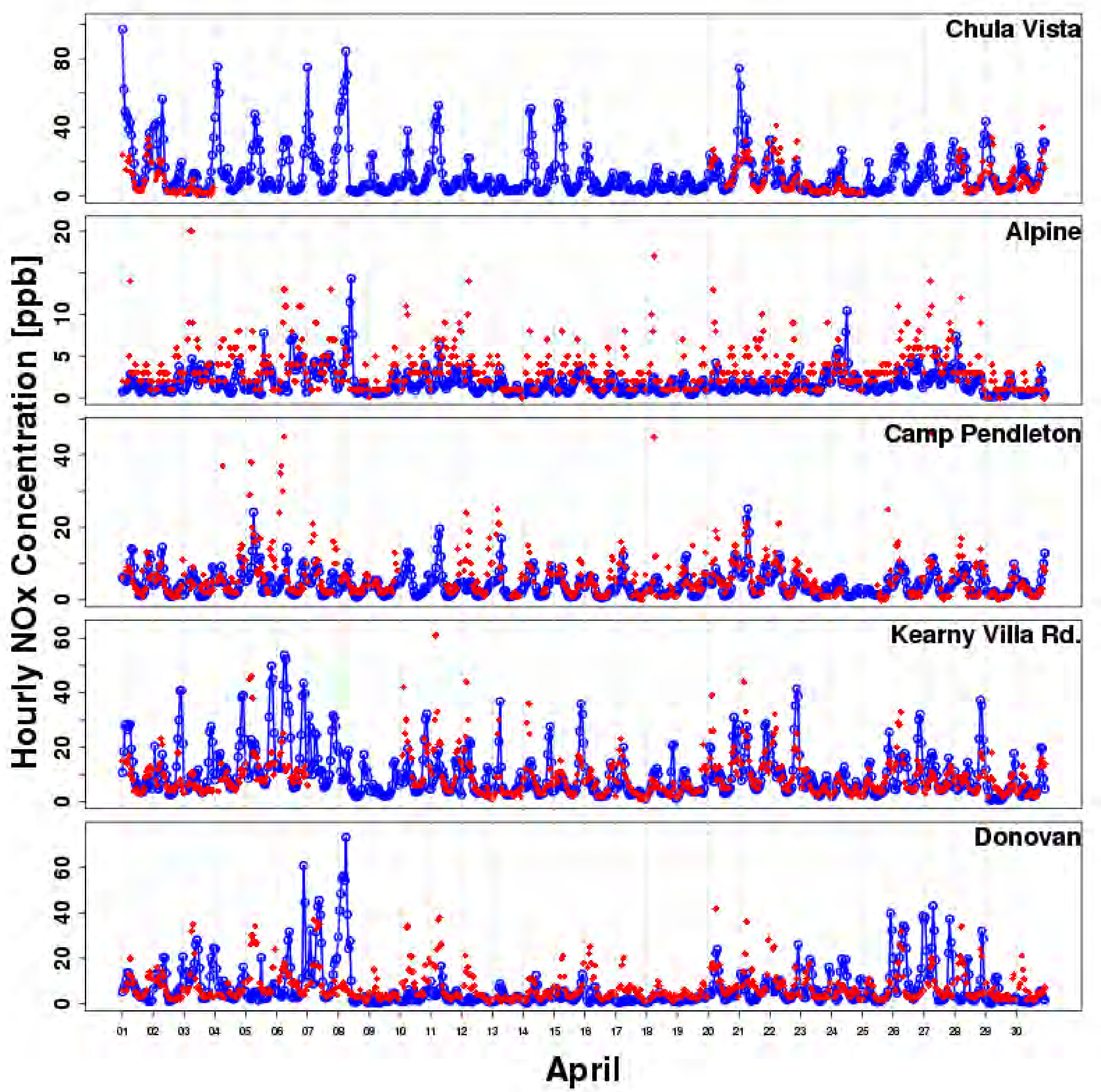

Figure K-S.16
Time series plots of hourly NOx concentration [ppb] of May 2017 at all 5 sites in San Diego Air District.
Blue dots and lines represent model outputs, and red dots represent observations.

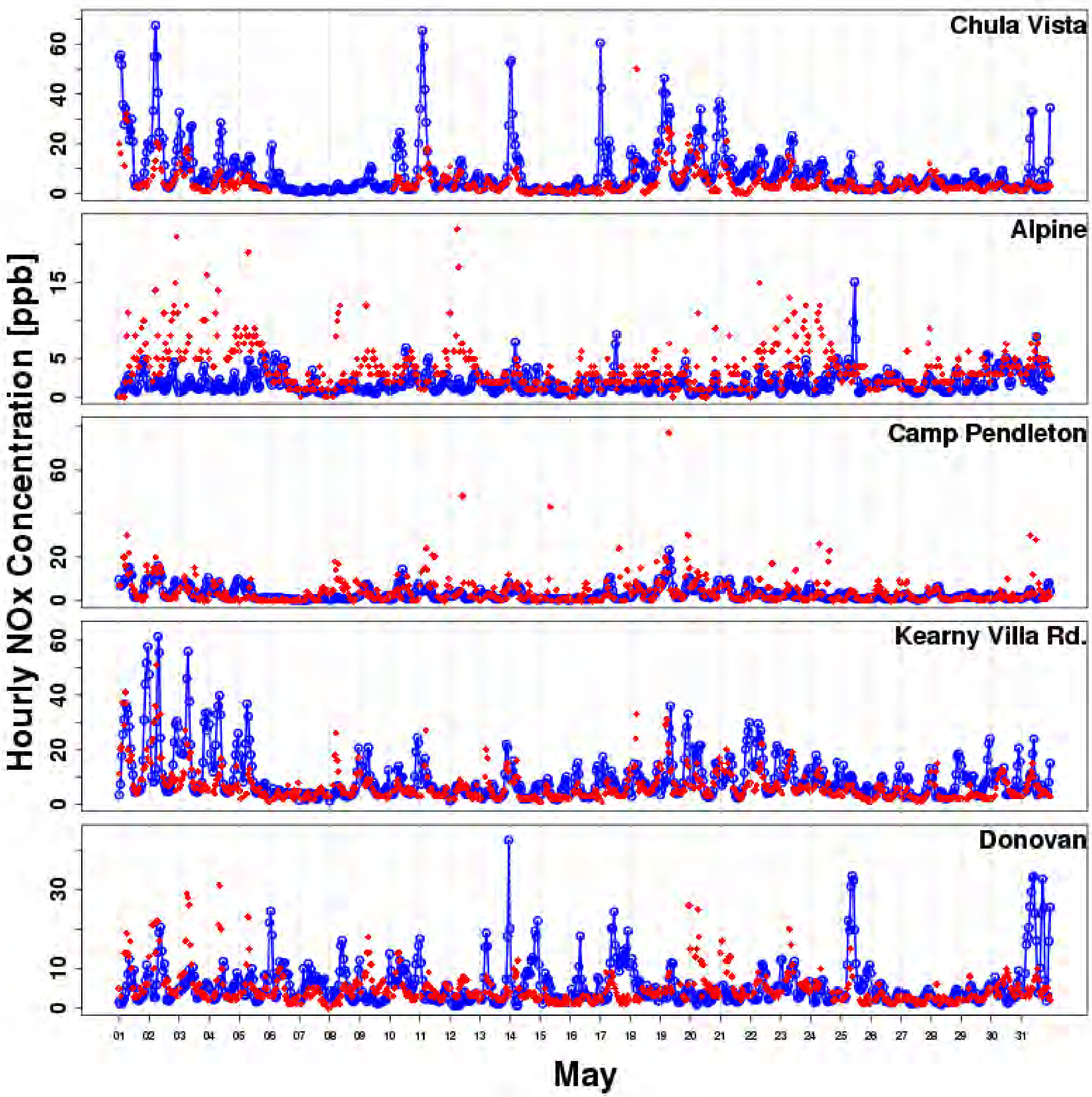

Figure K-S.17
Time series plots of hourly NOx concentration [ppb] of June 2017 at all 5 sites in San Diego Air District.
Blue dots and lines represent model outputs, and red dots represent observations.

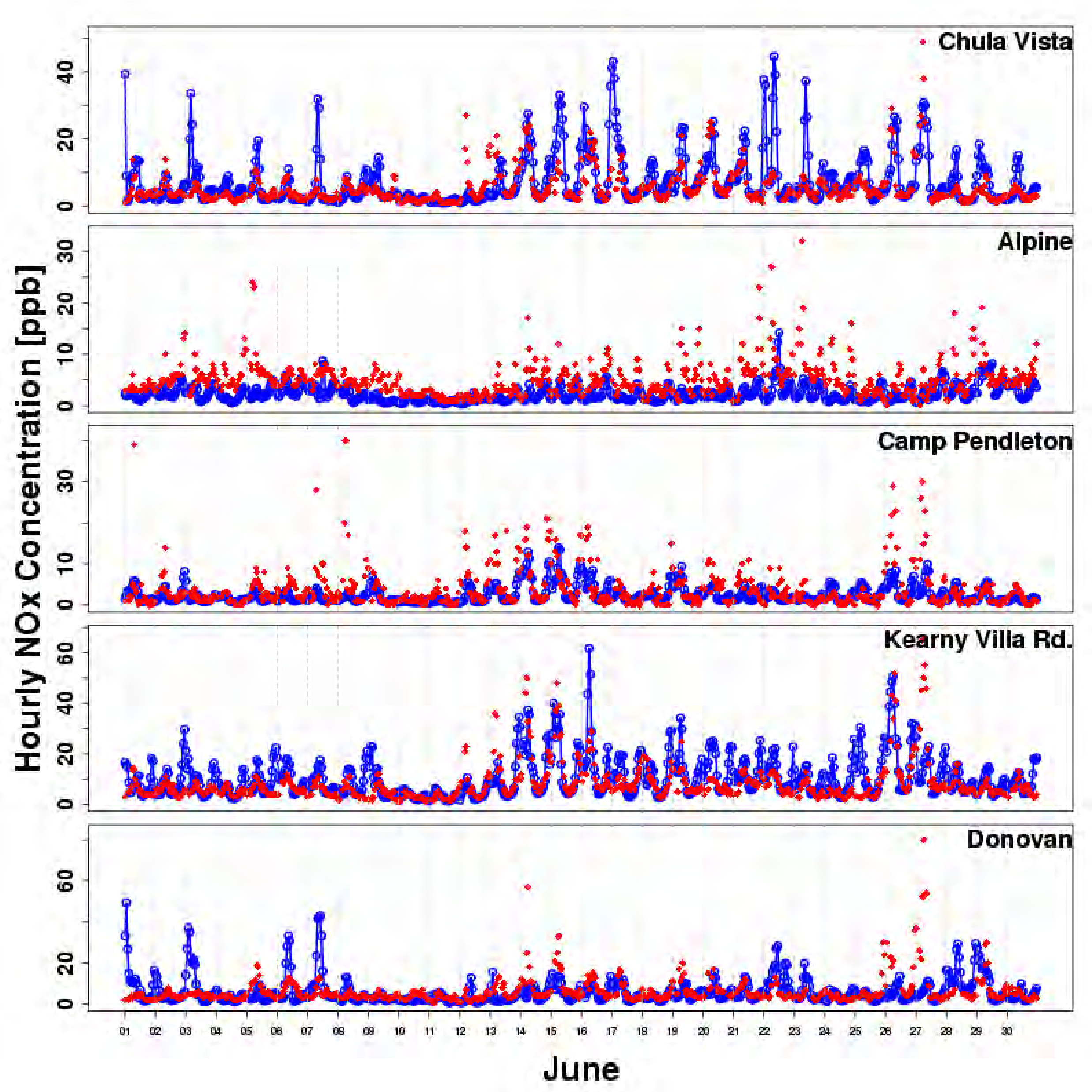

Figure K-S.18
Time series plots of hourly NOx concentration [ppb] of July 2017 at all 5 sites in San Diego Air District.
Blue dots and lines represent model outputs, and red dots represent observations.

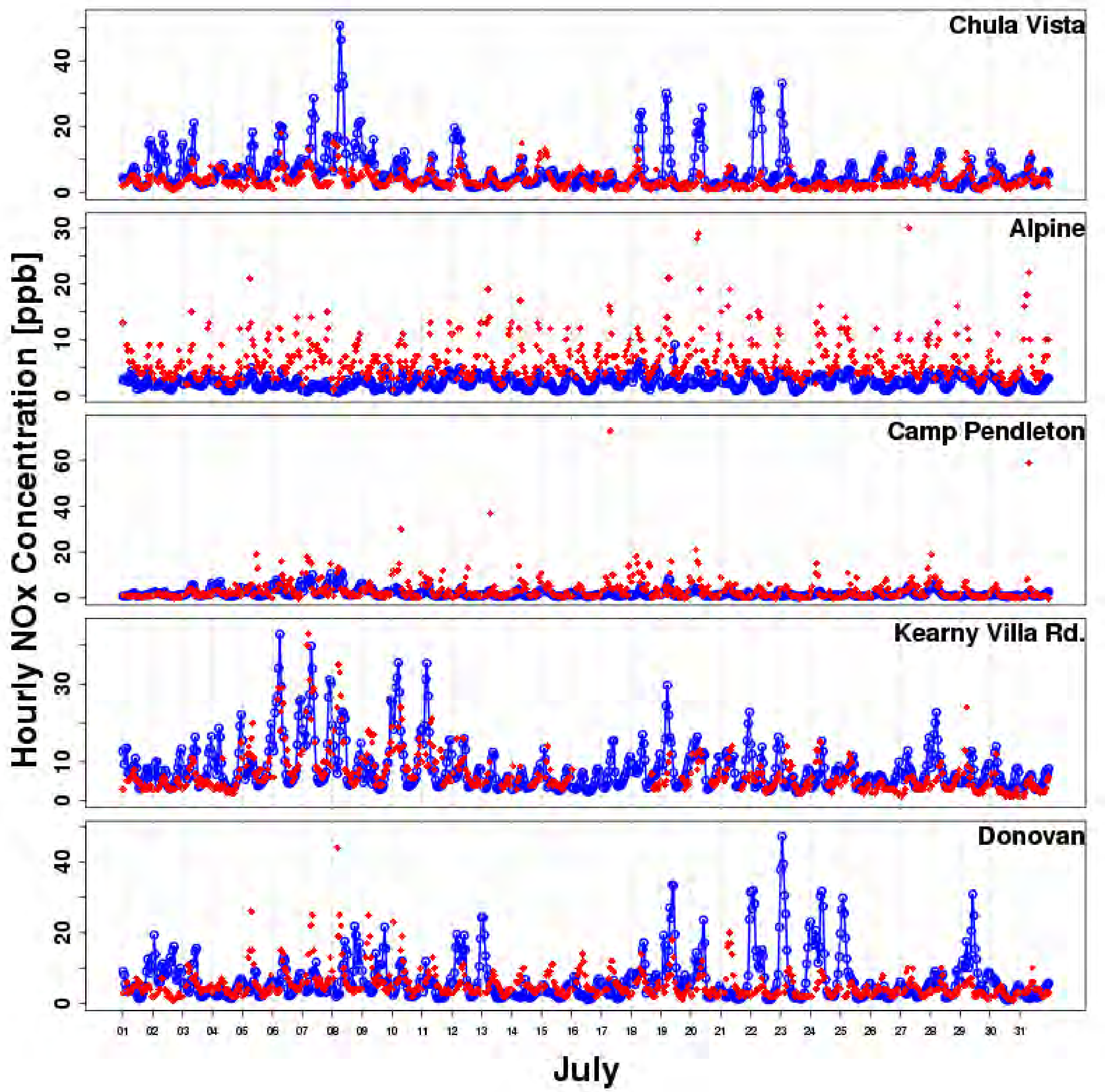

Figure K-S.19
Time series plots of hourly NOx concentration [ppb] of August 2017 at all 5 sites in San Diego Air District.
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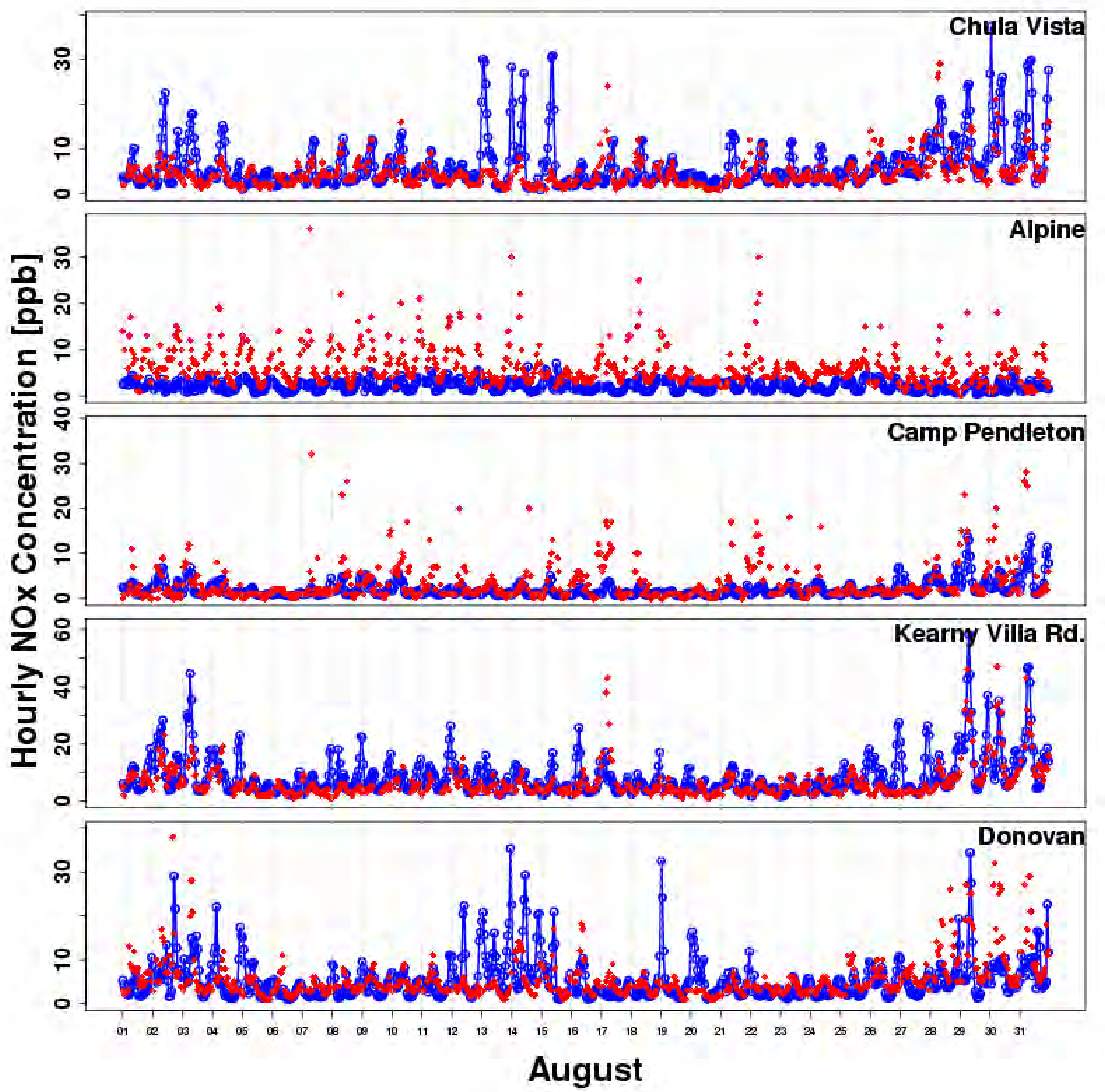


Figure K-S.20
Time series plots of hourly NOx concentration [ppb] of September 2017 at all 5 sites in San Diego Air District.
Blue dots and lines represent model outputs, and red dots represent observations.

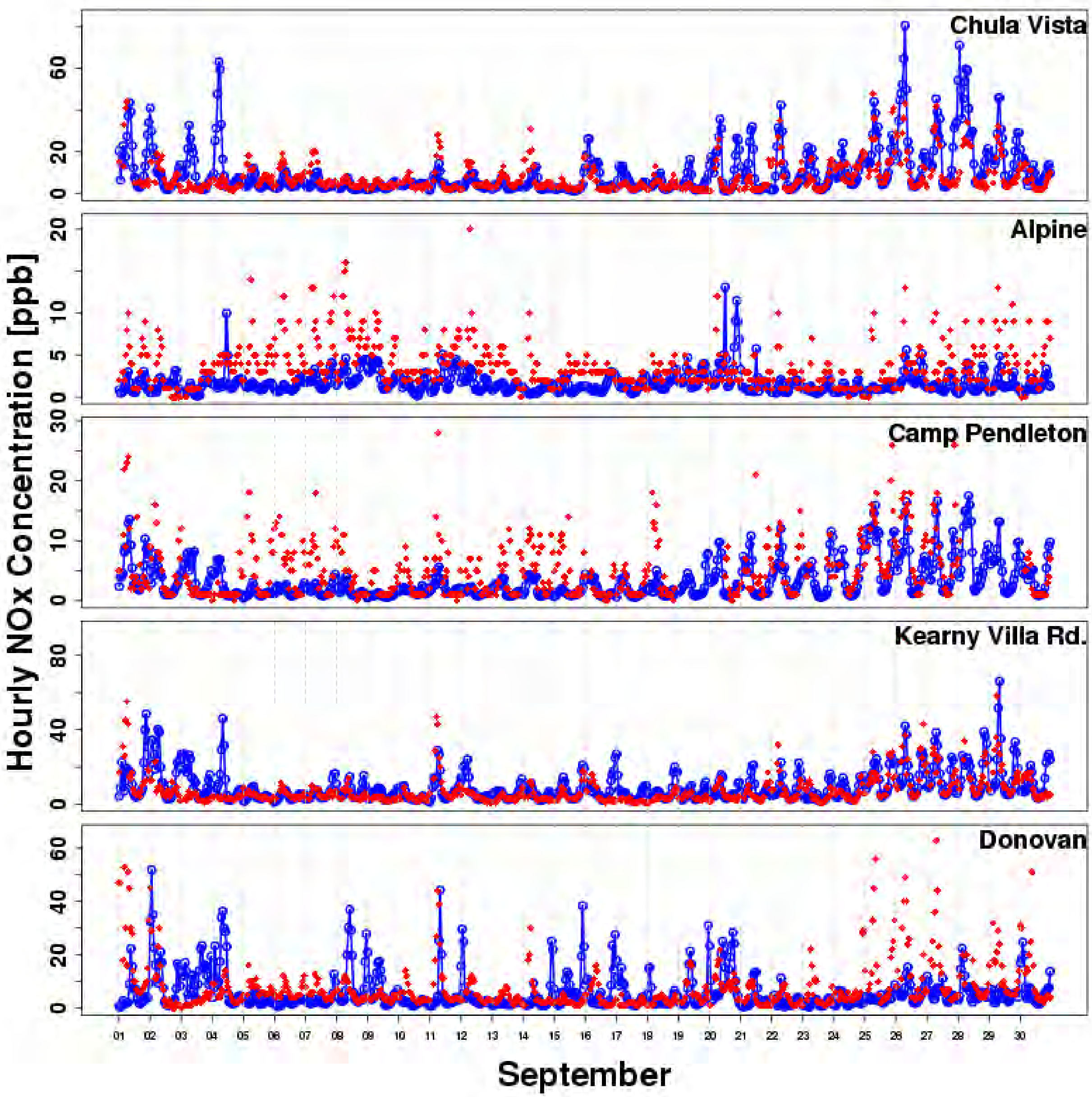
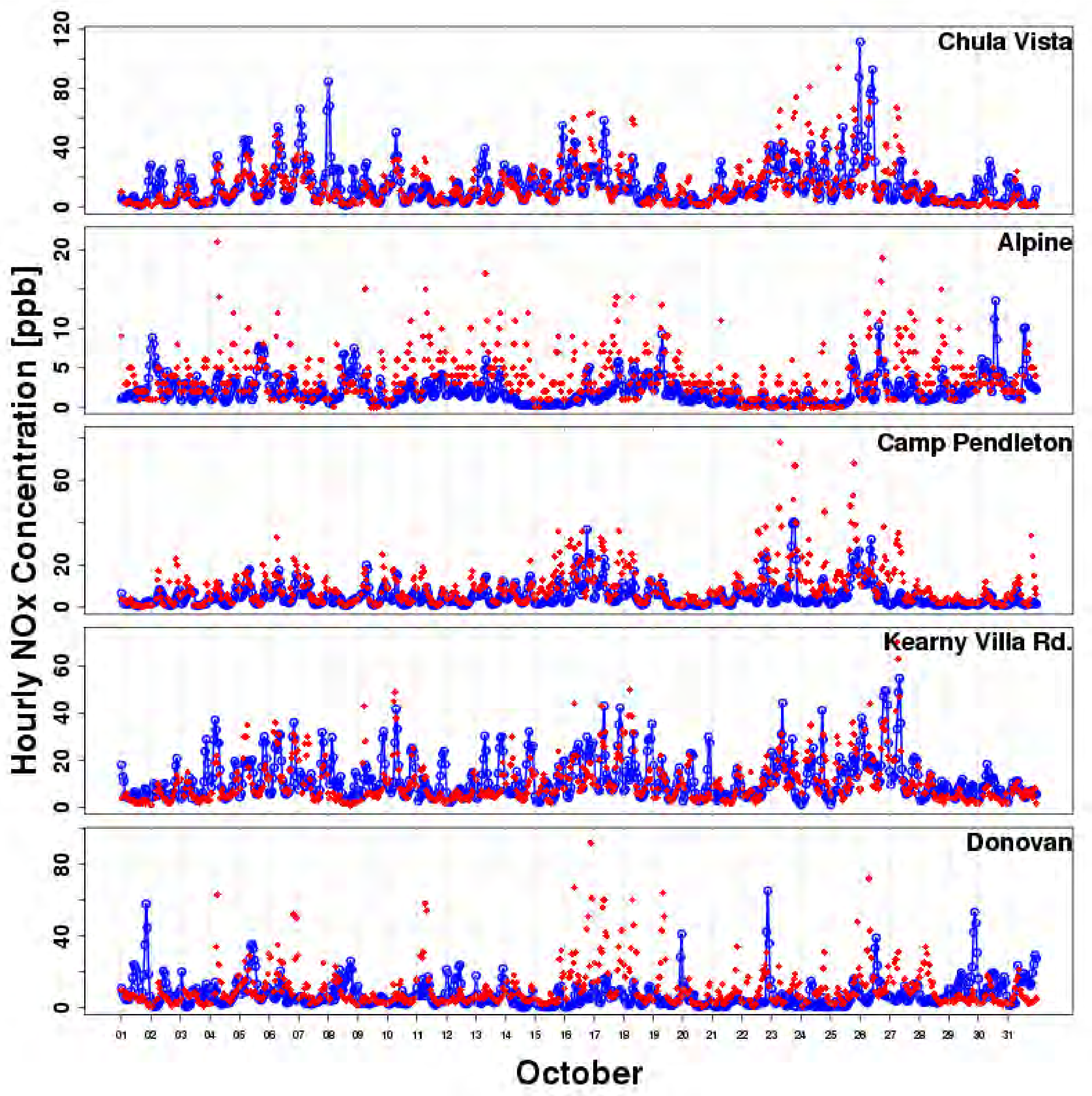


Figure K-S.21
Time series plots of hourly NOx concentration [ppb] of October 2017 at all 5 sites in San Diego Air District.
Blue dots and lines represent model outputs, and red dots represent observations.



ATTACHMENT L
MODELING EMISSION INVENTORY FOR THE OZONE STATE IMPLEMENTATION PLAN IN SAN DIEGO COUNTY

Prepared by
California Air Resources Board
San Diego County Air Pollution Control District

March 2020

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L.1. DEVELOPMENT OF OZONE EMISSIONS INVENTORIES

Emission inputs for air quality modeling (commonly and interchangeably referred to as “modeling inventories” or “gridded inventories”) have been developed by the California Air Resources Board (CARB) and staff from multiple air districts. These inventories support multiple State Implementation Plans (SIP)s across California to address nonattainment of the federal ozone (O_3) standards. CARB maintains an electronic database of emissions and other useful information to generate aggregate emission estimates at the county, air basin, and district level. This database is called the California Emission Inventory Development and Reporting System (CEIDARS). CEIDARS provides a foundation for the development of a more refined (hourly, grid cell-specific) set of emission inputs that are required by air quality models. The CEIDARS base year inventory is a primary input to the state’s emission forecasting system, known as the California Emission Projection Analysis Model (CEPAM). CEPAM produces the projected emissions that are then gridded and serve as the emission input for the air quality models.

The following sections of this document describe how base and future year emissions inventory estimates are prepared.

L.1.1 <u>Inventory Coordination</u>

Most of this inventory was developed in direct coordination with staff at the San Diego County Air Pollution Control District. In July of 2019 CARB convened the SIP Inventory Working Group (SIPIWG) to provide an opportunity and means for interested parties (CARB, districts, etc.) to discuss issues pertaining to the development and review of base year, future year, planning and gridded inventories to be used in SIP modeling. The group met every four to six weeks since convening and will continue to do so through 2020. Group participants included staff from Bay Area, Butte, Eastern Kern, El Dorado, Feather River, Imperial, Northern Sierra, Placer, Sacramento, San Diego, San Joaquin Valley, San Luis Obispo, South Coast, Ventura, and Yolo-Solano air districts.

Additionally, CARB established the SIPIWG Spatial Surrogate Sub-committee, which focuses on improving input data to spatially disaggregate emissions at a more refined level needed for air quality modeling. Local air districts that participate include San Joaquin Valley, South Coast, Ventura, and Sacramento.

In addition to the two coordination groups described above, a great deal of work preceded this modeling effort through the Central California Air Quality Studies (CCAQS). CCAQS consisted of two studies: 1) the Central California Ozone Study (CCOS); and 2) the California Regional PM_{10} (particulate matter 10µ in diameter and smaller) /$PM_{2.5}$ Air Quality Study (CRPAQS).

L.1.2 <u>Background</u>

California’s emission inventory is an estimate of the amounts and types of pollutants emitted from thousands of industrial facilities, millions of motor vehicles, and myriad emission sources such as consumer products and fireplaces. The development and maintenance of the emission inventory involves several agencies. This multi-agency effort includes: CARB, 35 local air pollution control and air quality management districts (Districts), regional transportation planning agencies (RTPAs), and the California Department of Transportation (Caltrans). CARB is responsible for the compilation of the final statewide emission inventory, and for maintaining this information in CEIDARS. In addition to the statewide emission inventory, emissions from northern Mexico, and Western States are also incorporated in the final emission inventory used for modeling. The final emission inventory reflects the best information available at the time.

The basic principle for estimating county-wide regulatory emissions is to multiply an estimated, per-unit emission factor by an estimate of typical usage or activity. For example, on-road motor vehicle emission factors are estimated for a specific vehicle type and applied to all applicable vehicles. The estimates are based on dynamometer tests of a small sample for a vehicle type. The activity for any given vehicle type is based on an estimate of typical driving patterns, number of vehicle starts, and typical miles driven. Assumptions are also made regarding typical usage: it is assumed that all vehicles of a certain vehicle type are driven under similar conditions in each region of the state.

Developing emission estimates for stationary sources involves the use of per unit emission factors and activity levels. Under ideal conditions, facility-specific emission factors are determined from emission tests for a particular process at a facility. A continuous emission monitoring system (CEMS) can also be used to determine a gas or particulate matter concentration or emission rate (U.S. EPA, 2016). More commonly, a generic emission factor is developed by averaging the results of emission tests from similar processes at several different facilities. This generic factor is then used to estimate emissions from similar types of processes when a facility-specific emission factor is not available. Activity levels from stationary sources can be derived from the amount of product produced, solvent used, or fuel used.

The district-reported and CARB-estimated emissions totals are stored in the CEIDARS database for any given pollutant. Both criteria and toxic air pollutant emission inventories are stored in this complex database. These are typically annual average emissions for each county, air basin, and district. Modeling inventories for reactive organic gases (ROG) are estimated from total organic gases (TOG). Similarly, the modeling inventories for PM_{10} and $PM_{2.5}$ are estimated from total particulate matter (PM). Details about chemical and size resolved speciation of emissions for modeling can be found in Section L.2.4. Additional information on CARB emission inventories can be found on the CARB website.

L.1.3 Inventory Years

The emission inventory scenarios used for air quality modeling must be consistent with U.S. EPA's Modeling Guidance (U.S. EPA, 2014). Since changes in the emissions inventory can affect the calculation of the relative response factors (RRFs) used to project air quality to future years, the terms used in the preparation of the emission inventory scenarios must be clearly defined. In this document, the following inventory definitions will be used.

L.1.3.1 Best Case Modeling Inventory (2017)

Base case modeling is intended to evaluate model performance and demonstrate confidence in the modeling system used for the modeled attainment test. The base case modeling inventory is not used as part of the modeled attainment test itself. Model performance is assessed relative to how well model-simulated concentrations match actual measured concentrations. The modeling inputs are developed to represent (as best as possible) actual, day-specific conditions. Therefore, the base case modeling inventory for 2017 includes day-specific emissions for certain sectors. This includes, for instance, available day-specific activities and emission adjustments. Actual district-reported point source emissions were gathered for the year 2011 and forecasted to 2017. The year 2017 was selected to coincide with the year selected for baseline design values (described below). The U.S. EPA modeling guidance states that once the model has been shown to perform adequately, the use of day-specific emissions is no longer needed. In preparation for SIP development, both CARB and the local air districts began a comprehensive review and update of the emission inventory several years ago resulting in a comprehensive emissions inventory for 2017.

L.1.3.2 Reference Year Modeling Inventory (2017)

The reference year inventory is intended to be a representation of emission patterns occurring through the baseline design value period and the emission patterns expected in the future year. U.S. EPA modeling guidance describes the reference year modeling inventory as “a common starting point” that represents average or “typical” conditions that are consistent with the baseline design value period. U.S. EPA guidance also states, “using a ‘typical’ or average reference year inventory provides an appropriate platform for comparisons between baseline and future years.” The 2017 reference year inventory represents typical average conditions and emission patterns through the 2017 design value period. This reference emissions inventory is not developed to capture day-specific emission characteristics; however, this reference inventory includes temperature, relative humidity, and solar insolation effects, for 2017.

L.1.3.3 Future Year Modeling Inventory (2026/2032)

Future year modeling inventories, along with the reference year modeling inventory, are used in the model-derived RRF calculation. Projected inventory years were chosen to address the following standards.

- 2026 is the modeled attainment year for the 8-hour 2008 ozone standard of 75 ppb.
- 2032 is the modeled attainment year for the 8-hour 2015 ozone standard of 70 ppb.

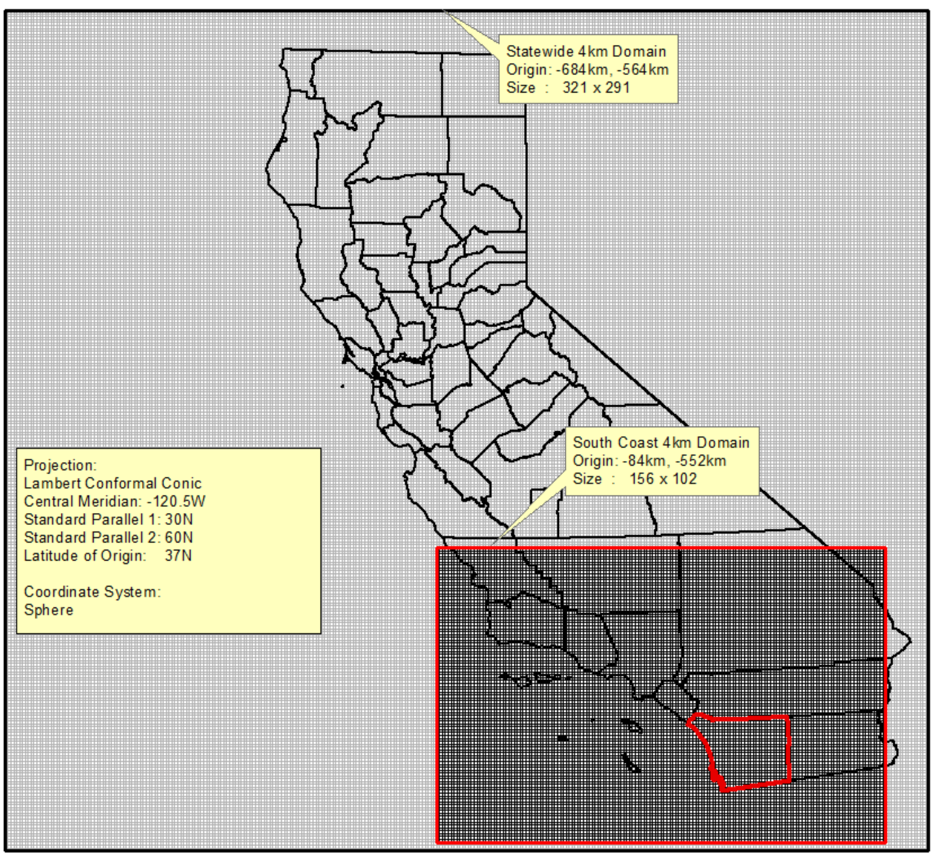
Each of these years reflects the date by which attainment can be achieved as expeditiously as practicable for the relevant ozone standard.

These inventories maintain the "typical," average patterns of the 2017 reference year modeling inventory. Some sectors of the 2026 and 2032 inventory include the temporal variations that were driven by temperature, relative humidity, and solar insolation effects from reference year (2017) meteorology. Future year point and area source emissions are projected from the 2011 baseline emissions used in the 2017 reference year modeling inventory. Future year on-road emission inventories are used, as projected by EMFAC. The application of control measure reduction factors is discussed for onroad in Section L.3.2.7 and Section L.3.9 for area and stationary sources.

L.1.4 Spatial Extent of Emission Inventories

The emissions model-ready files that are prepared for use as an input for the air quality model conform to the definition and extent of the grids shown in Figure L-1.

Figure L-1
Spatial Coverage and Parameter Summary of Modeling Domains



The domain uses a Lambert projection and assumes a spherical Earth. The emissions inventory grid uses a Lambert Conical Projection with two parallels. The parallels are at 30° and 60° N latitude, with a central meridian at 120.5° W longitude. The coordinate system origin is offset to 37° N latitude. The emissions inventory is developed for the gridded statewide domain on a spatial resolution of 4 km x 4 km. The State modeling domain extends entirely over California and 100 nautical miles west over the Pacific Ocean. The air quality modeling for San Diego is conducted on the 4km x 4km South Coast subdomain nested in the 12km x 12km resolution statewide domain. The specifications for the statewide and South Coast domains are summarized in Table L-1.

Table L-1
Modeling Domain Parameters

Parameter	Statewide domain	South Coast subdomain
Map Projection	Lambert Conformal Conic	Lambert Conformal Conic
Datum	None (Clarke 1866 spheroid)	None (Clarke 1866 spheroid)
1st Standard Parallel	30.0° N	30.0° N
2nd Standard Parallel	60.0° N	60.0° N
Central Meridian	-120.5° W	-120.5° W
Latitude of projection origin	37.0° N	37.0° N
COORDINATE SYSTEM		
Units	Meters	Meters
Semi-major axis	6370 km	6370 km
Semi-minor axis	6370 km	6370 km
DEFINITION OF GRID		
Grid size	12km x 12km	4km x 4km
Number of cells	107 x 97 cells	156 x 102 cells
Lambert origin	(-684,000 m, -564,000 m)	(-84,000 m, -552,000 m)
Geographic center	-120.5° Lat and 37.0° Lon	-120.5° Lat and 37.0° Lon

L.2. ESTIMATION OF BASE YEAR MODELING INVENTORY

As mentioned in Section L.1.3, base case modeling is intended to demonstrate confidence in the modeling system used for the modeled attainment test. The following sections describe the temporal and spatial distribution of emissions and how each of the sectors within the modeling inventories are prepared.

L.2.1 Terminology

The terms “point sources” and “area sources” are often confused. Traditionally, these terms have had different meanings to the developers of emissions inventories and the developers of modeling inventories. Table L-2 summarizes the difference in the terms. Both sets of terms are used in this document. In modeling terminology, “point sources” traditionally refer to elevated emission sources that exit from a stack and have an associated plume rise. While the current inventory includes emissions from stacks, all emission sources reported by the San Diego Air Pollution Control District (SDAPCD) associated with a facility are treated as potential elevated sources. The emissions processor calculates plume rise if appropriate; non-elevated sources are treated as ground-level sources. Examples of non-elevated emissions sources include gas dispensing facilities and storage piles. "Area sources" refers collectively to area-wide sources, stationary-aggregated sources, and other mobile sources (including aircraft, trains, ships, and all off-road vehicles and equipment). That is, "area sources" are low-level sources from a modeling perspective.

Table L-2
Inventory Terms for Emission Source Types

Modeling Term	Emission Inventory Term	Examples
Point	Stationary – Point Facilities	Stacks at Individual Facilities
Area	Off-road Mobile	Construction Equipment, Farm Equipment, Trains, Recreational Boats
Area	Area-wide	Residential Fuel Combustion, Livestock Waste, Consumer Products, Architectural Coatings
Area	Stationary - Aggregated	Industrial Fuel Use
On-road Motor Vehicles	On-road Mobile	Cars and Trucks
Biogenic	Biogenic	Trees

The following sections describe in more detail the temporal, spatial, and chemical disaggregation of the emissions inventory for point sources and area sources.

L.2.2 Temporal Distribution of Emissions

The emissions are temporally resolved by month, week, day, and hour to more accurately gauge model performance and ultimately to better assess the influence of control measures on attainment. This section covers the temporal distributions of the point, area, and off-road mobile sources. The temporal distribution of the emissions from on-road, biogenic, and ocean-going vessel (OGV) sources are discussed in Sections L.3.2, L.3.3, and L.3.5. The temporal distribution of residential wood combustion (RWC) and agricultural ammonia sectors are described in Section L.3.6.4 and Section L.3.6.5, respectively.

Temporal data are stored in CARB's emission inventory database. Each local air district assigns temporal data for all processes at each facility in their district to represent when emissions at each process occur. For example, emissions from degreasing may operate differently than a boiler. CARB or district staff also assign temporal data for each area source category by county/air basin/district.

L.2.2.1 Monthly Variation

Emissions are adjusted temporally to represent variations by month. Some emission sources operate the same throughout a year. For example, a process heater at a refinery or a line haul locomotive likely operates the same month to month. Other emission categories, such as a tomato processing plant or use of recreational boats, vary significantly by season. CARB's emission inventory database stores the relative monthly fractional activity for each process, the sum of which is 100. Using an example of emission sources that typically operate the same over each season, emissions from refinery heaters and line haul locomotives would have a monthly fraction (throughput) of 8.33 for each month (calculated as 100/12 = 8.33). This is considered a flat monthly profile. To apply monthly variations to create a gridded inventory, the annual average day's emissions (yearly emissions divided by 365) is multiplied by the typical monthly throughput. For example, a typical monthly throughput of 15 in July for recreational boats results in emissions about 1.8 times higher (15 / 8.33 = 1.8) than a day in a month with a flat monthly profile.

L.2.2.2 Weekly Variation

Emissions are adjusted temporally to represent variations by day of the week. Some operations are the same over a week, such as a utility boiler or a landfill. Many businesses operate only 5 days per week. Other emissions sources are similar on weekdays, but may operate differently on weekend days, such as architectural coatings or off-road motorcycles. To accommodate variations in days of the week, each process or emission category is assigned a days-per-week code or DPWK. Table L-3 shows the current DPWK codes and Table L-14 in Appendix C shows additional DPWK codes used for agricultural-related emissions.

(CONTINUED ON NEXT PAGE)

Table L-3
Day of Week Variation Factors

Code	WEEKLY CYCLE CODE DESCRIPTION	M	T	W	TH	F	S	S
1	One day per week	1	1	1	1	1	0	0
2	Two days per week	1	1	1	1	1	0	0
3	Three days per week	1	1	1	1	1	0	0
4	Four days per week	1	1	1	1	1	0	0
5	Five days per week - Uniform activity on week days; non on Saturday and Sunday	1	1	1	1	1	0	0
6	Six days per week - Uniform activity on week days; non on Saturday and Sunday	1	1	1	1	1	1	0
7	Seven days per week – Uniform activity every day of the week	1	1	1	1	1	1	1
20	Uniform activity on Saturday and Sunday; no activity the remainder of the week	0	0	0	0	0	1	1
21	Uniform activity on Saturday and Sunday; half as much activity on week days	5	5	5	5	5	10	10
22	Uniform activity on week days; reduced activity on weekends	10	10	10	10	10	7	4
23	Uniform activity on week days; reduced activity on weekends (For on-road motor vehicles)	10	10	10	10	10	8	8
24	Uniform activity on week days; half as much activity on Saturday. Little activity on Sunday	10	10	10	10	10	5	1
25	Uniform activity on week days; one third as much on Saturday; little on Sunday	10	10	10	10	10	3	1
26	Uniform activity on week days; little activity on Saturday; no activity on Sunday	10	10	10	10	10	3	0
27	Uniform activity on week days; half as much activity on weekends	10	10	10	10	10	5	5
28	Uniform activity on week days; five times as much activity on weekends	2	2	2	2	2	10	10
29	Uniform activity on Monday through Thursday; increased activity on Friday, Saturday, Sunday	8	8	8	8	10	10	10

L.2.2.3 Daily Variation

Emissions are adjusted temporally to represent variations by hour of day. Many emission sources occur 24 hours per day, such as livestock waste or a sewage treatment plant whereas many businesses operate 8 hours per day. Other emissions sources vary significantly over a day, such as residential space heating or pesticide application. Each process or emission category is assigned an hours-per-day (HPDY) code. Table L-4 displays the daily variation factors or current HPDY codes. These codes are mostly current except for Code 33 which changed in response to RWC temporal allocation methods (see Section L.3.6.4). Eventually, the morning-evening peak pattern is applied to most part of the state including San Diego, except for San Joaquin Valley where an evening-only profile is applied. Table L-15 in Appendix C: Additional Temporal Profiles shows additional daily variation codes used for agricultural-related emissions.

(CONTINUED ON NEXT PAGE)

Table L-4
Daily Variation Factors

Code	CODE DESCRIPTION	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
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1	1 HOUR PER DAY	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	2 HOURS PER DAY	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	3 HOURS PER DAY	0	0	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
4	4 HOURS PER DAY	0	0	0	0	0	0	0	0	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
5	5 HOURS PER DAY	0	0	0	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0
6	6 HOURS PER DAY	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0
7	7 HOURS PER DAY	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0
8	8 HOURS PER DAY - UNIFORM ACTIVITY FROM 8 A.M. TO 4 P.M. (NORMAL WORKING SHIFT)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
9	9 HOURS PER DAY	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0
10	10 HOURS PER DAY	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0
11	11 HOURS PER DAY	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0
12	12 HOURS PER DAY	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0
13	13 HOURS PER DAY	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0
14	14 HOURS PER DAY	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0
15	15 HOURS PER DAY	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0
16	16 HOURS PER DAY - UNIFORM ACTIVITY FROM 8 A.M. TO MIDNIGHT (2 WORKING SHIFTS)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
17	17 HOURS PER DAY	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
18	18 HOURS PER DAY	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
19	19 HOURS PER DAY	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0
20	20 HOURS PER DAY	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0
21	21 HOURS PER DAY	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0
22	22 HOURS PER DAY	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0
23	23 HOURS PER DAY	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
24	24 HOURS PER DAY - UNIFORM ACTIVITY DURING THE DAY	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
31	MAJOR ACTIVITY 5-9 P.M., AVERAGE DURING DAY, MINIMAL IN EARLY A.M.(GAS STATIONS)	3	1	1	1	1	1	1	5	5	5	5	5	5	5	5	5	5	10	10	10	10	7	7	3
33	MAX ACTIVITY 7-9 A.M. & 7-11 P.M.,AVERAGE DURING DAY, LOW AT NIGHT (RESIDENTIAL FUEL COMBUSTION)	2	2	2	2	2	2	2	10	10	6	6	5	5	5	5	5	5	5	5	10	10	10	10	2
34	ACTIVITY 1 TO 9 A.M.; NO ACTIVITY REMAINDER OF DAY (i.e. ORCHARD HEATERS)	0	8	8	8	8	10	10	10	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
35	MAX ACTIVITY 7 A.M. TO 1 A.M., REMAINDER IS LOW (i.e. COMMERCIAL AIRCRAFT)	10	1	1	1	1	1	1	8	8	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
37	ACTIVITY DURING DAYLIGHT HOURS; LESS CHANCE IN EARLY MORNING AND LATE EVENING	0	0	0	0	0	1	3	6	9	10	10	10	10	10	10	10	10	9	6	3	1	0	0	0
38	ACTIVITY DURING MEAL TIME HOURS (i.e. RESIDENTIAL COOKING)	0	0	0	0	0	2	6	6	2	2	1	2	4	4	2	1	1	3	10	8	7	6	1	0
50	PEAK ACTIVITY AT 7 A.M. & 4 P.M.; AVERAGE DURING DAY (ON-ROAD MOTOR VEHICLES)	1	1	1	1	1	1	6	10	6	5	5	5	5	5	5	6	10	8	6	4	1	1	1	1
51	ACTIVITY FROM 6 A.M. TO 12 P.M. (PETROLEUM DRY CLEANING)	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
52	MAJOR ACTIVITY FROM 6 A.M.-12 P.M., LESS FROM 12-7 P.M. (PESTICIDES)	0	0	0	0	0	1	6	10	10	10	10	10	6	3	3	3	3	4	4	0	0	0	0	0
53	ACTIVITY FROM 7 A.M. TO 12 P.M. (AGRICULTURAL AIRCRAFT)	0	0	0	0	0	0	0	2	2	2	2	2	1	0	0	0	0	0	0	0	0	0	0	0
54	UNIFORM ACTIVITY FROM 7 A.M. TO 9 P.M. (DAYTIME BIOGENICS)	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0
55	UNIFORM ACTIVITY FROM 9 P.M. TO 7 A.M. (NIGHTIME BIOGENICS)	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1
56	MAX ACTIVITY 8 A.M. TO 5 P.M, MINIMAL AT NIGHT & EARLY MORNING(CAN&COIL/METAL PARTS COATINGS)	0	0	0	0	1	1	2	3	10	10	10	10	10	10	10	10	9	1	1	1	1	1	1	1
57	MAX ACTIVITY 7 A.M. TO 2 P.M., MINIMAL AT EVENING AND MORNING HOURS (CONSTRUCTION EQUIPMENT ON HOT DAYS)	0	0	0	0	0	1	6	10	10	10	10	10	10	9	8	4	2	1	1	0	0	0	0	0
58	MAX ACTIVITY 7 A.M. TO NOON.;REDUCED ACTIVITY NOON TO 6 P.M. (AUTO REFINISHING)	0	0	0	0	0	0	0	10	10	10	10	10	8	8	8	8	8	8	0	0	0	0	0	0
59	MAXIMUM ACTIVITY FROM 7:00 AM TO 3:00 PM; REDUCED ACTIVITY FROM 3:00 TO 6:00 PM.(CONSTRUCTION EQUIPMENT ON NORMAL DAYS)	0	0	0	0	0	0	2	10	10	10	10	10	10	10	10	7	3	1	1	0	0	0	0	0
60	MAXIMUM ACTIVITY FROM NOON TO 7:00 PM; REDUCED ACTIVITY EVENING AND MORNING HOURS (RECREATIONAL BOAT EXHAUST)	0	0	0	0	0	0	0	2	4	6	7	9	10	10	10	10	10	10	10	7	5	3	1	0
81	MAX ACTIVITY 9 AM TO 3 PM; HALF THE ACTIVITY REMAINING HOURS (WASTE FROM DAIRY CATTLE)	7	6	6	5	4	4	4	5	7	8	9	10	10	10	7	3	3	3	4	4	5	6	7	7
82	ACTIVITY FROM 10 AM TO 9 PM RISING TO PEAK AT 3; NO ACTIVITY REMAINDER OF DAY (WASTE FROM POULTRY)	0	0	0	0	0	0	0	0	0	3	3	7	7	7	10	10	7	3	3	3	3	0	0	0
83	ACTIVITY FROM 9 AM TO 12 AM RISING TO PEAK AT 3; MINIMUM ACTIVITY REMAINDER OF DAY (WASTE FROM SWINE)	0	0	0	0	0	0	0	1	1	2	4	6	8	8	9	10	8	4	3	3	2	1	1	1
84	MAJOR ACTIVITY FROM 11AM TO 6PM; REDUCED OTHER HOURS (EVAP-COASTAL COUNTIES)	7	7	6	6	6	6	6	7	8	8	9	9	10	10	10	10	9	9	8	8	7	7	7	7
85	MAJOR ACTIVITY FROM 11AM TO 6PM; REDUCED OTHER HOURS (EVAP-NON-COASTAL COUNTIES)	5	5	5	5	4	4	5	5	6	7	8	9	9	10	10	10	9	9	8	7	6	6	6	5

L.2.3 Spatial Allocation

Once the base case, reference, or future year inventories are developed, the next step of modeling inventory development is to spatially allocate the emissions. Air quality models attempt to replicate the physical (e.g. transport) and chemical processes that occur in the atmosphere within a modeling domain. Therefore, it is important that the physical location of emissions be specified as accurately as possible. Ideally, the actual location of all emissions would be known exactly. In reality, however, some categories of emissions would be virtually impossible to determine—for example, the actual amount and location of consumer products (e.g. deodorant) used every day. To the extent possible, the spatial allocation of emissions in a modeling inventory approximates as closely as possible the actual location of emissions.

Spatial allocation is typically accomplished by using spatial surrogates. These spatial surrogates are processed into spatial allocation factors in order to geographically distribute county-wide area source emissions to individual grid cells. Spatial surrogates are developed based on demographic, land cover, and other data that exhibit patterns that vary geographically. Sonoma Technology, Inc. (STI) (Funk, et al., 2001) under the CCOS contract, originally developed many of the spatial surrogates by creating a base year (2000) and various future year surrogate inventories. STI updated the underlying spatial data and developed new surrogates (Reid, et al., 2006), completing the project in 2008. CARB and districts have since continued to update and improve many of the spatial surrogates, adding new ones as more data become available.

Three basic types of surrogate data were used to develop the original spatial allocation factors: land use and land cover, facility location, and demographic and socioeconomic data. Land use and land cover data are associated with specific land uses, such as agricultural harvesting or recreational boats. Facility locations are used for sources such as gas stations and dry cleaners. Demographic and socioeconomic data, such as population and housing, are associated with residential, industrial, and commercial activity (e.g. residential fuel combustion). To develop spatial allocation factors of high quality and resolution, local socioeconomic and demographic data were used when available for developing base case, baseline, and future year inventories. These data were available from local Metropolitan Planning Organizations (MPO)s or Regional Transportation Planning Agency (RTPA)s, where they are used as inputs for travel demand models. In rural regions for which local data were not available, data from Caltrans' Statewide Transportation Model were used.

The current snapshot used for the San Diego O_3 SIP emission inventory is defined as snapshot June 11th, 2019 (snp20190611). This working snapshot includes all previous updates noted in (CARB, 2018) and (CARB, 2017) as well as recent improvements outlined below:

- Improvements to onroad Emissions Spatial and Temporal Allocator (ESTA) surrogates.
    - Heavy Duty/Light Duty surrogates developed for Southern California counties including: San Diego, Imperial, Los Angeles, Orange, Riverside, San Bernardino and Ventura.

  - o Replacement of California Vehicle Activity Database (CalVAD) 2012 data for 2017 Southern California Association of Governments (SCAG) and San Diego Association of Governments (SANDAG) MPOs
  - o Improvement to gridded CALVAD VMT for all other counties by intersecting gridded information with the Topologically Integrated Geographic Encoding and Referencing (TIGER) road network (CARB, AMSS, 2019)

- Updates to ocean going vessel surrogates based on 2017 Marine Cadastre Data
  - o Vessel traffic data, or Automatic Identification System (AIS) data, are collected by the U.S. Coast Guard through an onboard navigation safety device that transmits and monitors the location and characteristics of large vessels in U.S. and international waters in real time.
  - o Information such as location, time, ship type, speed, length, beam, and draught have been extracted from the raw data and prepared for analyses in desktop geographic information system (GIS) software. Data used here are for 2011.
  - o The Bureau of Ocean Energy Management (BOEM) and the National Oceanic and Atmospheric Administration (NOAA) have worked jointly to repurpose and make available some of the most important records from the U.S. Coast Guard's national network website of AIS receivers.
  - o Updates included Fishing, Commercial, TugTow, Dredge, Military Vessels, Cargo, Tankers and Passenger Vessels.

- Improvements to pesticide surrogates (Methyl Bromide and No Methyl Bromide) using the department of pesticide regulation 2016 dataset.

- Improvements to landfills and compost surrogates from the Solid Waste Information System (SWIS) GIS data set developed by California's Department of Resources Recycling and Recovery (CalRecylce).

- Additional surrogates for Switcher Railyards and Passenger Rails were developed by the off-road diesel analysis section (CARB).

- Improvements to the ports surrogate using 2018 data from the U.S. Department of Transportation (USDOT)/Bureau of Transportation Statistics's (BTS's) National Transportation Atlas Database (NTAD) website and applying manual investigation of data parcels with google maps.

- Improvements to inland shipping and rail lines by pulling 2017 NTAD data and applying manual investigation of data parcels with google maps

- Improvements to ferries and dredge surrogates by manual investigation of current data parcels overlaid with google maps

Table L-5 provides a broad overview of surrogate assignments at the EICSUM level with information on data sources.

Table L-5
Primary Surrogate Assignment at the EICSUM level, Description and Data Source

EICSUM	EICSUMN	Primary Surrogate ID	Primary Surrogate Name	Data Source of Primary Surrogate
10	ELECTRIC UTILITIES	302	UCD_Industrial	Longitudinal Employer-Household Dynamics (LEHD)
20	COGENERATION	302	UCD_Industrial	Longitudinal Employer-Household Dynamics (LEHD)
30	OIL AND GAS PRODUCTION (COMBUSTION)	211	GASWELL	California Department of Conservation, Division of Oil, Gas and Geothermal Resources
30	OIL AND GAS PRODUCTION (COMBUSTION)	431	OILWELL	Division of Oil, Gas, and Geothermal Resources
50	MANUFACTURING AND INDUSTRIAL	302	UCD_Industrial	Longitudinal Employer-Household Dynamics (LEHD)
52	FOOD AND AGRICULTURAL PROCESSING	720	FARMRD_VMT	Sierra Research AgTool Contract
60	SERVICE AND COMMERCIAL	621	UCD_Ser_Comm _Employment	Metropolitan Planning Organization (MPO)/Council of Government (COG) data /California Statewide Travel Demand Model (CSTDM) data
99	OTHER (FUEL COMBUSTION)	302	UCD_Industrial	Longitudinal Employer-Household Dynamics (LEHD)
110	SEWAGE TREATMENT	470	POTWs	State Water Resources Control Board
120	LANDFILLS	341	LANDFILLS	CalRecycle - Solid waste informatin system (SWIS) dataset
130	INCINERATORS	302	UCD_Industrial	Longitudinal Employer-Household Dynamics (LEHD)

EICSUM	EICSUMN	Primary Surrogate ID	Primary Surrogate Name	Data Source of Primary Surrogate
140	SOIL REMEDIATION	302	UCD_Industrial	Longitudinal Employer-Household Dynamics (LEHD)
199	OTHER (WASTE DISPOSAL)	343	COMPOST	CalRecyle - Solid waste informatin system (SWIS) dataset
199	OTHER (WASTE DISPOSAL)	390	NonIrr_Pastureland	National Land Cover Database (NLCD)
199	OTHER (WASTE DISPOSAL)	470	POTWs	State Water Resources Control Board
210	LAUNDERING	150	Drycleaners	Dun & Bradstreet's Market Insight Database
220	DEGREASING	120	AutobodyShops	Dun & Bradstreet's Market Insight Database
220	DEGREASING	302	UCD_Industrial	Longitudinal Employer-Household Dynamics (LEHD)
230	COATINGS AND RELATED PROCESS SOLVENTS	120	AutobodyShops	Dun & Bradstreet's Market Insight Database
230	COATINGS AND RELATED PROCESS SOLVENTS	743	WOODFURN	Dun & Bradstreet's Market Insight Database
230	COATINGS AND RELATED PROCESS SOLVENTS	302	UCD_Industrial	Longitudinal Employer-Household Dynamics (LEHD)
240	PRINTING	731	PRINT	Dun & Bradstreet's Market Insight Database
250	ADHESIVES AND SEALANTS	302	UCD_Industrial	Longitudinal Employer-Household Dynamics (LEHD)
299	OTHER (CLEANING AND SURFACE COATINGS)	302	UCD_Industrial	Longitudinal Employer-Household Dynamics (LEHD)

EICSUM	EICSUMN	Primary Surrogate ID	Primary Surrogate Name	Data Source of Primary Surrogate
310	OIL AND GAS PRODUCTION	211	GASWELL	California Department of Conservation, Division of Oil, Gas and Geothermal Resources
310	OIL AND GAS PRODUCTION	431	OILWELL	California Department of Conservation, Division of Oil, Gas and Geothermal Resources
330	PETROLEUM MARKETING	460	Ports	(USDOT)/Bureau of Transportation Statistics's (BTS's) National Transportation Atlas Database (NTAD)
330	PETROLEUM MARKETING	200	GasStations	Dun & Bradstreet's Market Insight Database
330	PETROLEUM MARKETING	520	RefinieriesTankFarms	FEMA and The ARB Ceidars Database
330	PETROLEUM MARKETING	214	GAS_DISTRIBUTION	U.S. Energy Information Administration
399	OTHER (PETROLEUM PRODUCTION AND MARKETING)	200	GasStations	Dun & Bradstreet's Market Insight Database
410	CHEMICAL	741	PLASTIC	Dun & Bradstreet's Market Insight Database
420	FOOD AND AGRICULTURE	680	Wineries	Dun & Bradstreet's Market Insight Database
		320	Irr_Cropland	National Land Cover Database (NLCD)
430	MINERAL PROCESSES	590	SandandGravelMines	National Atlas
440	METAL PROCESSES	738	METALPARTS	Dun & Bradstreet's Market Insight Database
450	WOOD AND PAPER	732	WOOD	Dun & Bradstreet's Market Insight Database

EICSUM	EICSUMN	Primary Surrogate ID	Primary Surrogate Name	Data Source of Primary Surrogate
499	OTHER (INDUSTRIAL PROCESSES)	302	UCD_Industrial	Longitudinal Employer-Household Dynamics (LEHD)
500	SOLVENT EVAPORATION UNSPECIFIED	441	UCD_Population	Metropolitan Planning Organization (MPO)/Council of Government (COG) data /California Statewide Travel Demand Model (CSTDM) data
510	CONSUMER PRODUCTS	550	ResNonResChg_IndEmp	Council of Government (COG) Housing and Employment
510	CONSUMER PRODUCTS	252	UCD_Tot_Housing	Metropolitan Planning Organization (MPO)/Council of Government (COG) data /California Statewide Travel Demand Model (CSTDM) data
510	CONSUMER PRODUCTS	280	Housing_Restaurants	COMBO: Metropolitan Planning Organization (MPO)/Council of Government (COG) data /California Statewide Travel Demand Model (CSTDM) and Dun & Bradstreet Market Insight
510	CONSUMER PRODUCTS	260	Housing_Autobody	COMBO: Metropolitan Planning Organization (MPO)/Council of Government (COG) data /California Statewide Travel Demand Model (CSTDM) data and Dun & Bradstreet Market Insight

EICSUM	EICSUMN	Primary Surrogate ID	Primary Surrogate Name	Data Source of Primary Surrogate
510	CONSUMER PRODUCTS	120	AutobodyShops	Dun & Bradstreet's Market Insight Database
510	CONSUMER PRODUCTS	739	OTHERCOAT	Dun & Bradstreet's Market Insight Database
510	CONSUMER PRODUCTS	270	Housing_Com_Emp	Metropolitan Planning Organization (MPO)/Council of Government (COG) data /California Statewide Travel Demand Model (CSTDM)
510	CONSUMER PRODUCTS	651	UCD_Single_Family_Housing	Metropolitan Planning Organization (MPO)/Council of Government (COG) data /California Statewide Travel Demand Model (CSTDM) data
510	CONSUMER PRODUCTS	450	Pop_ComEmp_Hos	Metropolitan Planning Organization (MPO)/Council of Government (COG) data /California Statewide Travel Demand Model (CSTDM) data and ESRI
510	CONSUMER PRODUCTS	672	Devplnd_HiDensity	National Land Cover Database (NLCD)
520	ARCHITECTURAL COATINGS AND RELATED PROCESS SOLVENTS	230	HE_Sqft	Council of Government (COG) Housing and Employment

EICSUM	EICSUMN	Primary Surrogate ID	Primary Surrogate Name	Data Source of Primary Surrogate
520	ARCHITECTURAL COATINGS AND RELATED PROCESS SOLVENTS	270	Housing_Com_Emp	Metropolitan Planning Organization (MPO)/Council of Government (COG) data /California Statewide Travel Demand Model (CSTDM)
520	ARCHITECTURAL COATINGS AND RELATED PROCESS SOLVENTS	110	All_PavedRds	TIGER Geodatabases from U.S. Census Bureau
530	PESTICIDES/ FERTILIZERS	230	HE_Sqft	Council of Government (COG) Housing and Employment
530	PESTICIDES/ FERTILIZERS	514	PEST_ME_BR	Department of Pesticide Regulation
530	PESTICIDES/ FERTILIZERS	732	WOOD	Dun & Bradstreet's Market Insight Database
540	ASPHALT PAVING / ROOFING	588	UCD_Onroad_Construction	CALTRANS highway construction projects dataset (line)
610	RESIDENTIAL FUEL COMBUSTION	573	FIREPLACES	Digital Map Products 2017 Parcel Data
610	RESIDENTIAL FUEL COMBUSTION	572	ResLPGHeat	US Census American Community Survey (ACS)
620	FARMING OPERATIONS	356	HORSE_RANCHES	CARB Green House Gas Inventory group for a study of Methane
620	FARMING OPERATIONS	320	Irr_Cropland	National Land Cover Database (NLCD)
620	FARMING OPERATIONS	690	LANDPREP	Sierra Research AgTool Contract
630	CONSTRUCTION AND DEMOLITION	588	UCD_Onroad_Construction	CALTRANS highway construction projects dataset (line)
630	CONSTRUCTION AND DEMOLITION	587	UCD_Offroad_Construction	Storm Notice of Intent (NOI) dataset

EICSUM	EICSUMN	Primary Surrogate ID	Primary Surrogate Name	Data Source of Primary Surrogate
640	PAVED ROAD DUST	590	SandandGravelMines	National Atlas
640	PAVED ROAD DUST	610	SecondaryPaved Rds	TIGER Geodatabases from U.S. Census Bureau
645	UNPAVED ROAD DUST	384	MILITARY_TACTICAL	Federal Aviation Administration / National Transportation Atlas Database (NTAD) and ESRI
645	UNPAVED ROAD DUST	190	Forestland	National Land Cover Database (NLCD)
645	UNPAVED ROAD DUST	720	FARMRD_VMT	Sierra Research AgTool Contract
645	UNPAVED ROAD DUST	660	UnpavedRds	TIGER Geodatabases from U.S. Census Bureau
650	FUGITIVE WINDBLOWN DUST	391	PASTURE	Sierra Research AgTool Contract
650	FUGITIVE WINDBLOWN DUST	660	UnpavedRds	TIGER Geodatabases from U.S. Census Bureau
650	FUGITIVE WINDBLOWN DUST	160	DryLakeBeds	U.S. Geological Survey (USGS)
660	FIRES	441	UCD_Population	Metropolitan Planning Organization (MPO)/Council of Government (COG) data /California Statewide Travel Demand Model (CSTDM) data
660	FIRES	480	PrimaryRoads	TIGER Geodatabases from U.S. Census Bureau
670	MANAGED BURNING AND DISPOSAL	674	Devplnd_LoDensity	National Land Cover Database (NLCD)

EICSUM	EICSUMN	Primary Surrogate ID	Primary Surrogate Name	Data Source of Primary Surrogate
670	MANAGED BURNING AND DISPOSAL	190	Forestland	National Land Cover Database (NLCD)
670	MANAGED BURNING AND DISPOSAL	720	FARMRD_VMT	Sierra Research AgTool Contract
680	UTILITY EQUIPMENT	651	UCD_Single_Family_Housing	Metropolitan Planning Organization (MPO)/Council of Government (COG) data /California Statewide Travel Demand Model (CSTDM) data
690	COOKING	561	CHARBROILING	SJVAPCD & Dun and Bradstreet Insight Market
699	OTHER (MISCELLANEOUS PROCESSES)	441	UCD_Population	Metropolitan Planning Organization (MPO)/Council of Government (COG) data /California Statewide Travel Demand Model (CSTDM) data
700	ONROAD	ESTA	ESTA Spatial Surrogates	CALVAD VMT SCAG/SANDAG MPOs LINEHAUL and ITN
810	AIRCRAFT	382	MILITARY_AIRCRAFT	Federal Aviation Administration / National Transportation Atlas Database (NTAD) and ESRI
810	AIRCRAFT	100	Airports	Federal Aviation Administration and ESRI
810	AIRCRAFT	140	Comm_Airports	Federal Aviation Administration, National Transportation Atlas Database (NATD)

EICSUM	EICSUMN	Primary Surrogate ID	Primary Surrogate Name	Data Source of Primary Surrogate
810	AIRCRAFT	320	Irr_Cropland	National Land Cover Database (NLCD)
820	TRAINS	491	LINEHAUL	ARB in-house rail modeling
820	TRAINS	360	Metrolink_Lines	CARB Green House Gas Inventory group for a study of Methane
820	TRAINS	490	Raillines	Federal Railroad Administration / National Transportation Atlas Database (NTAD)
820	TRAINS	361	Passenger_Rail	Offroad Diesel Analysis Section, AQPSD
820	TRAINS	501	Switcher_RailYards	Off-Road Diesel Analysis Section, AQPSD: Union Pacific Railroad (UP) and Burlington Northern Santa Fe Railway (BNSF)
830	SHIPS AND COMMERCIAL BOATS	460	Ports	(USDOT)/Bureau of Transportation Statistics's (BTS's) National Transportation Atlas Database (NTAD)
830	SHIPS AND COMMERCIAL BOATS	431	OILWELL	Division of Oil, Gas, and Geothermal Resources
830	SHIPS AND COMMERCIAL BOATS	640	Shiplanes	Marine Cadastre Automatic Identification System
833	OCEAN GOING VESSELS	460	Ports	(USDOT)/Bureau of Transportation Statistics's (BTS's) National Transportation Atlas Database (NTAD)
833	OCEAN GOING VESSELS	383	MILITARY_SHIPS	Marine Cadastre - Military Vessel
833	OCEAN GOING VESSELS	640	Shiplanes	Marine Cadastre Automatic Identification System

EICSUM	EICSUMN	Primary Surrogate ID	Primary Surrogate Name	Data Source of Primary Surrogate
833	OCEAN GOING VESSELS	642	Tanker	Marine Cadastre Automatic Identification System
833	OCEAN GOING VESSELS	643	Passenger	Marine Cadastre Automatic Identification System
835	COMMERCIAL HARBOR CRAFT	460	Ports	(USDOT)/Bureau of Transportation Statistics's (BTS's) National Transportation Atlas Database (NTAD)
835	COMMERCIAL HARBOR CRAFT	332	FERRIES	Ferry Company Websites and Google Maps
835	COMMERCIAL HARBOR CRAFT	383	MILITARY_SHIPS	Marine Cadastre - Military Vessel
835	COMMERCIAL HARBOR CRAFT	641	CREW_SUPPLY	Marine Cadastre Automatic Identification System
835	COMMERCIAL HARBOR CRAFT	339	DREDGE	Marine Cadastre Coastal Maintained Channels
840	RECREATIONAL BOATS	338	OCEAN_RECBOAT	Marine Cadastre Automatic Identification System - Pleasure Craft
840	RECREATIONAL BOATS	651	UCD_Single_Family_Housing	Metropolitan Planning Organization (MPO)/Council of Government (COG) data /California Statewide Travel Demand Model (CSTDM) data
840	RECREATIONAL BOATS	336	OCEAN_LAKES_RECBOAT	U.S. Geological Survey (USGS)
840	RECREATIONAL BOATS	335	LAKES_RIVERS_RECBOAT	U.S. Geological Survey (USGS)
850	OFF-ROAD RECREATIONAL VEHICLES	220	GolfCourses	ESRI

EICSUM	EICSUMN	Primary Surrogate ID	Primary Surrogate Name	Data Source of Primary Surrogate
850	OFF-ROAD RECREATIONAL VEHICLES	651	UCD_Single_Family_Housing	Metropolitan Planning Organization (MPO)/Council of Government (COG) data /California Statewide Travel Demand Model (CSTDM) data
850	OFF-ROAD RECREATIONAL VEHICLES	660	UnpavedRds	TIGER Geodatabases from U.S. Census Bureau
850	OFF-ROAD RECREATIONAL VEHICLES	170	Elev5000ft	U.S. Geological Survey (USGS)
860	OFF-ROAD EQUIPMENT	580	Res_NonRes_Chg	Council of Government (COG) Housing and Employment
860	OFF-ROAD EQUIPMENT	630	Ser_ComEmp_Sch_GolfC_Cem	Council of Government (COG) Service and Commercial Employment & ESRI
860	OFF-ROAD EQUIPMENT	460	Ports	(USDOT)/Bureau of Transportation Statistics's (BTS's) National Transportation Atlas Database (NTAD)
860	OFF-ROAD EQUIPMENT	431	OILWELL	Division of Oil, Gas, and Geothermal Resources
860	OFF-ROAD EQUIPMENT	384	MILITARY_TACTICAL	Federal Aviation Administration / National Transportation Atlas Database (NTAD) and ESRI
860	OFF-ROAD EQUIPMENT	100	Airports	Federal Aviation Administration and ESRI
860	OFF-ROAD EQUIPMENT	500	RailYards	Federal Railroad Administration / National Transportation Atlas Database (NTAD)

EICSUM	EICSUMN	Primary Surrogate ID	Primary Surrogate Name	Data Source of Primary Surrogate
860	OFF-ROAD EQUIPMENT	485	TRU	Integrated Transportation Network and Caltrans Truck Network and Digital Map Products 2017 Parcel Data - USECODES 2006, 5003, 5005, 5007 6002
860	OFF-ROAD EQUIPMENT	302	UCD_Industrial	Longitudinal Employer-Household Dynamics (LEHD)
860	OFF-ROAD EQUIPMENT	339	DREDGE	Marine Cadastre Coastal Maintained Channels
860	OFF-ROAD EQUIPMENT	651	UCD_Single_Fa mily_Housing	Metropolitan Planning Organization (MPO)/Council of Government (COG) data /California Statewide Travel Demand Model (CSTDM) data
860	OFF-ROAD EQUIPMENT	190	Forestland	National Land Cover Database (NLCD)
860	OFF-ROAD EQUIPMENT	587	UCD_Offroad_Co nstruction	Storm Notice of Intent (NOI) dataset
870	FARM EQUIPMENT	720	FARMRD_VMT	Sierra Research AgTool Contract
890	FUEL STORAGE AND HANDLING	651	UCD_Single_Fa mily_Housing	Metropolitan Planning Organization (MPO)/Council of Government (COG) data /California Statewide Travel Demand Model (CSTDM) data
890	FUEL STORAGE AND HANDLING	335	LAKES_RIVERS _RECBOAT	U.S. Geological Survey (USGS)
910	BIOGENIC SOURCES	672	Devplnd_HiDensi ty	National Land Cover Database (NLCD)
910	BIOGENIC SOURCES	190	Forestland	National Land Cover Database (NLCD)

EICSUM	EICSUMN	Primary Surrogate ID	Primary Surrogate Name	Data Source of Primary Surrogate
920	GEOGENIC SOURCES	190	Forestland	National Land Cover Database (NLCD)
920	GEOGENIC SOURCES	212	GAS_SEEP	U.S. Geological Survey (USGS)
920	GEOGENIC SOURCES	432	OIL_SEEP	U.S. Geological Survey (USGS) – Pacific Coastal & Marine Science
930	WILDFIRES	190	Forestland	National Land Cover Database (NLCD)
930	WILDFIRES	391	PASTURE	Sierra Research AgTool Contract
940	WINDBLOWN DUST	412	Fugitive_Dust	National Land Cover Database (NLCD)

L.2.3.1 Spatial Allocation of Area Sources

Each area source category is assigned a primary spatial surrogate that is used to allocate emissions to a grid cell in CARB's 4km statewide modeling domain. Examples of surrogates include population, land use, and other data with known geographic distributions for allocating emissions to grid cells, as described above.

L.2.3.2 Spatial Allocation of Point Sources

Each point source is allocated to grid cells using the latitude and longitude reported for each stack. If there are no stack latitude and longitude, the facility coordinates are used. There are two types of point sources: elevated and non-elevated sources. Most stationary point sources with existing stacks are regarded as potentially elevated sources. Those without physical stacks that provide only latitude/longitude, such as airports or landfills, are considered non-elevated. Emissions are allocated vertically for elevated sources using the SMOKE (Sparse Matrix Operator Kernel Emissions) modeling system's in-line plume rise calculation within the CMAQ (Community Multi-scale Air Quality) photochemical model. SMOKE will select the sources which will receive the CMAQ in-line plume rise treatment, and group together sources with nearly identical stack parameters in order to reduce the number of calculations performed by the CMAQ in-line plume rise module. SMOKE will then output the emissions by grouped sources and the accompanying stack/facility coordinates and stack parameters for CMAQ's in-line plume rise module to handle the vertical allocation of the elevated sources.

L.2.3.3 Spatial Allocation of Wildfires, Prescribed Burns, and Wildland Fire Use

Emissions from wildfires, prescribed burns, and wildland fires are event- and location-based.

A fire event can last a few hours or span multiple days. Each fire is spatially allocated to grid cells using the extent of each fire event while the temporal distribution also reflects the actual duration of the fire. The spatial information to allocate the fire emissions comes from a statewide interagency fire perimeters geodatabase maintained by the Fire and Resource Assessment Program (FRAP) of the California Department of Forestry and Fire Protection (CALFIRE). More details on the methodology and estimation of the wildfire emissions can be found in Section L.3.6.1.

L.2.3.4 Spatial Allocation of Ocean-going Vessels (OGV)

CARB OGV emissions consist of four activity types: hoteling, maneuvering, anchorage and transit. Since hoteling is stationary in port areas, it was treated as a point source. The remaining activity types are regarded as area sources. Individual berths were identified from a combination of AIS telemetry data, satellite and aerial photography, and detailed port maps where available. The centroids of grid cells on the statewide domain containing berth locations were then associated with hoteling emissions for each GAI. Transit, spatial surrogates were constructed based on the National Waterway Network, The Ship Traffic, and AIS data from 2017. Maneuvering spatial surrogates were drawn to connect the transit lanes with the berth locations for each port. Anchorage locations were determined based on raster data from NOAA (NOAA, 2019) which reflects anchorage locations codified in the Federal Register.

L.2.3.5 Spatial Allocation of On-road Motor Vehicles

The spatial allocation of on-road motor vehicles is based on data from travel demand models provided by the Southern California Association of Governments (SCAG), San Diego Association of Governments (SANDAG), California Department of Transportation (Caltrans), and the California Vehicle Activity Database (CalVAD). For more details, see Section L.3.2.3

L.2.4 <u>Speciation Profiles</u>

CARB's emission inventory lists the amount of pollutants discharged into the atmosphere by source in a certain geographical area during a given time period. It currently contains estimates for CO, NH_3, NOx, SOx, total organic gases (TOG) and particulate matter (PM). CO and NH_3 each are single species; NOx emissions are composed of NO, NO_2 and HONO; and SOx emissions are composed of SO_2 and SO_3. TOG and PM potentially contain over hundreds of different chemical species, and speciation is the process of disaggregating these inventory pollutants into individual chemical species components or groups of species. CARB maintains and updates such speciation profiles for organic gases (OG) and PM for a variety of source categories.

Photochemical models simulate the physical and chemical processes in the lower atmosphere, and include all emissions of the important classes of chemicals involved in photochemistry as well as less reactive compounds that are of concern from a health or visibility standpoint. TOG includes all organic compounds that can become airborne (through evaporation, sublimation, as aerosols, etc.), excluding CO, CO_2, carbonic acid, metallic carbides or carbonates, and ammonium carbonate. TOG emissions reported in the CARB's emission inventory are the basis for deriving the reactive organic gas (ROG) emission components, which are also reported in the inventory. ROG is defined as TOG minus CARB's exempt compounds (e.g., methane, ethane, various chlorinated fluorocarbons, acetone, perchloroethylene, volatile methyl siloxanes, etc.). ROG is nearly identical to U.S. EPA's Volatile Organic Compounds (VOC), which is based on EPA's exempt list. For all practical purposes, use of the terms ROG and VOC are interchangeable.

The OG speciation profiles are applied to estimate the amounts of various organic compounds that make up TOG emissions. A speciation profile contains a list of organic compounds and the weight fraction that each compound comprises of the TOG emissions from a particular source type. In addition to the chemical name for each chemical constituent, the file also shows the 5-digit CARB internal identification chemical code. The speciation profiles are applied to TOG to develop both the photochemical model inputs and the emission inventory for ROG. It should be noted that districts are allowed to report their own reactive fraction of TOG that is used to calculate ROG rather than use the information from the assigned OG speciation profiles. These district-reported fractions are not used in developing modeling inventories because the information needed to calculate the amount of each organic compound is not available.

The PM emissions are size-fractionated by using PM size distribution profiles, which contain the total weight fraction for $PM_{2.5}$ and PM_{10} out of total PM. The fine and coarse PM chemical compositions are characterized by applying the PM chemical speciation profiles for each source type, which contain the weight fractions of each chemical species for $PM_{2.5}$, PM_{10}, and total PM. PM chemical speciation profiles may also vary for different PM size fractions even for the same emission source. PM size profiles and speciation profiles are typically generated based on source testing data. In most previous source testing studies aimed at determining PM chemical composition, filter-based sampling techniques were used to collect PM samples for chemical analyses.

The original OG profiles and PM profiles are available for download from CARB's speciation web site. Based on these original profiles, a model-ready speciation file, gspro, was generated for a specific chemical mechanism (for example, SAPRC07T) to separate aggregated inventory pollutant emission totals into emissions of model species required by the air quality model.

Each process or product category is keyed to one of the OG profiles and one of the PM profiles. Also available for download from CARB's web site (see link in previous paragraph) is a cross-reference file that indicates which OG profile and PM profile are assigned to each category in the inventory. The inventory source categories are represented by an 8-digit source classification code (SCC) for point sources, or a 14-digit emission inventory code (EIC) for area and mobile sources. Some of the OG profiles and PM profiles related to motor vehicles, ocean going vessels, and fuel evaporative sources vary by the inventory year of interest, due to changes in fuel composition, vehicle fleet composition, and emissions control devices such as diesel particulate filters (DPFs). Details can be found in CARB's references of speciation profile development available under the previous speciation website link. Mapping of each category to OG and PM profiles is summarized in rogpm and gsref files.

Research studies are conducted regularly to improve CARB's speciation profiles. These profiles support ozone and PM modeling studies but are also designed to be used for regional toxics modeling. Other health or welfare related modeling studies where the compounds of interest cannot always be anticipated make use of these profiles. Therefore, speciation profiles need to be as complete and accurate as possible. CARB has an ongoing effort to update speciation profiles as data become available, such as through testing of emission sources or surveys of product formulations. New speciation data generally undergo technical and peer review, and updating of the profiles is coordinated with users of the data. The recent additions to CARB's speciation profiles include (CARB, 2019a):

(1) OG profiles
- Off-road recreational vehicle exhaust and evaporation
- Biomass burning
- Consumer products
- Architectural coating
- Gasoline fuel and headspace vapor
- Gasoline vehicle hot soak and diurnal evaporation
- Gasoline vehicle start and running exhaust
- Silage
- Aircraft exhaust
- Compressed Natural Gas (CNG) bus running exhaust

(2) PM profiles
- Tire burning
- Gasoline vehicle exhaust
- On-road diesel exhaust
- Off-road diesel exhaust
- Ocean going vessel exhaust
- Aircraft exhaust
- Concrete batching
- Commercial cooking
- Residential fuel combustion-natural gas
- Coating/painting
- Cotton ginning
- Stationary combustion

L.3 METHODOLOGY FOR DEVELOPING BASE CASE, BASELINE, AND FUTURE PROJECTED EMISSIONS INVENTORIES

As mentioned in Section L.1, the base case and reference inventories include temperature, humidity, and solar insolation effects for some emission categories; development of these data is described in Sections L.3.6. Sections L.3.1 through L.3.8 detail how the base case and reference inventories were created for different sectors of the inventory such as point, area, on-road motor vehicles, biogenic, OGV, other day-specific sources, Northern Mexico, and Western States.

L.3.1 Estimation of Gridded Area and Point Sources

Emissions inventories that are temporally, chemically, and spatially resolved are needed as inputs for the photochemical air quality model. Point sources and area sources (area-wide, off-road mobile, and aggregated stationary) are processed into emissions inventories for photochemical modeling using the SMOKE modeling system. California-specific improvements to SMOKE were implemented under a CARB contract for version 4.0 of SMOKE (Baek, 2015); however, GenTpro, a pre-SMOKE utility program that modulates annual hourly temporal profiles based on modeled meteorology, cannot run in CARB SMOKE due to the fact that it does not recognize the COABDIS-defined region code as an acceptable alphanumeric parameter. In 2018, CARB SMOKE was replaced with the CMAS-released SMOKEv4.0 (referred as Official SMOKE hereafter) and included changes to the GenTpro program that accepted the numeric CARB GAI region code. COABDIS-based cross-reference files were subsequently changed to GAI in order to match the Official SMOKE format.

Inputs for SMOKE are annual emissions totals from CEPAM and information for allocating to temporal, chemical, and spatial resolutions. Temporal inputs for SMOKE are screened for missing or invalid temporal codes as discussed in Section L.4.1. Temporal allocation of emissions using SMOKE involves the disaggregation of annual emissions totals into monthly, day-of-week, and hour-of-day emissions totals. The temporal codes from Table L-3 and Table L-4 are reformatted into an input-ready format as explained in the SMOKE user's manual. Chemical speciation profiles, as described in Section L.2.4, and emissions source cross-reference files used as inputs for SMOKE are developed by CARB staff. SMOKE uses the files for the chemical speciation of NOx, SOx, TOG, and PM to produce the species needed by photochemical air quality models.

Emissions for area sources are allocated to grid cells as stated by the modeling grid domain defined in Section L.1.4. Emissions are spatially disaggregated by the use of spatial surrogates as described in Section L.2.3. These spatial surrogates are converted to a SMOKE-ready format as described in the SMOKE user's manual. Emissions for point sources are allocated to grid cells by SMOKE using the latitude and longitude coordinates reported for each stack.

L.3.2 Estimation of On-road Motor Vehicle Emissions

The EMFAC emissions model is used by CARB to assess emissions from on-road vehicles including cars, trucks, and buses in California, and to support air quality planning efforts to meet the Federal Highway Administration's transportation planning requirements. EMFAC is designed to produce county-level, average-day estimates. As a result, these estimates must be disaggregated spatially and temporally into gridded, hourly estimates for air quality modeling.

At the time of the development of these inventories the most recent version of EMFAC that has been approved by U.S. EPA for SIP and conformity purposes is EMFAC2017 (84 FR 41717) (U.S. EPA, 2019). EMFAC2017 has three separate modules: one that estimates emissions, one that estimates emission rates, and one that estimates activity data. Only the emission module and the activity module are relevant for the preparation of the on-road emissions gridded inventory. The emissions module runs for every county and every day of the modeled year using day-specific temperature and relative humidity. The activity module is run once to estimate vehicle miles traveled (VMT), number of vehicle trips, fuel consumption, and the number of vehicles in use.

L.3.2.1 General Methodology

The EMFAC2017 emissions are processed into on-road emissions inventories using ESTA developed by CARB. The ESTA model applies spatial and temporal surrogates to emissions to create top-down emission inventory files. More information on ESTA is available at the following link.

L.3.2.2 Activity Data Updates

Link-based and Traffic Analysis Zone (TAZ)-based travel activity from travel demand models provided by different MPOs, Caltrans and other California RTPAs. Different types of quality control parameters like vehicle mix and VMT are obtained from default EMFAC and Caltrans databases. Before spatial allocation occurs, quality control tests are run on the data to ensure values lie within reasonable limits.

L.3.2.3 Spatial Adjustment

On-road motor vehicle emissions for Imperial, Los Angeles, Orange, Riverside, San Bernardino, San Diego, and Ventura counties were spatially allocated using link-based travel demand model data provided by the Southern California Association of Governments (SCAG) and San Diego Association of Governments (SANDAG). SANDAG data came from the 2018 adopted Regional Transportation Improvement Program, while SCAG data came from 2016 the Regional Transportation Plan / Sustainable Communities Strategy (RTP/SCS) Amendment #3. Each MPO provided three modeling years of transportation data. EMFAC growth factors were used to create uniform modeling years. For the vintages of all data sets used, see Table L-6. Data from both MPOs were split into light-duty and heavy-duty vehicle types data sets based on information provided by each model. On-road spatial allocation for these counties was weighted using vehicle miles traveled (VMT).

All other California county data were sourced from the California Vehicle Activity Database (CalVAD) for light-duty vehicle types and the California Statewide Travel Demand Model (CSTDM) for heavy-duty vehicle types. Light-duty data from CalVAD were processed into a gridded dataset for the entire state. This gridded dataset was intersected with primary and secondary roadways from the Topologically Integrated Geographic Encoding and Referencing (TIGER) roadway network in order to assign VMT values to each roadway. Heavy-duty data from CSTDM data was extracted for all major California highways. The on-road spatial allocation of emissions was allocated using VMT as the weighting field.

Data from SANDAG and SCAG MPOs were combined with the CalVAD and CSTDM data sources to create a statewide data set for on-road emission spatial allocations for both heavy-duty and light-duty vehicle types.

Travel demand model on and off-peak periods were assigned to closest matching CSTDM period. MPO travel demand model data were quality assured using EMFAC Vehicle Miles Traveled (VMT) totals. Spatial allocations were also checked for potential inaccurate hotspots created by any of the processing steps. EMFAC growth factors were used to convert the MPO data to the appropriate modeling years.

Table L-6
Vintage of Data Sources Used for Analysis

Data Source	Version/ Base Year	Data types received
SANDAG	2008	Links, Trips
SCAG	2008	Links, Trips
CSTDM	2010	Links
CalVAD	2012	Links
TIGER	2010	Roadways

L.3.2.4 Temporal Adjustment (Day-of-week Adjustments to EMFAC Daily Totals)

EMFAC2017 produces average day-of-week (DOW) estimates that represent Tuesday, Wednesday, and Thursday. In order to more accurately represent daily emissions, DOW adjustments are made to all emissions estimated on a Friday, Saturday, Sunday or Monday. The DOW adjustment factors were developed using CalVAD data. The California Vehicle Activity Database (CalVAD), developed by UC Irvine for CARB, is a system that fuses available data sources to produce a “best estimate” of vehicle activity by class. The CalVAD data set includes actual daily measurements of VMT on the road network for 43 of the 58 counties in California. However, there are seven counties that cannot be used because the total vehicle miles traveled are less than the sum of the heavy heavy-duty truck vehicle miles traveled and trucks excluding heavy heavy-duty vehicle miles traveled. Furthermore, two more counties that have high vehicle miles traveled on Sunday are also excluded. Therefore, only 34 of these counties had useful data. In order to fill the missing 24 counties' data to cover all of California, a county which is nearby and similar in geography is selected for each of the missing counties. The CalVAD fractions were developed for three categories of vehicles: passenger cars (LD), light- and medium-duty trucks (LM), and heavy-heavy duty trucks (HHDT). Table L-7 also shows the corresponding assignment to each vehicle type. Furthermore, the CalVAD fractions are scaled so that a typical workday (Tuesday, Wednesday, or Thursday) gets a scaling factor of 1.0. All other days of the week receive a scaling factor where their VMT is related back to the typical workday. This means there are a total of five weekday scaling factors. Lastly, the CalVAD data were used to create a typical holiday, because the traffic patterns for holidays are quite different than a typical weekday. Thus, in the end, there are six daily fractions for each of the three vehicle classes, for all 58 counties. The DOW factors and vehicle type can be found in Appendix A: Day-of-week Redistribution Factors by Vehicle Type and County.

Table L-7
Vehicle Classification and Type of Adjustment

Vehicle Class	Vehicle	Type of adjustment
1	LDA	LD
2	LDT1	LD
3	LDT2	LD
4	MDV	LD
5	LHDT1	LM
6	LHDT2	LM
7	T6	LM
8	T7 HHDT	HHDT
9	Other Bus	LM
10	School Bus	Unadjusted on weekdays, zeroed on weekends
11	Urban Bus	LD
12	Motorhomes	LD
13	Motorcycles	LD

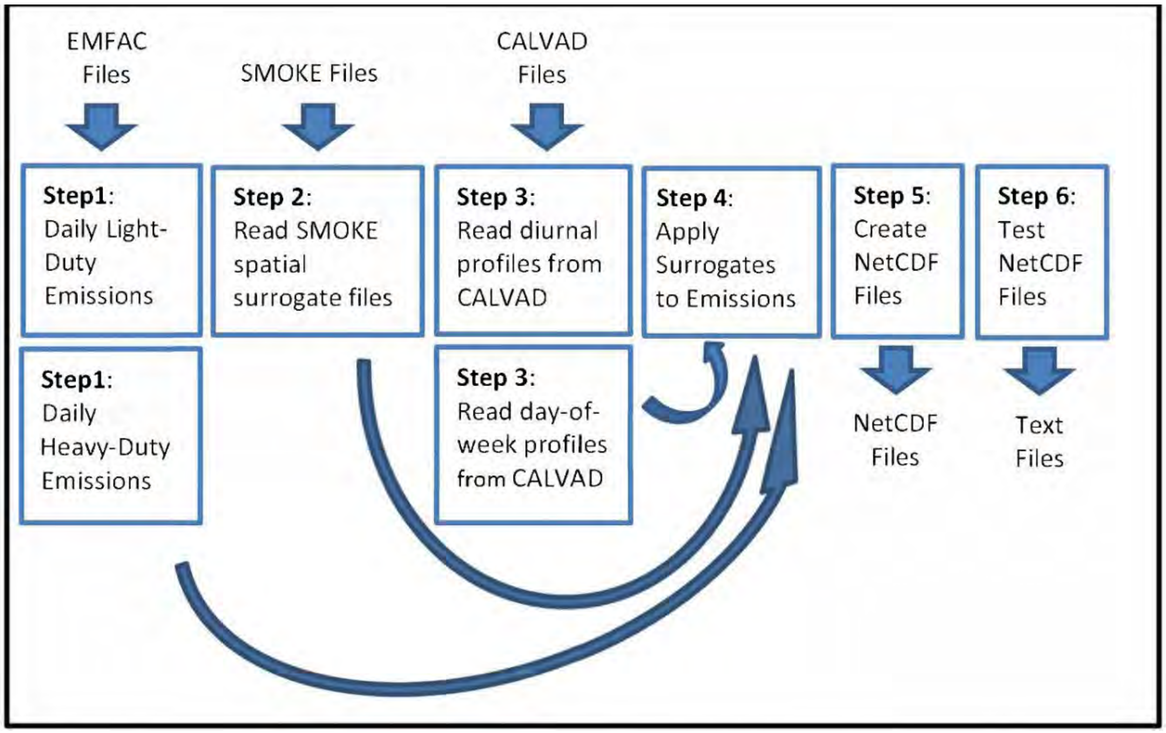
L.3.2.5 Temporal Adjustment (Hour-of-Day Profiles for EMFAC Daily Totals)

EMFAC produces emission estimates for an average weekday and lacks the day-of-week hour-of-day temporal variations that are known to occur on specific days of the week. To rectify this, the CalVAD data were used to develop hour-of-day profiles for Friday through Monday, a typical weekday and a typical holiday. The hour-of-day profiles can be found in Appendix B: Hour-of-Day Profiles by Vehicle Type and County.

L.3.2.6 Summary of On-Road Emissions Processing Steps

The six steps to process on-road emissions for regional air quality modeling with CMAQ are represented in Figure L-2 below. Step 1 reads daily emissions input data from EMFAC. Step 2 reads SMOKE-ready spatial surrogates files. Step 3 reads day of week and diurnal temporal activity profiles from CALVAD. Step 4 applies both the spatial surrogates and temporal allocations to the daily emissions from EMFAC. Step 5 creates the gridded, hourly NETCDF files for each day of the year being modeled. Lastly, step 6 produces text files for use in quality assurance and quality checks of the emissions data.

Figure L-2
Workflow for Spatial and Temporal Allocation of On-Road Emissions



L.3.2.7 Adjustment to the Future Year On-Road Emissions

CARB is committed to reduce the diesel NOx emissions for medium heavy-duty diesel trucks and heavy heavy-duty diesel trucks in the South Coast and San Diego for 2032. The reduction programs include the Low NOx Standard (CARB, 2019b), Advanced Clean Truck (ACT) (CARB, 2019c), and Heavy Duty Inspection and Maintenance Program (HD I&M) (CARB, 2019d). The factors for 2032 are shown in Table L-8.

Table L-8
NOx Reductions (TPD) by Air Basin and Program for 2032

Air Basin	Low NOx	ACT	HD I&M
San Diego	1.94	0.42	1.67
South Coast	11.01	1.11	10.07

On-road emissions were further adjusted to account for the “Safer Affordable Fuel-Efficient (SAFE) Vehicles Rule Part One: One National Program” (84 FR 51310) adopted by EPA and the Department of Transportation’s National Highway Traffic and Safety Administration (U.S. EPA and NHTSA, 2019). The SAFE vehicle rule relaxes ZEV sales and GHG standards leading to an increase in criteria pollutants. CARB released the “EMFAC Off-Model Adjustment Factors to Account for the SAFE Vehicle Rule Part One” on November 20, 2019 (CARB, 2019e). The document includes a table of NOx, TOG, PM, and CO adjustment factors by year for light duty vehicles. An excerpt of the adjustment factors through 2032 are included in Table L-9 below.

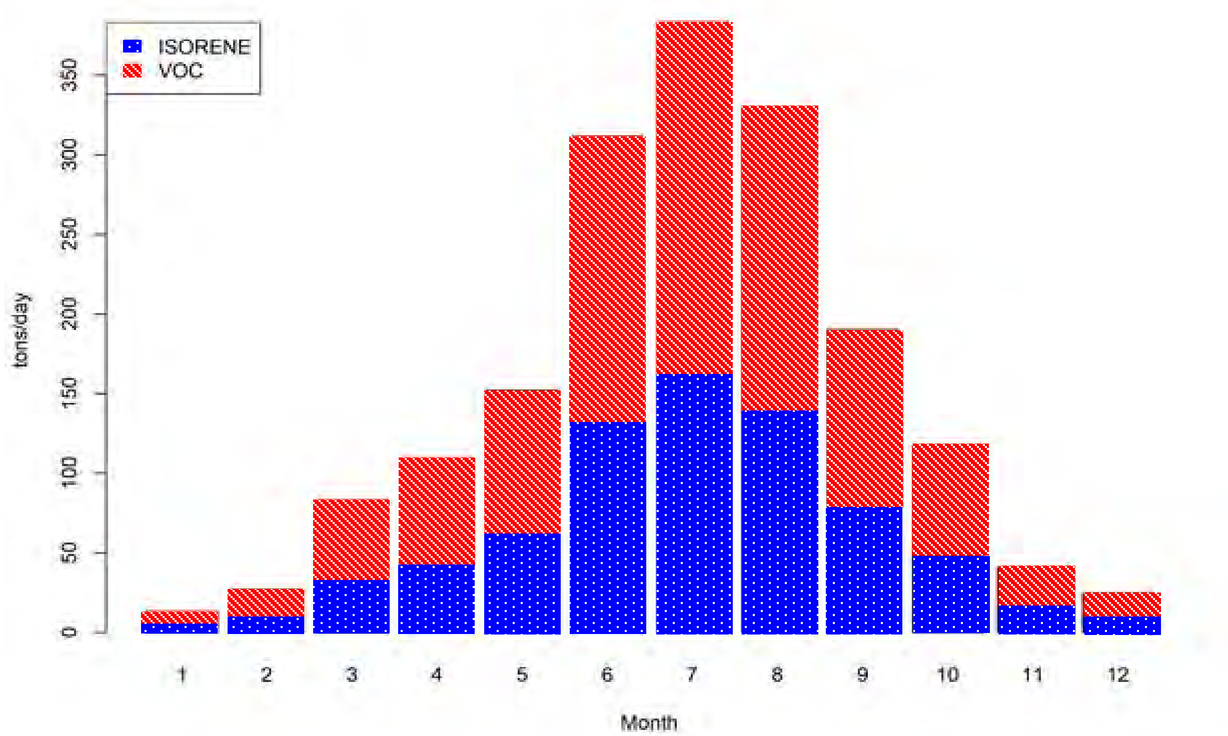
Table L-9
SAFE Act Vehicle Adjustment Factors for EMFAC2017

Adjustment Factors for EMFAC2017 Gasoline Light Duty Vehicles					
Year	**NOx Exhaust**	**TOG Evaporative**	**TOG Exhaust**	**PM Exhaust**	**CO Exhaust**
2021	1.0002	1.0001	1.0002	1.0009	1.0005
2022	1.0004	1.0003	1.0004	1.0018	1.0014
2023	1.0007	1.0006	1.0007	1.0032	1.0027
2024	1.0012	1.0010	1.0011	1.0051	1.0044
2025	1.0018	1.0016	1.0016	1.0074	1.0065
2026	1.0023	1.0022	1.0020	1.0091	1.0083
2027	1.0028	1.0028	1.0024	1.0105	1.0102
2028	1.0034	1.0035	1.0028	1.0117	1.0120
2029	1.0040	1.0042	1.0032	1.0129	1.0138
2030	1.0047	1.0051	1.0037	1.0142	1.0156
2031	1.0054	1.0061	1.0042	1.0155	1.0173
2032	1.0061	1.0072	1.0047	1.0169	1.0189

L.3.3 Estimation of Gridded Biogenic Emissions

Biogenic emissions were generated using the MEGAN3.0 biogenics emissions model. MEGAN3.0 incorporates a new pre-processor (MEGAN-EFP) for estimating biogenic emission factors based on available landcover and emissions data. The MEGAN3.0 default datasets for plant growth form, ecotype, and emissions were utilized. Leaf Area Index (LAI) for non-urban grid cells was based on the 8-day 500-m resolution MODIS Terra/AQUA combined product (MCD15A2H) for 2017. The LAI data was converted to LAIv, which represents the LAI for the vegetated fraction within each grid cell, by dividing the gridded MODIS LAI values by the Maximum Green Vegetation Fraction (MGVF) for each grid cell. The MODIS LAI product does not provide information on LAI in urban regions, so urban LAIv was estimated from the US Forest Service’s Forest Inventory and Analysis (FIA) urban tree plot data, processed through the i-Tree v6 software. Peak summertime urban LAIv for San Diego was estimated to be 4.6, and this peak value was adjusted for each 8-day MODIS period based on the relative change in non-urban MODIS LAI across the state. Hourly meteorology was provided by 4-km WRF simulations, and all stress factor adjustments were turned off. Figure L-3 shows the monthly variation in biogenic isoprene and total ROG (VOC) within the San Diego basin for 2017. Basin-wide biogenic ROG emissions are roughly 3-4 times the anthropogenic ROG emissions during summer months, peaking in July, with total ROG emissions nearing 400 tons/day and remaining above 300 tons/day for the peak summer months (June, July, August).

Figure L-3
Monthly Variations in Isoprene and VOC Emissions for San Diego (2017)



L.3.4 Aircraft Emissions

Aircraft emissions were generated using the Gridded Aircraft Trajectory Emissions Model (GATE) developed by CARB (AQPSD CARB, 2019). The GATE model distributes aircraft emissions in three dimensions. The GATE model takes annual, ungridded aircraft emissions during: landing, taxiing, and take-off. GATE converts this data into gridded, hourly files with the following steps:

1. Read aircraft emissions from an annual inventory
2. Split the emissions into hourly components
3. Split any county-wide emissions into individual runways
4. Geometrically model the 3D flight paths at each runway

5. Intersect the above 3D paths with the 3D modeling grid
6. Distribute the hourly aircraft emissions into the 3D grid

More information on GATE is available at the following link.

L.3.5 Estimation of Ocean-Going Vessel (OGV) Emissions

As of May 2019, annual emissions are provided through CEPAM for commercial and military OGV. The Mobile Source Analysis Branch compiled port activity data for 2016 reported by major three ports Long Beach, Port of Los Angeles, Bay Area, and San Diego. The activity data consisted of daily visits by vessel types for the full calendar year. This data was used to derive of monthly and weekly temporal profiles for OGV sources. At the time of developing this SIP the 2016 year data is the most current port specific activity data reported. No activity data was available to create temporal profiles for the military sector; default SMOKE temporal profiles were assumed.

After applying the port activity factors mentioned above, emissions were separated by at-berth and everything else. At-berth emissions are processed through SMOKE and plume rise is calculated for every day of the year (Kwok, 2015). For transit, maneuvering, and anchorage, emissions are distributed evenly in two vertical layers (2 and 3) (Kwok, 2015).

L.3.6 Estimation of Other Day-Specific Sources

Day-specific data were used for preparing base case inventories when data were available. CARB and district staff were able to gather hourly/daily emission information for 1) wildfires and prescribed burns, 2) paved and unpaved road dust, and 3) agricultural burns in six districts (more details highlighted below).

For the reference and future year inventories, which are used to calculate RRFs, day-specific emissions for wildfires, prescribed burns, and wildland fires use (WFU) are left out of the inventory. All other day-specific data are included in both reference and future year modeling inventories.

L.3.6.1 Wildfires and Prescribed Burns

Day-specific, base case estimates of emissions from wildfires and prescribed fires were developed in a two-part process. The first part consisted of estimating micro-scale, fire-specific emissions (i.e. at the fire polygon scale, which can be at a smaller spatial scale than the grid cells used in air quality modeling). The second part consisted of several steps of post-processing fire polygon emission estimates into gridded, hourly emission estimates that were formatted for use in air quality modeling.

Fire event-specific emissions were estimated using a combination of geospatial databases and a federal wildland fire emission model (Clinton, et al., 2006). A series of pre-processing steps were performed using GIS to develop fuel loading and fuel moisture inputs to the First

Order Fire Effects (FOFEM) fire emission model (Lutes, et al., 2012). Polygons from a statewide interagency fire perimeters geodatabase (Fire Perimeters data (ZIP, filename Fire17_1.zip, downloaded May 8, 2018) maintained by the Fire and Resource Assessment Program (FRAP) of the California Department of Forestry and Fire Protection (CALFIRE) provided georeferenced information on the location, size (area), spatial shape, and timing of wildfires and prescribed burns. Under interagency Memorandums of Understanding, federal, State, and local agencies report California wildfire and prescribed burning activity data to FRAP. Using GIS software, fire polygons were overlaid upon a vegetation fuels raster dataset called the Fuel Characteristic Classification System (FCCS) (Ottmar, et al., 2007). The FCCS maps vegetation fuels at a 30-meter spatial resolution, and is maintained and distributed by LANDFIRE.GOV, a State and federal consortium of wildland fire and natural resource management agencies. With spatial overlay of fire polygons upon the FCCS raster, fuel model codes were retrieved and component areas within each fire footprint tabulated. For each fuel code, loadings (tons/acre) for fuel categories were retrieved from a FOFEM look-up table. Fuel categories included dead woody fuel size classes, overstory live tree crown, understory trees, shrubs, herbaceous vegetation, litter, and duff. Fuel moisture values for each fire were estimated by overlaying fire polygons on year- and month-specific 1 km spatial resolution fuel moisture raster files generated from the national Wildland Fire Assessment System (WFAS.net) and retrieving moisture values from fire polygon centroids. Fire event-specific fuel loads and fuel moisture values were compiled and formatted to a batch input file and run through FOFEM.

A series of post-processing steps were performed on the FOFEM batch output to include emission estimates (pounds/acre) for three supplemental pollutant species (NH_3, TNMHC, and N_2O) in addition to the seven species native to FOFEM (CO, CO_2, $PM_{2.5}$, PM_{10}, CH_4, NO_x, and SO_2), and to calculate total emissions (tons) by pollutant species for each fire. Emission estimates for NH_3, TNMHC, and N_2O were based on mass ratios to emitted CO and CO_2 (Gong, et al., 2003).

Fire polygon emissions were apportioned to CMAQ model grid cells using area fractions, developed using GIS software, by intersecting fire polygons to the grid domain.

Another set of post-processing steps were applied to allocate fire polygon emissions by date and hour of the day. Fire polygon emissions were allocated evenly between fire start and end dates, taken from the fire perimeters geodatabase. Daily emissions were then allocated to hour of day and to the model grid cells by using a script developed by CARB. A stack file and a 2-D hourly emissions file are generated for each day that has fire emissions. The stack file includes the fire locations, stack parameters and the number of acres burned for a fire in one day. The 2-D hourly emissions file includes the emissions for each specie and the heat flux (BTU/hr). CMAQ's in-line plume rise module will handle the vertical allocation of the fire emissions.

L.3.6.2 Paved and Unpaved Road Dust

Statewide emissions of total particulate matter from both paved and unpaved road dust are also a part of the CEPAM inventory. To adjust for precipitation, daily precipitation data for 2017 were used, provided by an in-house database maintained by CARB staff that stores meteorological data collected from outside sources. The specific data sources for these data include Remote Automated Weather Stations (RAWS), Atmospheric Infrared Sounder (AIRS), California Irrigation Management Information System (CIMIS) networks, and Federal Aviation Administration (FAA). FAA data provide precipitation data collected from airports in California. As soon as the precipitation reaches or exceeds 0.01 inches (measured anywhere within a county or county/air basin boundary on a particular day), the uncontrolled emissions are reduced on that day only: 25% for paved road dust, and total removal for the unpaved. The reductions can be achieved by running SMOKE with control matrix.

L.3.6.3 Agricultural Burning

Agricultural burn 2017 data processed were reported by San Diego. The tons burned provided in the data were converted to acres using fuel loading data. After the conversion to acres, less than 50 of all burns were set to a duration of one hour. With date of the burns, the location of the burns (latitude and longitude coordinates), crop type, and burn duration, the agricultural burn data were processed into PMEDS format and then projected onto a statewide grid for each hour of a specific day.

L.3.6.4 Residential Wood Curtailment

Emissions were reduced to reflect residential wood curtailment (RWC) in three districts: San Joaquin Valley APCD, Sacramento Metropolitan AQMD, and South Coast AQMD. South Coast is relevant since it is within the modeling domain for San Diego.

A pre-SMOKE utility program called GenTpro is used to generate county-specific temporal profiles taking into account average temperature by grid cell (UNC Chapel Hill - The Institute for the Environment, 2016). Emissions for any given county will only be allocated whenever the daily average temperature by grid cell is below 50 °F based on WRF simulated meteorology.

SCAQMD staff provided the dates in 2017 when a residential wood combustion curtailment (RWCC) was declared based on district rule 455. When an RWCC was declared emissions were reduced by 75% (i.e. 25% remaining) in SCAQMD-designated areas. In future years, emissions continued to be reduced by 75%, using the same dates as in 2017.

L.3.6.5 Estimation of Agricultural Ammonia Emissions

Ammonia emissions from fertilizers/pesticides (EIC3 530) and livestock (EIC3 620) are separated from the aggregated area source inventory as they are affected by local meteorology. For EIC3 530, emissions vary based on WRF's two-meter temperature and ten-meter wind speed. For EIC3 620, WRF's ground temperature and aerodynamic resistance drive variations in emissions. Through GenTpro these meteorological factors are averaged by county before creating year-long hourly profiles for each of the respective sectors. All algorithms are described in the SMOKE Manual 4.0 (UNC Chapel Hill - The Institute for the Environment, 2016), while the results of CARB in-house tests were summarized in an internal report (Kwok, 2016). In general, higher temperature and/or wind speeds favor ammonia emissions.

L.3.7 Northern Mexico Emissions

Transboundary flow of pollutants between California and Mexico must be considered and accounted for in air quality simulations of Southern California. Affected areas in California include the border regions of San Diego, Imperial and given the right meteorological conditions, more northern counties such as Riverside, Orange, and Los Angeles. As a result, emissions within the five municipal districts of Mexico's State of Baja California and one municipal district in Sonora must be included when running regional air quality models on the California Statewide Domain.

CARB's Mexico emissions inventory has been developed using the U.S. Environmental Protection Agency (EPA) 2011 National Emissions Inventory (NEI) platform version 3 with future year projections for 2017, 2023 and 2028. All inventory and ancillary files are available for download at: https://www.epa.gov/air-emissions-inventories/2017-national-emissions-inventory-nei-data (U.S. EPA, 2018)

The 2011NEIv3 platform for Mexico area, point and nonroad emissions are currently future year projections produced by Eastern Research Group Inc (ERG, 2014) and grown from the 2008 Mexico National Emissions Inventory developed by the Secretariat of Environment and Natural Resources (SEMARNAT) agency from Mexico. Under contract to CARB, ERG recently completed an update to the Baja California portion of the Mexico National Emissions Inventory (MNEI) 2014 and this update will be used in future inventories (ERG, 2019). The reported MNEI2014 was missing key gridded-inventory items such as source classification codes and stack parameters for stationary sources. It is for this reason, large uncertainties and availability of inventories at the time of base-year development that the2011NEIv3 platform is being used. Unfortunately, this may result in a slight over-prediction as emissions values are grown from an older inventory that may not be reflective of newer technology and/or implementation of cleaner processes. For mobile sources, the U.S. EPA onroad emissions model SMOKE-MOVES Mexico (Sparse Matrix Operator Kernel Emissions – Motor Vehicle Emission Simulator) was used to produce an onroad emissions inventory. The on-road sector is reflective of true 2017 emissions.

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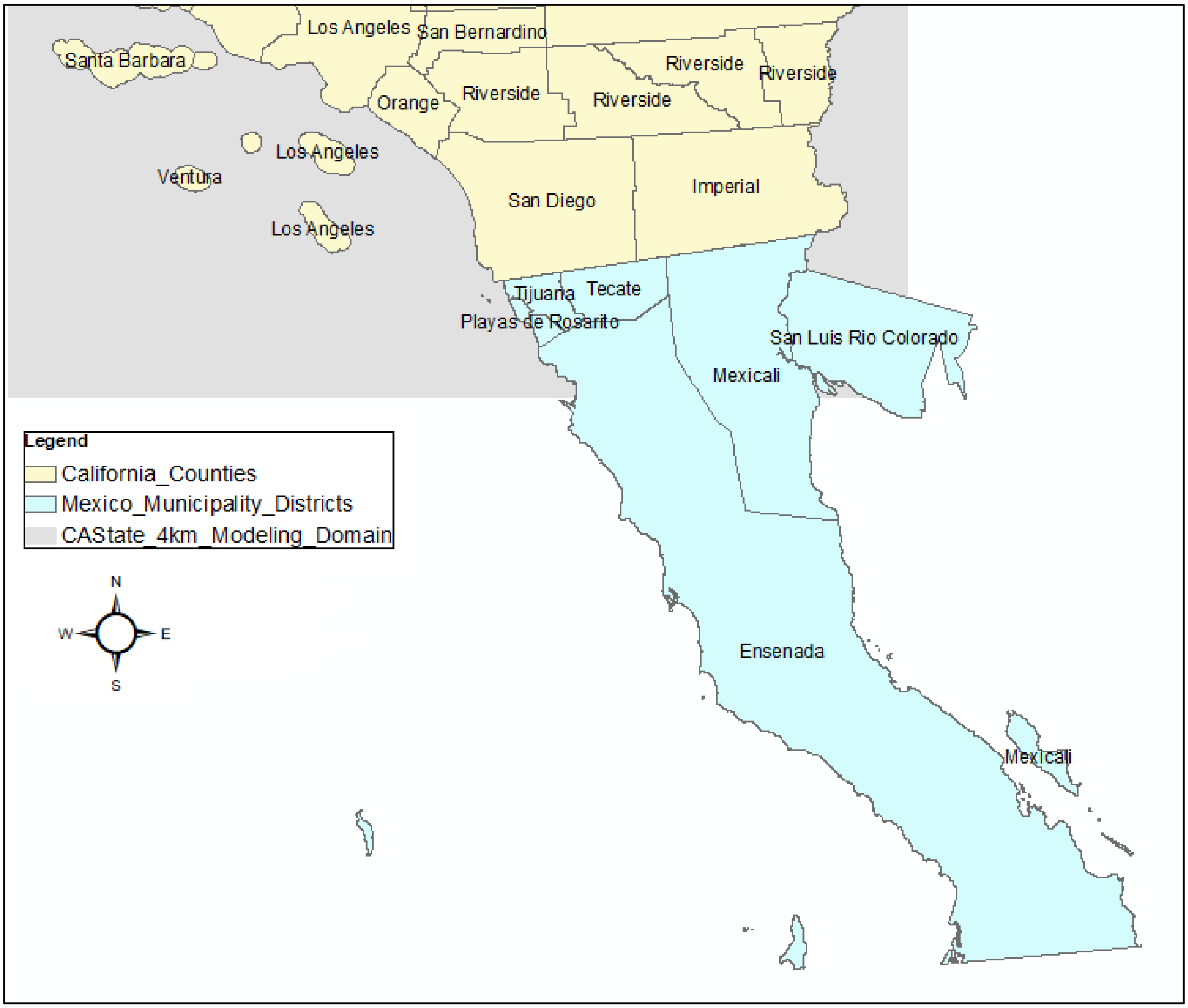
Figure L-4
Outline of Mexico Municipalities Included in California Air Quality Simulations



L.3.7.1 Spatial Allocation of Mexico Emissions

EPA's National Emission Inventory (NEI) has been used by ARB as a foundation for finding spatial surrogates that will aid in allocating emissions in the northern part of Mexico. While searching for improved surrogates, different online databases were investigated to find shapefiles relevant to established source sectors. The updated population surrogate was pulled from Instituto Nacional de Estadística y Geografía (INEGI) using information from Mexico's 2010 Population and Housing Census. INEGI provides spatial information about Mexico such as resources, population, and land use. The population surrogate was also used to update the following residential heating sources: wood, distillate oil, coal, and LP gas. The total road miles surrogate that is used to spatially allocate onroad emissions was also updated using data provided by INEGI's dataset containing information on urban and rural roads and highways. Agriculture and forests spatial surrogates were updated using the same dataset from Comisión Nacional Forestal (CONAFOR). Using satellite images taken by the MODIS sensor (Moderate Resolution Imaging Spectroradiometer), the resulting vector data set from CONAFOR was produced to characterize Mexico's land. The border crossings surrogate was updated using statistics from the U.S. Bureau of Transportation, which provided points of entry along California and Mexico's border. Once the shapefiles were collected, they were converted to the standard projection used in CARB's modelling.

Under contract to CARB, ERG recently completed an update to the spatial distribution of Mexico's area, nonroad and onroad emissions (ERG, 2019). These updates include additional spatial surrogates such as the location of brick kilns, bakeries, ports, airports etc. In addition, the project supports large improvements on emission estimates at the border crossings (ERG, 2019). Future inventories will reflect these improvements.

Table L-10
List Indicating the Mexico Surrogates as of May 2018

#	SURROGATE	YEAR	SHAPEFILE	WEIGHT FIELD
10	Population	2010	north_mexico_population.shp	population
12	Housing	2010	north_mexico_population.shp	population
14	Residential Heating Wood	2010	north_mexico_population.shp	population
16	Residential Heating Distillate Oil	2010	north_mexico_population.shp	population
18	Residential Heating Coal	2010	north_mexico_population.shp	population
20	Residential Heating LP Gas	2010	north_mexico_population.shp	population
22	Total Road Miles	2011	MEX_roads.shp	WEIGHT
24	Total Railroad Miles	2000	mexico_rr_MM5.shp	LENGTH
26	Total Agriculture	2015	MEX_agriculture.shp	WEIGHT
28	Forest Land	2015	MEX_Forests.shp	WEIGHT
30	Land Area	2000	REPMEX_ES_HEAT1_MM5.shp	P001
32	Commercial Land	1999	com_ind_viv_MM5.shp	A500_2000
34	Industrial Land	1999	com_ind_viv_MM5.shp	A505_2000
36	Commercial Plus Industrial	1999	com_ind_viv_MM5.shp	A510_2000

#	SURROGATE	YEAR	SHAPEFILE	WEIGHT FIELD
38	Commercial plus Industrial Land	1999	com_ind_viv_MM5.shp	A515_2000
40	Residential Commercial Industrial Institutional	1999	com_ind_viv_MM5.shp	a535_2000
42	Personal Repair	1999	REP_CRUCES_MM5.shp	a545_1999
44	Airports Area	1999	mexico_air_MM5.shp	WEIGHT
46	Marine Ports	1999	mexico_ports_MM5.shp	VALUE
48	Brick Kilns	1999	BOSQUE_LAD_MM5.shp	LAD_2000
50	Mobile Sources Border Crossing	2014	Border_Crossing_Years_MM5.shp	Y20**

L.3.8 Western States Emissions

In addition to transboundary flow from Mexico into California cities, pollutants can travel between various bordering states such as Nevada, Arizona, Oregon, Idaho and Utah. The current statewide modeling domain includes grid cells that cover these regions and therefore emission estimates from the four major source sectors (area, point, nonroad and onroad) need to be included for a complete California State modeling domain inventory. As CARB or California air districts are not responsible for the development of emission estimates in those geographic regions, the national emission inventory developed by the U.S. EPA was used.

CARB's Western US emissions inventory has been developed using the U.S. Environmental Protection Agency (EPA) 2011 National Emissions Inventory (NEI) platform version 3 with future year projections for 2017, 2023 and 2028. All inventory and ancillary files for spatial and temporal allocation are available for download at: https://www.epa.gov/air-emissions-inventories/2017-national-emissions-inventory-nei-data (U.S. EPA, 2018).

Base year 2017 emissions were developed with "2011v3 NEI 2017ek_cb6v2_v6_11g" which are 2017 projections from the 2011 national emissions inventory version three, while future year 2026 and future year 2032 emissions were developed with "2011v3 NEI 2028el_cb6v2_v6_11g" which are 2028 projections from the 2011 national emissions inventory version three. Spatial and temporal allocations were applied using the U.S. EPA ancillary files however, all spatial surrogates were processed through the spatial allocator tool with the California statewide map projection applied.

L.3.9 Application of Control Measure Reduction Factors in San Diego

Future year onroad vehicle emissions were adjusted to reflect the SAFE Act in 2026 and 2032. Onroad emissions reduction commitments for CARB's Low NOx, ACT, and HD I&M were included for 2032. Both of these onroad adjustments are summarized in Section L.3.2.7.

Additional District reductions for area and stationary sources were included to account for the impact of Rules 69.2.1 (SDCAPCD, 2019) , 69.2.2 (SDCAPCD, 2019), and 69.4.1 (SDCAPCD, 2019). Rules 69.2.1 and 69.2.2 impact small and medium boilers, process heaters, steam generators, and large water heaters. Rule 69.4.1 affects stationary reciprocating internal combustion engines. Estimates for the impacts of these rules were provided by District staff. Rule 69.4.1 would be fully phased in by 2032 while Rules 69.2.1 and 69.2.2 would be partially phased in by 2032. CARB staff in consultation with district staff assumed a linear phase in of reductions for Rule 69.2.1 between the implementation year of 2021 and an out year of 2036. Rule 69.2.2 was assumed to phase in linearly between 2021 and an out year of 2040. Reductions through the year 2032 were applied to the inventory to the EICs in Table L-11.

Table L-11
Area and Stationary Source Reduction Factors for San Diego County

Factor (adjusted/original)	
EIC	**2032**
020- 040- 0142- 0000	0.344
050- 040- 0012- 0000	0.344
050- 040- 0110- 0000	0.344
050- 040- 1200- 0000	0.344
050- 040- 1210- 0000	0.344
060- 040- 0142- 0000	0.344
060- 040- 0146- 0000	0.344
060- 040- 1210- 0000	0.344
099- 040- 1200- 0000	0.344
610- 608- 0110- 0000	0.616
610- 995- 0110- 0000	0.616
010- 005- 0110- 0000	0.464
050- 005- 0110- 0000	0.438
050- 995- 0110- 0000	0.436
050- 995- 0120- 0000	0.436
050- 995- 1220- 0000	0.420
060- 995- 0110- 0000	0.344
060- 005- 0144- 0000	0.445
060- 995- 0120- 0000	0.427
060- 995- 1220- 0000	0.423

L.4 QUALITY ASSURANCE OF MODELING INVENTORIES

L.4.1 Area and Point Sources

Before utilizing SMOKE to process the annual emissions totals into temporally, chemically, and spatially-resolved emissions inventories for photochemical modeling, all SMOKE inputs are subject to extensive quality assurance procedures performed by CARB staff. Annual and forecasted emissions are carefully reviewed before input into SMOKE. CARB and district staff review data used to calculate emissions along with other associated data, such as the location of facilities and assignment of SCC to each process. Growth and control information are reviewed and updated as needed.

The next check is to compare annual average emissions from CEPAM with planning inventory totals to ensure data integrity. The planning and modeling inventories start with the same annual average emissions. The planning inventory is developed for an average summer day and an average winter day, whereas the modeling inventory is developed by month. Both inventory types use the same temporal data described in Section L.2.2. The summer planning inventory uses the monthly throughputs from May through October. Similarly, the winter planning inventory uses the monthly throughputs from November through April. The modeling inventory produces emissions for every day of the year.

Annual emissions totals are plotted using the same gridding inputs as used in SMOKE in order to visually inspect and analyze the spatial allocation of emissions independent of temporal allocation and chemical speciation. Spatial plots by source category like the one shown in Figure L-5 are carefully screened for proper spatial distribution of emissions.

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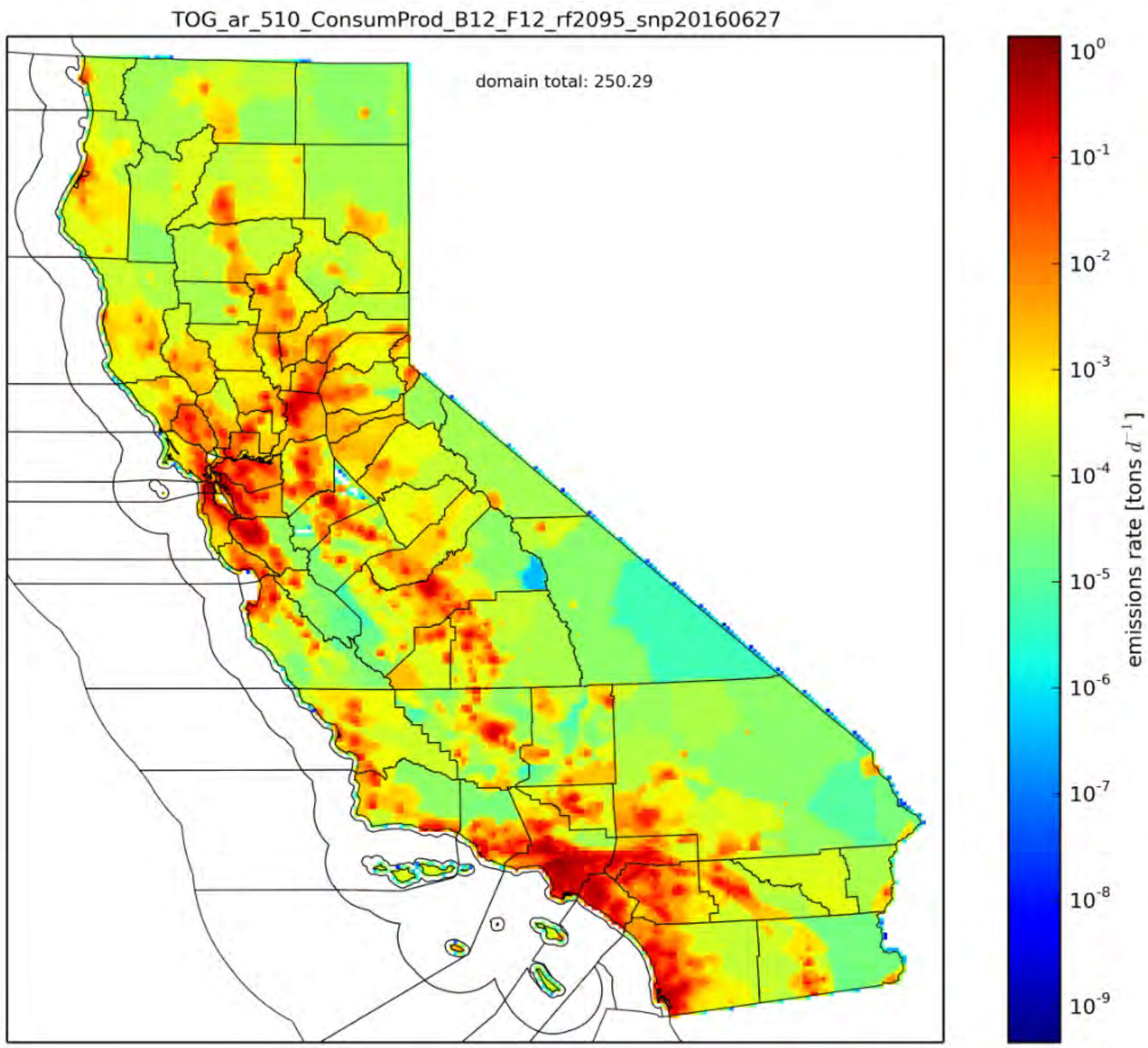
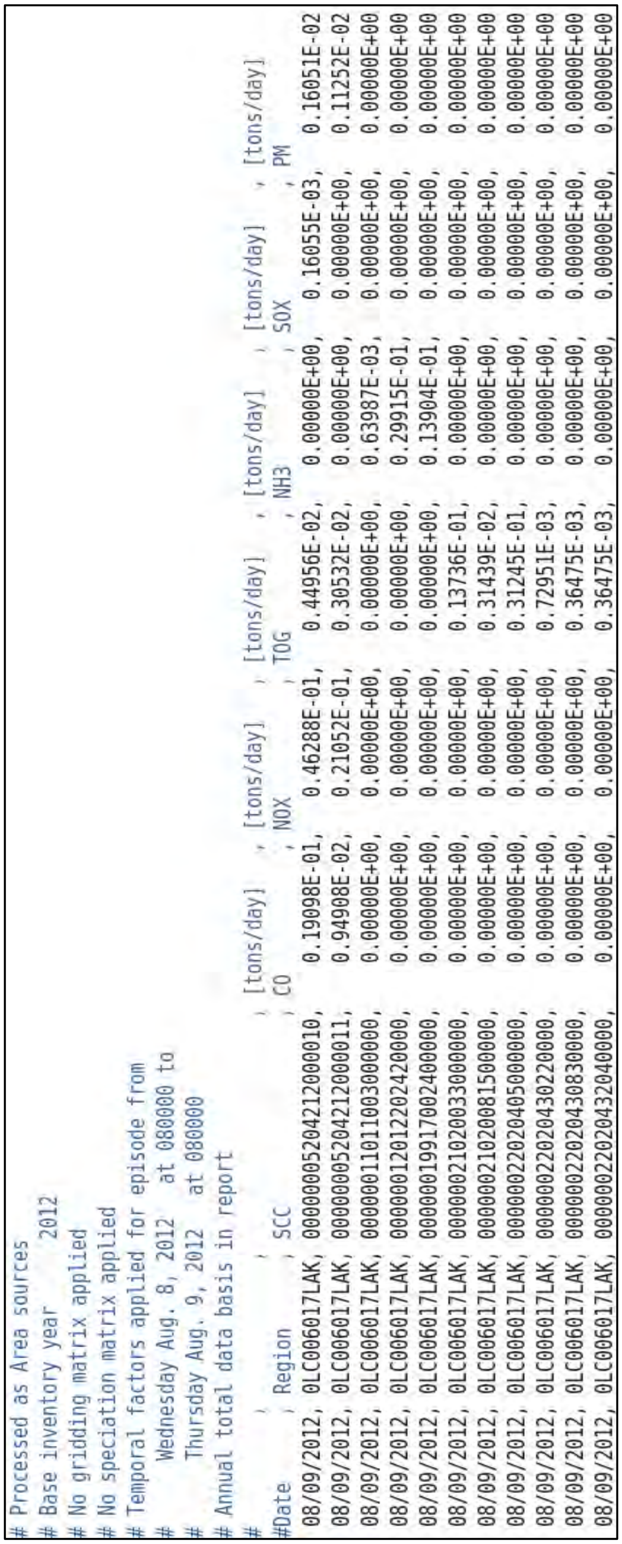
Figure L-5
Example of a Spatial Plot by Source Category (Consumer Products)



Before air quality model-ready emissions files are generated by SMOKE, the run configurations and parameters set within the SMOKE environment are checked for consistency for both the reference and future years.

To aid in the quality assurance process, SMOKE is configured to generate inventory reports of temporally, chemically, and spatially-resolved emissions inventories. CARB staff utilize the SMOKE reports by checking emissions totals by source category and region, creating and analyzing time series plots, and comparing aggregate emissions totals with the pre-SMOKE emissions totals obtained from CEPAM. A screenshot capture of a portion of such report can be seen in Figure L-6.

Figure L-6
Screen Capture of a SMOKE-Generated QA Report



```
# Processed as Area sources
# Base inventory year      2012
# No gridding matrix applied
# No speciation matrix applied
# Temporal factors applied for episode from
#      Wednesday Aug. 8, 2012   at 080000 to
#      Thursday Aug. 9, 2012   at 080000
# Annual total data basis in report
#          ,              ,                      , [tons/day]    , [tons/day]    , [tons/day]    , [tons/day]    , [tons/day]    , [tons/day]
#Date      , Region       , SCC                  , CO            , NOX           , TOG           , NH3           , SOX           , PM
 08/09/2012, 0LC006017LAK, 00000005204212000010,   0.19098E-01,   0.46288E-01,   0.44956E-02,   0.00000E+00,   0.16055E-03,   0.16051E-02
 08/09/2012, 0LC006017LAK, 00000005204212000011,   0.94908E-02,   0.21052E-01,   0.30532E-02,   0.00000E+00,   0.00000E+00,   0.11252E-02
 08/09/2012, 0LC006017LAK, 00000011011003000000,   0.00000E+00,   0.00000E+00,   0.00000E+00,   0.63987E-03,   0.00000E+00,   0.00000E+00
 08/09/2012, 0LC006017LAK, 00000012012202420000,   0.00000E+00,   0.00000E+00,   0.00000E+00,   0.29915E-01,   0.00000E+00,   0.00000E+00
 08/09/2012, 0LC006017LAK, 00000019917002400000,   0.00000E+00,   0.00000E+00,   0.00000E+00,   0.13904E-01,   0.00000E+00,   0.00000E+00
 08/09/2012, 0LC006017LAK, 00000021020033000000,   0.00000E+00,   0.00000E+00,   0.13736E-01,   0.00000E+00,   0.00000E+00,   0.00000E+00
 08/09/2012, 0LC006017LAK, 00000021020081500000,   0.00000E+00,   0.00000E+00,   0.31439E-02,   0.00000E+00,   0.00000E+00,   0.00000E+00
 08/09/2012, 0LC006017LAK, 00000022020405000000,   0.00000E+00,   0.00000E+00,   0.31245E-01,   0.00000E+00,   0.00000E+00,   0.00000E+00
 08/09/2012, 0LC006017LAK, 00000022020430220000,   0.00000E+00,   0.00000E+00,   0.72951E-03,   0.00000E+00,   0.00000E+00,   0.00000E+00
 08/09/2012, 0LC006017LAK, 00000022020430830000,   0.00000E+00,   0.00000E+00,   0.36475E-03,   0.00000E+00,   0.00000E+00,   0.00000E+00
 08/09/2012, 0LC006017LAK, 00000022020432040000,   0.00000E+00,   0.00000E+00,   0.36475E-03,   0.00000E+00,   0.00000E+00,   0.00000E+00
```

Checks for missing or invalid temporal assignments are conducted to ensure accurate temporal allocation of emissions. Special attention is paid to checking monthly throughputs and appropriate monthly temporal distribution of emissions for each source category. In addition, checks for time-invariant temporal assignments are done for certain source categories and suitable alternate temporal assignments are determined and applied. For the agricultural source sector (e.g. agricultural pesticides/fertilizers, farming operations, fugitive windblown dust, managed burning and disposal, and farm equipment), replacement temporal assignments are extracted from the Agricultural Emissions Temporal and Spatial Allocation Tool (AgTool) (Anderson, et al., 2012). The AgTool is a database management system capable of temporally and spatially allocating emissions from the agricultural source sector. It was developed by Sierra Research, Inc., and its subcontractor Alpine Geophysics, LLC, along with collaboration from CARB and SJVAPCD. Temporal allocation data outputs from the AgTool were compiled using input data provided by the UC Cooperative Extension, U.S. Department of Agriculture, and the CA Department of Pesticide Regulation.

Further improvements to temporal profiles used in the allocation of area source emissions are performed using suitable alternate temporal assignments determined by CARB staff. Select sources from manufacturing and industrial, degreasing, petroleum marketing, mineral processes, consumer products, residential fuel combustion, farming operations, aircraft, and commercial harbor craft sectors are among the source categories included in the application of adjustments to temporal allocation.

L.4.2 <u>On-Road Emissions</u>

There are several processes to conduct quality assurance of the on-road mobile source modeling inventory at various stages of the inventory processing. The specific steps taken are described below.

1. Plot MPO provided data spatially to find any missing or incomplete links.
2. Compare spatial distribution of VMT between on and off-peak periods for each MPO.
3. Generate time series plots for the on-road emissions files to check the diurnal pattern.
4. Compare the daily total emissions for the on-road emissions files and the EMFAC 2017 emissions files for each county to ensure that the emissions are the same.
5. Generate the spatial plot for the on-road emissions files to check if there were any missing emissions.

L.4.3 <u>Aircraft Emissions</u>

There are two steps to conduct quality assurance of the aircraft emissions.

1. Compare the daily total emissions for the aircraft emissions files and the raw emissions files for each county to ensure that the emissions are the same.
2. Generate the spatial plot for the aircraft emissions files to check if there were any missing emissions.

L.4.4 Day-Specific Sources

L.4.4.1 Wildfires

GIS records for 607 wildfires and 219 prescribed wildland burn events reported for 2017 were downloaded from the California Department of Forestry and Fire Protection website and imported to a geodatabase. Data fields included wildfire or burn project name, burned area, and start and end dates. A series of geoprocessing steps were used to map and overlay wildfire and prescribed burn footprint polygons on the statewide vegetation fuels (FCCS) and moisture raster datasets, to retrieve associated fuel loadings and moisture values for use as input to FOFEM. Wildfire and prescribed burn footprint polygons were also overlaid on the statewide 4-km modeling grid to assign grid cell IDs to each wildfire and prescribed burn. Emission estimates for each wildfire and prescribed burn event were generated by FOFEM and summarized in an Access database. In order to check the location of the fires and the daily total emissions, a script is used to make a netCDF file from the stack file and the 2-D hourly emissions file for each day. The spatial plot and the daily total emissions from processing the netCDF file are then compare to the raw fire emissions data to check for accuracy.

L.4.4.2 Agricultural Burning

Checks were done to verify the quality of the agricultural burn data. The day-specific emissions from agricultural burning were compared to the emissions from CEPAM for each county to check for reasonableness. Time series plots were reviewed for each county to see that days when burning occurred matched the days provided by the local air district. For each county, a few individual fires were calculated by hand starting from the raw data through all the steps to the final MEDS files to make sure the calculations were done correctly. Spatial plots were made to double check the location of each burn.

L.4.5 Additional Quality Assurance

In addition to the quality assurance described above, comparisons are made between annual average inventories from CEPAM and modeling inventories. The modeling inventory shows emissions by month and subsequently calculates the annual average for comparison with CEPAM emissions. Annual average inventories and modeling inventories can be different, but differences should be well understood. For example, modeling inventories are adjusted to reflect different days of the week for on-road motor vehicles as detailed in Section L.3.2; since weekend travel is generally less than weekday travel, modeling inventory emissions are usually lower when compared to annual average inventories from CEPAM. Figure L-7 provides a screen capture of a report that summarizes different emission categories for San Luis Obispo County. Please note that this report is only an example since emissions have been updated from what is displayed here.

Figure L-7
Screenshot of Comparison of Inventories Report

County:***40*** Spec:***NOx***

EIC	Description	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual	CEPAM	Difference
10	electric utilities	0.12	0.11	0.1	0.06	0.09	0.13	0.13	0.16	0.14	0.16	0.14	0.13	0.12	0.12	0.00
20	cogeneration	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.00
30	oil and gas production (combustion)	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.00
40	petroleum refining (combustion)	0.3	0.3	0.26	0.3	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.26	0.31	0.31	0.00
50	manufacturing and industrial	0.06	0.06	0.06	0.06	0.07	0.06	0.07	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.00
52	food and agricultural processing	0.19	0.19	0.19	0.34	0.34	0.34	0.38	0.38	0.38	0.18	0.18	0.18	0.27	0.27	0.00
60	service and commercial	0.91	0.92	0.92	0.92	0.92	0.9	0.9	0.91	0.91	0.91	0.92	0.91	0.91	0.91	0.00
99	other (fuel combustion)	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.00
110	sewage treatment	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00
120	landfills	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00
130	incinerators	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00
140	soil remediation	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00
199	other (waste disposal)	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00
210	laundering	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00
220	degreasing	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00
230	coatings and related process solvents	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00
240	printing	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00
250	adhesives and sealants	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00
299	other (cleaning and surface coatings)	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00
310	oil and gas production	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00
320	petroleum refining	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.00
330	petroleum marketing	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00
399	other (petroleum production and marketing)	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00
410	chemical	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00
420	food and agriculture	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00
430	mineral processes	0.03	0.03	0.03	0.03	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.03	0.04	0.04	0.00
440	metal processes	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00
450	wood and paper	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00
460	glass and related products	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00
470	electronics	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00
499	other (industrial processes)	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00
510	consumer products	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00
520	architectural coatings and related process sol	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00
530	pesticides/fertilizers	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00
540	asphalt paving / roofing	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00
610	residential fuel combustion	0.73	0.73	0.68	0.65	0.57	0.57	0.57	0.57	0.57	0.65	0.7	0.73	0.64	0.64	0.00
620	farming operations	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00
630	construction and demolition	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00
640	paved road dust	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00
645	unpaved road dust	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00
650	fugitive windblown dust	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00
660	fires	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00
670	managed burning and disposal	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.00
690	cooking	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00
699	other (miscellaneous processes)	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00
700	on-road vehicles	9.34	9.32	9.36	9.17	9.06	8.81	8.69	8.77	8.63	8.79	9.3	9.23	9.04	9.60	0.56
810	aircraft	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.00
820	trains	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.93	0.74
830	ships and commercial boats	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00
833	ocean going vessels	11.23	11.23	11.23	11.23	11.23	11.23	11.23	11.23	11.23	11.23	11.23	11.23	11.23	11.52	0.29
835	commercial harbor craft	1.12	1.12	1.12	1.12	1.12	1.12	1.12	1.12	1.12	1.12	1.12	1.12	1.12	0.83	-0.29
840	recreational boats	0.05	0.05	0.17	0.18	0.16	0.47	0.46	0.43	0.12	0.11	0.11	0.06	0.2	0.20	0.00
850	off-road recreational vehicles	0.03	0.03	0.03	0.03	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.03	0.04	0.04	0.00
860	off-road equipment	1.08	1.24	1.21	1.24	1.25	1.28	1.25	1.25	1.28	1.21	1.19	1.12	1.21	1.21	0.00
870	farm equipment	1.08	1.22	1.72	1.77	2.21	2.21	2.16	2.21	2.17	1.52	1.14	1.06	1.71	1.71	0.00
890	fuel storage and handling	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00
920	geogenic sources	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00
***	Total	26.78	27.05	27.59	27.61	27.93	28.05	27.88	28.01	27.55	26.87	27.01	26.67	27.42	28.73	1.31

Notes:

CEPAM refers to annual average emissions from 2016 SIP Baseline Emission Inventory Tool with external adjustments: http://outapp.arb.ca.gov/cefs/2016o
Monthly gridded emissions comes from GeoVAST mo-yr/avg tabular summary - gid 319

On-road vehicles: The modeling inventory adjusts on-road by day of week as well as day-specific temperatures and relative humidity - Fridays are higher wi
time series plots shows weekdays are ~9-10 tpd

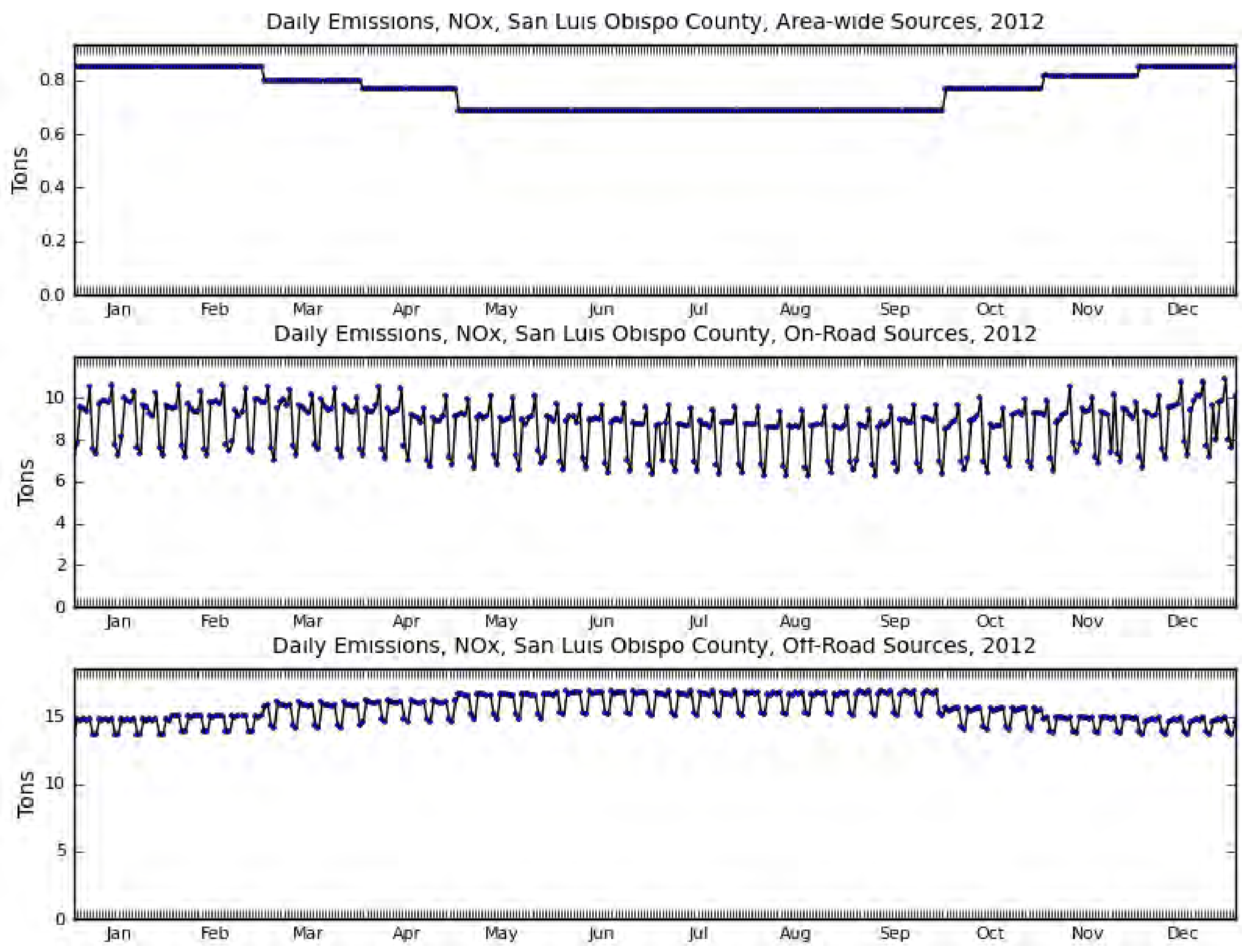
Trains: The modeling inventory reflects the revised locomotive emissions; the planning inventory reflects the previous emission estimates

OGV model produces gridded OGV emissions, which can vary from planning inventory (these emissions include OC1 and OC2 offshore air basins)

CHC The modeling inventory reflects the revised commercial harbor craft emissions; the planning inventory reflects the previous emission estimates

Staff also review how modeling emissions vary over a year. Figure L-8 provides an example of a modeling inventory time series plot for San Luis Obispo County for area-wide sources, on-road sources and off-road sources. Again, this figure is only an example.

Figure L-8
Daily Variation of NOx Emissions for Mobile Sources for San Luis Obispo



L.4.6 Model-Ready Files Quality Assurance

Prior to developing the modeling inventory emissions files used in the photochemical models, the same model-ready emissions files developed for the individual source categories (e.g. on-road, area, point, day-specific sources) are checked for quality assurance. Extensive quality assurance procedures are already performed by CARB staff on the intermediate emissions files (e.g. MEDS, SMOKE-generated reports); however, further checks are needed to ensure data integrity is preserved when the model-ready emissions files are generated from those intermediate emissions files.

Comparisons of the totals for both the intermediate and model-ready emissions files are made. Emissions totals are aggregated spatially, temporally, and chemically to single-layer, statewide, daily values by inventory pollutant. Spatial plots are also generated for both the intermediate and model-ready emissions files using the same graphical utilities and aggregated to the same spatial, temporal, and chemical resolution to allow equal comparison of emissions. Any discrepancies in the emissions totals are reconciled before proceeding with the development of the model-ready inventory emissions files.

Before combining the model-ready emissions files of the individual source category inventories into a single model-ready inventory, they are checked for completeness. Day-specific source inventories (when necessary) should have emissions for every day in the modeling period. Likewise, source inventories with emissions files that use averaged temporal allocation (e.g. day-of-week, weekday/weekend, monthly) should have model-ready emissions files to represent every day in the modeling period. In particular, it is important that during these checks source inventories with missing files are identified and resolved. Once all constituent source inventories are complete, they are used to develop the model-ready inventory used in photochemical modeling. When the modeling inventory files are generated, log files are also generated documenting the constituents of each daily model-ready emissions file as an additional means of verifying that each daily model-ready inventory is complete.

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Appendix A:
Day-of-Week Redistribution Factors by Vehicle Type and County

The factors shown in Table L-12 represent the “day-of-week” factors for each county for a broad vehicle class: LD is Light-Duty, LM is Light- and Medium-Duty Trucks, and HH is Heavy Heavy-Duty Trucks.

Table L-12
Day-of-Week Adjustment by Vehicle Class and County

County	Day of Week	LD	LM	HH
Imperial	Sunday	1.082	0.608	0.396
Imperial	Monday	1.004	0.931	0.948
Imperial	Tues/Wed/Thurs	1	1	1
Imperial	Friday	1.109	1.161	0.983
Imperial	Saturday	1.065	0.687	0.522
Imperial	Holiday	1.024	0.814	0.673
Kern	Sunday	1.114	0.63	0.416
Kern	Monday	1.061	0.942	0.849
Kern	Tues/Wed/Thurs	1	1	1
Kern	Friday	1.253	1.044	0.9
Kern	Saturday	1.1	0.734	0.535
Kern	Holiday	0.986	0.911	0.837
Los Angeles	Sunday	0.858	0.489	0.398
Los Angeles	Monday	0.973	0.936	0.878
Los Angeles	Tues/Wed/Thurs	1	1	1
Los Angeles	Friday	1.047	1.005	0.918
Los Angeles	Saturday	0.979	0.641	0.509
Los Angeles	Holiday	0.863	0.808	0.801
Orange	Sunday	0.808	0.415	0.327
Orange	Monday	0.962	0.92	0.891
Orange	Tues/Wed/Thurs	1	1	1
Orange	Friday	1.038	1.025	0.988
Orange	Saturday	0.94	0.587	0.433
Orange	Holiday	0.831	0.774	0.796
Riverside	Sunday	0.894	0.489	0.383
Riverside	Monday	0.974	0.941	0.887
Riverside	Tues/Wed/Thurs	1	1	1
Riverside	Friday	1.085	1.028	0.977
Riverside	Saturday	1.011	0.629	0.491
Riverside	Holiday	0.933	0.848	0.844
San Bernardino	Sunday	0.89	0.56	0.532
San Bernardino	Monday	0.988	0.931	0.913
San Bernardino	Tues/Wed/Thurs	1	1	1

County	Day of Week	LD	LM	HH
San Bernardino	Friday	1.094	1.069	1.012
San Bernardino	Saturday	0.97	0.743	0.634
San Bernardino	Holiday	0.942	0.818	0.831
San Diego	Sunday	0.796	0.532	0.341
San Diego	Monday	0.963	0.928	0.882
San Diego	Tues/Wed/Thurs	1	1	1
San Diego	Friday	1.067	1.022	0.982
San Diego	Saturday	0.928	0.665	0.446
San Diego	Holiday	0.808	0.785	0.785
San Luis Obispo	Sunday	1.038	0.629	0.413
San Luis Obispo	Monday	1.064	0.97	0.935
San Luis Obispo	Tues/Wed/Thurs	1	1	1
San Luis Obispo	Friday	1.113	1.094	1.047
San Luis Obispo	Saturday	0.99	0.725	0.563
San Luis Obispo	Holiday	0.967	0.714	0.669
Santa Barbara	Sunday	0.81	0.388	0.301
Santa Barbara	Monday	1.044	0.952	0.912
Santa Barbara	Tues/Wed/Thurs	1	1	1
Santa Barbara	Friday	1.08	1.011	0.996
Santa Barbara	Saturday	0.829	0.542	0.562
Santa Barbara	Holiday	0.811	0.535	0.545
Ventura	Sunday	0.772	0.406	0.491
Ventura	Monday	0.956	0.924	0.932
Ventura	Tues/Wed/Thurs	1	1	1
Ventura	Friday	1.036	0.992	1.004
Ventura	Saturday	0.888	0.554	0.637
Ventura	Holiday	0.817	0.785	0.863

Appendix B:
Hour-of-Day Profiles by Vehicle Type and County

The factors shown in Table L-13 below represent the differently hourly profiles for different days of the week for each county for a broad vehicle class: LD is Light-Duty, LM is Light- and Medium-Duty Trucks, and HH is Heavy Heavy-Duty Trucks.

Table L-13
Hour-of-Day Profiles by Vehicle Type and County

Day of Week	Hr	Imperial			Kern			Los Angeles			Orange			Riverside		
		LD	LM	HH	LD	LM	HH	LD	LM	HH	LD	LM	HH	LD	LM	HH
Sunday	0	0.026	0.015	0.017	0.014	0.028	0.041	0.025	0.043	0.051	0.023	0.045	0.061	0.022	0.036	0.050
Sunday	1	0.026	0.013	0.016	0.010	0.024	0.038	0.018	0.033	0.044	0.015	0.032	0.049	0.015	0.028	0.044
Sunday	2	0.025	0.009	0.014	0.007	0.022	0.034	0.014	0.028	0.040	0.011	0.025	0.041	0.011	0.023	0.040
Sunday	3	0.025	0.008	0.015	0.006	0.020	0.033	0.009	0.022	0.035	0.007	0.019	0.034	0.009	0.020	0.036
Sunday	4	0.027	0.010	0.015	0.007	0.021	0.033	0.008	0.021	0.034	0.007	0.018	0.031	0.009	0.020	0.035
Sunday	5	0.030	0.015	0.017	0.012	0.024	0.033	0.012	0.024	0.035	0.011	0.022	0.034	0.012	0.023	0.036
Sunday	6	0.032	0.019	0.021	0.016	0.027	0.034	0.018	0.029	0.037	0.018	0.029	0.038	0.019	0.029	0.039
Sunday	7	0.033	0.026	0.029	0.024	0.032	0.035	0.025	0.034	0.039	0.026	0.036	0.041	0.026	0.035	0.041
Sunday	8	0.037	0.039	0.035	0.032	0.039	0.038	0.035	0.040	0.042	0.037	0.046	0.046	0.036	0.045	0.044
Sunday	9	0.040	0.053	0.047	0.042	0.045	0.040	0.047	0.050	0.045	0.050	0.058	0.051	0.049	0.054	0.047
Sunday	10	0.043	0.063	0.057	0.051	0.051	0.042	0.057	0.056	0.047	0.059	0.065	0.052	0.057	0.061	0.047
Sunday	11	0.046	0.071	0.065	0.059	0.056	0.045	0.062	0.059	0.047	0.065	0.067	0.052	0.064	0.065	0.048
Sunday	12	0.048	0.075	0.068	0.066	0.060	0.046	0.065	0.060	0.047	0.068	0.066	0.049	0.067	0.066	0.047
Sunday	13	0.052	0.078	0.068	0.071	0.063	0.047	0.068	0.060	0.046	0.069	0.064	0.046	0.069	0.065	0.045
Sunday	14	0.053	0.074	0.065	0.075	0.065	0.047	0.068	0.058	0.044	0.068	0.059	0.043	0.069	0.063	0.044
Sunday	15	0.056	0.071	0.061	0.078	0.064	0.048	0.067	0.055	0.043	0.068	0.055	0.040	0.068	0.060	0.042
Sunday	16	0.056	0.068	0.058	0.077	0.063	0.048	0.065	0.052	0.042	0.067	0.051	0.038	0.067	0.056	0.041
Sunday	17	0.059	0.067	0.055	0.074	0.060	0.047	0.063	0.049	0.040	0.064	0.047	0.036	0.064	0.052	0.040
Sunday	18	0.059	0.062	0.055	0.069	0.055	0.046	0.059	0.045	0.040	0.060	0.041	0.034	0.061	0.047	0.039
Sunday	19	0.057	0.051	0.051	0.061	0.049	0.046	0.056	0.042	0.039	0.055	0.036	0.033	0.057	0.042	0.039
Sunday	20	0.052	0.041	0.049	0.053	0.042	0.045	0.052	0.040	0.040	0.052	0.034	0.034	0.053	0.037	0.039
Sunday	21	0.047	0.032	0.044	0.042	0.035	0.044	0.047	0.038	0.041	0.045	0.032	0.036	0.044	0.031	0.039
Sunday	22	0.039	0.023	0.042	0.032	0.030	0.045	0.036	0.034	0.042	0.034	0.028	0.038	0.032	0.024	0.038
Sunday	23	0.031	0.018	0.038	0.021	0.025	0.046	0.024	0.029	0.042	0.022	0.024	0.042	0.021	0.018	0.038
Monday	0	0.025	0.010	0.016	0.013	0.022	0.025	0.012	0.018	0.025	0.010	0.016	0.024	0.011	0.018	0.027
Monday	1	0.025	0.008	0.016	0.009	0.019	0.024	0.007	0.015	0.023	0.006	0.012	0.021	0.008	0.016	0.026
Monday	2	0.024	0.008	0.017	0.008	0.019	0.024	0.006	0.015	0.023	0.005	0.012	0.021	0.007	0.016	0.027
Monday	3	0.030	0.014	0.019	0.011	0.022	0.026	0.007	0.017	0.024	0.006	0.013	0.022	0.011	0.020	0.030
Monday	4	0.030	0.022	0.025	0.021	0.029	0.028	0.016	0.024	0.030	0.015	0.022	0.029	0.024	0.033	0.038
Monday	5	0.034	0.036	0.031	0.040	0.041	0.033	0.038	0.042	0.038	0.034	0.041	0.043	0.040	0.049	0.045
Monday	6	0.036	0.043	0.034	0.047	0.046	0.034	0.054	0.056	0.044	0.054	0.060	0.054	0.053	0.059	0.049
Monday	7	0.040	0.056	0.039	0.056	0.054	0.038	0.061	0.062	0.049	0.066	0.073	0.060	0.059	0.064	0.051
Monday	8	0.041	0.065	0.045	0.050	0.052	0.038	0.059	0.061	0.049	0.064	0.073	0.061	0.056	0.062	0.052
Monday	9	0.043	0.064	0.051	0.049	0.052	0.039	0.054	0.058	0.049	0.056	0.065	0.058	0.053	0.059	0.051
Monday	10	0.044	0.069	0.058	0.052	0.053	0.042	0.052	0.057	0.050	0.052	0.061	0.055	0.052	0.058	0.051
Monday	11	0.047	0.071	0.066	0.057	0.056	0.044	0.052	0.058	0.051	0.052	0.060	0.055	0.053	0.058	0.052
Monday	12	0.048	0.068	0.067	0.061	0.059	0.046	0.054	0.058	0.052	0.053	0.060	0.054	0.055	0.058	0.051

Day of Week	Hr	Imperial			Kern			Los Angeles			Orange			Riverside		
		LD	LM	HH	LD	LM	HH	LD	LM	HH	LD	LM	HH	LD	LM	HH
Monday	13	0.050	0.070	0.067	0.064	0.060	0.049	0.055	0.058	0.052	0.055	0.059	0.053	0.057	0.059	0.051
Monday	14	0.051	0.069	0.066	0.068	0.063	0.052	0.059	0.060	0.052	0.060	0.061	0.054	0.061	0.060	0.051
Monday	15	0.057	0.072	0.062	0.074	0.067	0.057	0.062	0.060	0.052	0.064	0.061	0.053	0.065	0.061	0.050
Monday	16	0.054	0.063	0.061	0.073	0.065	0.058	0.063	0.058	0.051	0.067	0.060	0.052	0.067	0.059	0.049
Monday	17	0.057	0.054	0.055	0.067	0.058	0.057	0.064	0.055	0.050	0.068	0.057	0.050	0.066	0.054	0.047
Monday	18	0.054	0.040	0.047	0.050	0.044	0.053	0.059	0.047	0.047	0.060	0.044	0.042	0.056	0.043	0.042
Monday	19	0.052	0.032	0.041	0.037	0.034	0.049	0.049	0.036	0.042	0.047	0.029	0.034	0.044	0.031	0.037
Monday	20	0.047	0.022	0.037	0.032	0.028	0.048	0.039	0.028	0.038	0.037	0.020	0.028	0.035	0.023	0.033
Monday	21	0.045	0.018	0.031	0.026	0.023	0.048	0.034	0.023	0.037	0.032	0.017	0.026	0.030	0.017	0.031
Monday	22	0.038	0.013	0.026	0.021	0.018	0.044	0.027	0.020	0.036	0.024	0.013	0.025	0.023	0.012	0.029
Monday	23	0.030	0.014	0.025	0.014	0.015	0.042	0.017	0.016	0.035	0.015	0.010	0.026	0.016	0.009	0.028
Tues/ Wed/Thurs	0	0.024	0.011	0.023	0.010	0.021	0.032	0.011	0.019	0.029	0.009	0.015	0.026	0.010	0.017	0.030
Tues/ Wed/Thurs	1	0.025	0.009	0.020	0.007	0.019	0.031	0.006	0.016	0.028	0.005	0.012	0.024	0.007	0.015	0.029
Tues/ Wed/Thurs	2	0.026	0.008	0.020	0.006	0.020	0.031	0.005	0.016	0.027	0.004	0.012	0.023	0.006	0.015	0.029
Tues/ Wed/Thurs	3	0.027	0.012	0.022	0.009	0.022	0.031	0.007	0.017	0.028	0.005	0.013	0.025	0.010	0.019	0.032
Tues/ Wed/Thurs	4	0.029	0.018	0.025	0.019	0.029	0.034	0.015	0.025	0.033	0.013	0.022	0.031	0.022	0.032	0.040
Tues/ Wed/Thurs	5	0.034	0.036	0.032	0.039	0.041	0.037	0.037	0.042	0.041	0.033	0.040	0.045	0.039	0.048	0.047
Tues /Wed/Thurs	6	0.036	0.046	0.039	0.048	0.046	0.039	0.054	0.056	0.047	0.054	0.061	0.057	0.053	0.060	0.051
Tues/ Wed/Thurs	7	0.040	0.057	0.044	0.058	0.053	0.042	0.061	0.062	0.051	0.065	0.073	0.062	0.059	0.064	0.053
Tues /Wed/Thurs	8	0.041	0.065	0.048	0.052	0.052	0.042	0.059	0.062	0.051	0.063	0.073	0.062	0.056	0.062	0.053
Tues/ Wed/Thurs	9	0.041	0.062	0.053	0.049	0.050	0.041	0.054	0.058	0.050	0.057	0.066	0.059	0.052	0.059	0.052
Tues/ Wed/Thurs	10	0.044	0.066	0.057	0.050	0.051	0.042	0.052	0.057	0.051	0.052	0.061	0.056	0.051	0.058	0.052
Tues/ Wed/Thurs	11	0.046	0.067	0.061	0.054	0.054	0.044	0.052	0.057	0.051	0.052	0.061	0.054	0.051	0.058	0.051
Tues/ Wed/Thurs	12	0.048	0.067	0.064	0.059	0.056	0.046	0.053	0.057	0.051	0.053	0.060	0.053	0.053	0.058	0.051
Tues/ Wed/Thurs	13	0.049	0.069	0.063	0.062	0.058	0.047	0.055	0.058	0.050	0.055	0.060	0.052	0.056	0.059	0.051
Tues/ Wed/Thurs	14	0.052	0.069	0.061	0.068	0.062	0.050	0.059	0.059	0.050	0.059	0.061	0.052	0.060	0.061	0.050
Tues/ Wed/Thurs	15	0.055	0.071	0.057	0.075	0.067	0.053	0.060	0.058	0.049	0.063	0.061	0.051	0.064	0.061	0.048
Tues/ Wed/Thurs	16	0.057	0.065	0.056	0.075	0.066	0.054	0.062	0.056	0.048	0.065	0.059	0.049	0.066	0.060	0.047
Tues/ Wed/Thurs	17	0.056	0.054	0.051	0.070	0.060	0.053	0.062	0.053	0.046	0.066	0.055	0.046	0.066	0.055	0.044
Tues/ Wed/Thurs	18	0.053	0.041	0.045	0.052	0.046	0.048	0.058	0.046	0.043	0.060	0.044	0.040	0.058	0.045	0.040
Tues/ Wed/Thurs	19	0.052	0.032	0.039	0.039	0.036	0.044	0.051	0.036	0.039	0.049	0.030	0.032	0.046	0.032	0.035

Day of Week	Hr	Imperial			Kern			Los Angeles			Orange			Riverside		
		LD	LM	HH	LD	LM	HH	LD	LM	HH	LD	LM	HH	LD	LM	HH
Tues/ Wed/Thurs	20	0.050	0.024	0.036	0.033	0.030	0.042	0.042	0.028	0.036	0.040	0.021	0.027	0.038	0.024	0.032
Tues/ Wed/Thurs	21	0.045	0.021	0.030	0.029	0.025	0.041	0.037	0.024	0.034	0.035	0.017	0.025	0.033	0.018	0.029
Tues/ Wed/Thurs	22	0.039	0.016	0.027	0.023	0.020	0.039	0.030	0.020	0.033	0.026	0.013	0.024	0.025	0.012	0.027
Tues/ Wed/Thurs	23	0.031	0.013	0.025	0.015	0.017	0.038	0.019	0.016	0.032	0.016	0.010	0.025	0.017	0.008	0.026
Friday	0	0.023	0.009	0.025	0.009	0.021	0.035	0.012	0.021	0.032	0.010	0.017	0.029	0.011	0.018	0.031
Friday	1	0.024	0.009	0.022	0.007	0.019	0.034	0.008	0.017	0.030	0.006	0.014	0.026	0.007	0.015	0.030
Friday	2	0.024	0.009	0.021	0.006	0.019	0.034	0.007	0.017	0.030	0.005	0.013	0.025	0.007	0.016	0.030
Friday	3	0.026	0.011	0.023	0.008	0.021	0.035	0.007	0.018	0.031	0.006	0.014	0.026	0.009	0.019	0.033
Friday	4	0.028	0.017	0.027	0.015	0.027	0.037	0.014	0.025	0.035	0.013	0.021	0.032	0.020	0.030	0.041
Friday	5	0.032	0.031	0.034	0.031	0.037	0.040	0.033	0.040	0.044	0.029	0.038	0.045	0.034	0.045	0.048
Friday	6	0.034	0.040	0.040	0.039	0.043	0.043	0.049	0.054	0.050	0.048	0.057	0.057	0.046	0.055	0.052
Friday	7	0.036	0.052	0.049	0.048	0.050	0.045	0.057	0.060	0.053	0.061	0.070	0.063	0.053	0.061	0.054
Friday	8	0.039	0.058	0.051	0.045	0.050	0.045	0.056	0.060	0.054	0.059	0.070	0.063	0.051	0.059	0.054
Friday	9	0.040	0.059	0.056	0.045	0.049	0.046	0.052	0.058	0.054	0.054	0.064	0.060	0.050	0.058	0.053
Friday	10	0.043	0.063	0.060	0.049	0.053	0.047	0.052	0.058	0.054	0.052	0.062	0.058	0.051	0.059	0.053
Friday	11	0.045	0.066	0.064	0.054	0.055	0.048	0.053	0.059	0.054	0.054	0.062	0.057	0.053	0.060	0.053
Friday	12	0.046	0.063	0.065	0.058	0.057	0.049	0.054	0.059	0.054	0.055	0.062	0.056	0.055	0.061	0.053
Friday	13	0.049	0.066	0.063	0.063	0.060	0.050	0.056	0.059	0.052	0.057	0.062	0.055	0.058	0.061	0.052
Friday	14	0.051	0.067	0.059	0.068	0.063	0.051	0.057	0.059	0.051	0.060	0.062	0.053	0.061	0.062	0.050
Friday	15	0.054	0.069	0.057	0.072	0.067	0.053	0.058	0.057	0.049	0.061	0.060	0.051	0.062	0.061	0.048
Friday	16	0.056	0.067	0.053	0.073	0.064	0.052	0.059	0.055	0.046	0.063	0.057	0.048	0.063	0.058	0.046
Friday	17	0.058	0.060	0.048	0.070	0.059	0.050	0.059	0.051	0.044	0.063	0.053	0.044	0.062	0.053	0.043
Friday	18	0.057	0.051	0.042	0.060	0.048	0.044	0.057	0.045	0.040	0.058	0.042	0.036	0.058	0.045	0.039
Friday	19	0.057	0.043	0.038	0.049	0.039	0.039	0.051	0.037	0.035	0.050	0.031	0.030	0.050	0.035	0.034
Friday	20	0.053	0.033	0.033	0.042	0.032	0.035	0.045	0.029	0.030	0.042	0.023	0.024	0.043	0.026	0.030
Friday	21	0.049	0.025	0.027	0.037	0.027	0.032	0.040	0.024	0.027	0.038	0.018	0.022	0.039	0.020	0.027
Friday	22	0.042	0.017	0.023	0.031	0.023	0.029	0.036	0.021	0.026	0.033	0.015	0.021	0.032	0.014	0.024
Friday	23	0.034	0.014	0.020	0.021	0.018	0.027	0.027	0.017	0.024	0.024	0.012	0.021	0.023	0.009	0.021
Saturday	0	0.025	0.018	0.036	0.016	0.028	0.043	0.020	0.031	0.046	0.017	0.030	0.049	0.017	0.027	0.047
Saturday	1	0.027	0.015	0.030	0.011	0.023	0.041	0.013	0.025	0.041	0.011	0.022	0.041	0.012	0.021	0.042
Saturday	2	0.027	0.012	0.024	0.009	0.022	0.040	0.011	0.023	0.039	0.009	0.019	0.037	0.010	0.019	0.040
Saturday	3	0.028	0.015	0.027	0.009	0.021	0.040	0.008	0.020	0.037	0.007	0.016	0.034	0.009	0.019	0.039
Saturday	4	0.031	0.019	0.030	0.014	0.025	0.041	0.010	0.022	0.038	0.009	0.018	0.036	0.012	0.021	0.041
Saturday	5	0.034	0.035	0.037	0.027	0.034	0.044	0.017	0.028	0.042	0.015	0.026	0.042	0.018	0.029	0.045
Saturday	6	0.035	0.038	0.043	0.034	0.038	0.045	0.027	0.036	0.046	0.026	0.037	0.050	0.028	0.039	0.050
Saturday	7	0.038	0.050	0.050	0.042	0.045	0.047	0.037	0.046	0.051	0.037	0.049	0.058	0.039	0.048	0.055
Saturday	8	0.040	0.057	0.055	0.050	0.052	0.050	0.046	0.052	0.054	0.048	0.060	0.064	0.047	0.056	0.056
Saturday	9	0.043	0.064	0.058	0.056	0.056	0.052	0.053	0.057	0.056	0.055	0.065	0.065	0.054	0.062	0.057
Saturday	10	0.044	0.066	0.064	0.060	0.057	0.053	0.057	0.060	0.056	0.059	0.068	0.064	0.058	0.064	0.056
Saturday	11	0.045	0.064	0.069	0.063	0.059	0.053	0.060	0.062	0.056	0.062	0.069	0.062	0.062	0.066	0.054
Saturday	12	0.046	0.063	0.066	0.065	0.061	0.052	0.062	0.062	0.054	0.064	0.068	0.058	0.063	0.065	0.052
Saturday	13	0.049	0.063	0.063	0.066	0.061	0.050	0.062	0.060	0.051	0.064	0.064	0.053	0.064	0.064	0.050
Saturday	14	0.051	0.062	0.059	0.067	0.060	0.049	0.062	0.058	0.048	0.064	0.061	0.048	0.064	0.062	0.047
Saturday	15	0.053	0.062	0.053	0.067	0.060	0.048	0.062	0.056	0.045	0.064	0.057	0.044	0.064	0.059	0.044
Saturday	16	0.053	0.057	0.047	0.064	0.056	0.044	0.062	0.053	0.042	0.064	0.053	0.039	0.063	0.056	0.041
Saturday	17	0.054	0.054	0.039	0.058	0.052	0.041	0.060	0.049	0.038	0.062	0.048	0.034	0.061	0.051	0.037

Day of Week	Hr	Imperial			Kern			Los Angeles			Orange			Riverside		
		LD	LM	HH	LD	LM	HH	LD	LM	HH	LD	LM	HH	LD	LM	HH
Saturday	18	0.055	0.048	0.034	0.051	0.046	0.036	0.057	0.044	0.034	0.057	0.041	0.028	0.056	0.043	0.033
Saturday	19	0.052	0.040	0.030	0.044	0.037	0.032	0.051	0.037	0.029	0.050	0.032	0.022	0.049	0.035	0.028
Saturday	20	0.049	0.032	0.026	0.039	0.033	0.028	0.046	0.033	0.026	0.044	0.027	0.018	0.044	0.030	0.024
Saturday	21	0.045	0.025	0.023	0.035	0.029	0.026	0.043	0.030	0.024	0.042	0.026	0.018	0.042	0.026	0.022
Saturday	22	0.040	0.020	0.020	0.030	0.024	0.024	0.042	0.029	0.024	0.040	0.025	0.018	0.037	0.022	0.020
Saturday	23	0.036	0.018	0.016	0.023	0.020	0.020	0.033	0.026	0.022	0.030	0.021	0.019	0.029	0.017	0.018
Holiday	0	0.027	0.013	0.019	0.015	0.023	0.028	0.017	0.024	0.031	0.015	0.023	0.030	0.015	0.023	0.032
Holiday	1	0.028	0.009	0.017	0.009	0.021	0.028	0.011	0.020	0.028	0.009	0.018	0.027	0.010	0.018	0.030
Holiday	2	0.026	0.008	0.018	0.007	0.020	0.028	0.009	0.019	0.027	0.007	0.015	0.025	0.008	0.018	0.029
Holiday	3	0.027	0.010	0.018	0.008	0.021	0.028	0.007	0.019	0.028	0.006	0.015	0.025	0.009	0.020	0.031
Holiday	4	0.030	0.016	0.022	0.013	0.024	0.028	0.012	0.023	0.030	0.010	0.019	0.029	0.016	0.027	0.035
Holiday	5	0.030	0.026	0.029	0.027	0.032	0.032	0.024	0.033	0.036	0.023	0.032	0.038	0.026	0.036	0.041
Holiday	6	0.032	0.032	0.031	0.033	0.037	0.033	0.034	0.041	0.040	0.038	0.047	0.047	0.035	0.044	0.044
Holiday	7	0.036	0.042	0.037	0.039	0.043	0.036	0.042	0.047	0.043	0.047	0.057	0.053	0.041	0.049	0.046
Holiday	8	0.040	0.055	0.044	0.043	0.047	0.037	0.045	0.050	0.045	0.047	0.058	0.053	0.046	0.054	0.049
Holiday	9	0.042	0.061	0.054	0.050	0.050	0.040	0.048	0.053	0.047	0.050	0.060	0.054	0.051	0.057	0.050
Holiday	10	0.045	0.067	0.060	0.055	0.055	0.042	0.054	0.058	0.050	0.055	0.064	0.056	0.056	0.061	0.051
Holiday	11	0.047	0.070	0.068	0.064	0.060	0.047	0.058	0.061	0.051	0.059	0.067	0.058	0.061	0.065	0.053
Holiday	12	0.046	0.069	0.070	0.068	0.061	0.050	0.061	0.063	0.053	0.061	0.068	0.057	0.063	0.066	0.053
Holiday	13	0.053	0.080	0.070	0.071	0.066	0.051	0.063	0.064	0.053	0.062	0.067	0.057	0.064	0.066	0.053
Holiday	14	0.051	0.075	0.068	0.073	0.064	0.052	0.064	0.064	0.053	0.064	0.066	0.055	0.064	0.064	0.052
Holiday	15	0.054	0.067	0.062	0.075	0.067	0.055	0.065	0.061	0.051	0.065	0.062	0.052	0.064	0.061	0.050
Holiday	16	0.056	0.066	0.057	0.072	0.064	0.055	0.064	0.057	0.050	0.064	0.057	0.049	0.064	0.058	0.048
Holiday	17	0.056	0.061	0.054	0.066	0.059	0.054	0.063	0.053	0.048	0.064	0.051	0.045	0.064	0.053	0.045
Holiday	18	0.052	0.047	0.045	0.056	0.046	0.049	0.058	0.046	0.045	0.058	0.042	0.040	0.059	0.046	0.043
Holiday	19	0.053	0.039	0.040	0.047	0.042	0.050	0.052	0.038	0.042	0.052	0.032	0.034	0.052	0.036	0.038
Holiday	20	0.049	0.029	0.035	0.039	0.033	0.046	0.047	0.032	0.039	0.046	0.025	0.030	0.045	0.029	0.036
Holiday	21	0.046	0.022	0.030	0.031	0.027	0.046	0.042	0.028	0.038	0.041	0.021	0.029	0.039	0.022	0.032
Holiday	22	0.042	0.020	0.027	0.025	0.021	0.043	0.037	0.025	0.037	0.035	0.018	0.029	0.029	0.016	0.030
Holiday	23	0.032	0.019	0.025	0.016	0.018	0.041	0.025	0.020	0.036	0.023	0.014	0.030	0.021	0.011	0.028

Day of Week	Hr	San Bernardino			San Diego			San Luis Obispo			Santa Barbara			Ventura		
		LD	LM	HH	LD	LM	HH	LD	LM	HH	LD	LM	HH	LD	LM	HH
Sunday	0	0.024	0.030	0.035	0.019	0.033	0.051	0.017	0.009	0.017	0.020	0.017	0.032	0.014	0.036	0.048
Sunday	1	0.017	0.025	0.031	0.012	0.029	0.044	0.017	0.006	0.012	0.021	0.015	0.026	0.009	0.026	0.042
Sunday	2	0.014	0.022	0.028	0.009	0.026	0.040	0.018	0.005	0.009	0.020	0.012	0.022	0.006	0.021	0.038
Sunday	3	0.011	0.020	0.027	0.007	0.023	0.036	0.018	0.004	0.011	0.019	0.010	0.022	0.004	0.018	0.036
Sunday	4	0.012	0.020	0.027	0.007	0.023	0.034	0.019	0.005	0.009	0.023	0.014	0.023	0.004	0.018	0.035
Sunday	5	0.015	0.022	0.028	0.011	0.026	0.035	0.022	0.009	0.012	0.023	0.017	0.029	0.008	0.021	0.036
Sunday	6	0.021	0.026	0.030	0.018	0.030	0.037	0.026	0.015	0.017	0.029	0.024	0.031	0.014	0.027	0.038
Sunday	7	0.027	0.031	0.033	0.026	0.035	0.040	0.030	0.024	0.025	0.031	0.029	0.031	0.022	0.034	0.041
Sunday	8	0.036	0.038	0.037	0.037	0.041	0.043	0.037	0.037	0.039	0.036	0.042	0.037	0.034	0.044	0.044
Sunday	9	0.046	0.046	0.041	0.050	0.048	0.047	0.043	0.056	0.050	0.042	0.054	0.047	0.049	0.057	0.047
Sunday	10	0.055	0.055	0.047	0.062	0.055	0.050	0.051	0.072	0.068	0.046	0.065	0.055	0.065	0.070	0.050
Sunday	11	0.060	0.060	0.050	0.068	0.059	0.050	0.054	0.079	0.080	0.049	0.072	0.059	0.074	0.076	0.051
Sunday	12	0.064	0.066	0.053	0.072	0.061	0.051	0.058	0.089	0.088	0.055	0.078	0.062	0.078	0.077	0.051
Sunday	13	0.067	0.067	0.054	0.072	0.062	0.049	0.059	0.085	0.081	0.057	0.074	0.057	0.080	0.074	0.049
Sunday	14	0.068	0.066	0.054	0.071	0.059	0.046	0.062	0.085	0.075	0.060	0.072	0.051	0.079	0.068	0.047
Sunday	15	0.066	0.063	0.053	0.071	0.057	0.043	0.065	0.081	0.066	0.061	0.070	0.051	0.077	0.062	0.045
Sunday	16	0.065	0.060	0.052	0.070	0.056	0.042	0.067	0.076	0.063	0.063	0.066	0.049	0.075	0.057	0.043

Day of Week	Hr	San Bernardino			San Diego			San Luis Obispo			Santa Barbara			Ventura		
		LD	LM	HH	LD	LM	HH	LD	LM	HH	LD	LM	HH	LD	LM	HH
Sunday	17	0.063	0.056	0.051	0.067	0.053	0.040	0.065	0.070	0.064	0.064	0.059	0.049	0.070	0.050	0.041
Sunday	18	0.060	0.051	0.049	0.061	0.048	0.038	0.063	0.058	0.055	0.061	0.054	0.046	0.062	0.040	0.038
Sunday	19	0.056	0.045	0.047	0.054	0.043	0.036	0.057	0.046	0.044	0.059	0.046	0.043	0.055	0.034	0.037
Sunday	20	0.052	0.042	0.047	0.047	0.039	0.036	0.053	0.037	0.035	0.053	0.040	0.043	0.046	0.028	0.036
Sunday	21	0.044	0.036	0.045	0.039	0.035	0.036	0.045	0.026	0.032	0.045	0.031	0.046	0.037	0.024	0.036
Sunday	22	0.034	0.030	0.042	0.029	0.030	0.037	0.034	0.016	0.025	0.035	0.023	0.045	0.026	0.020	0.035
Sunday	23	0.023	0.025	0.041	0.019	0.027	0.040	0.023	0.010	0.024	0.026	0.017	0.042	0.015	0.018	0.037
Monday	0	0.015	0.017	0.023	0.009	0.018	0.023	0.018	0.004	0.008	0.016	0.005	0.012	0.006	0.015	0.027
Monday	1	0.011	0.015	0.022	0.005	0.017	0.022	0.017	0.003	0.008	0.015	0.004	0.014	0.003	0.012	0.026
Monday	2	0.010	0.015	0.022	0.004	0.017	0.023	0.018	0.003	0.010	0.016	0.005	0.016	0.002	0.012	0.026
Monday	3	0.014	0.018	0.024	0.005	0.018	0.024	0.020	0.006	0.014	0.018	0.007	0.019	0.003	0.013	0.028
Monday	4	0.025	0.028	0.029	0.012	0.022	0.028	0.024	0.011	0.019	0.020	0.013	0.028	0.008	0.019	0.032
Monday	5	0.041	0.044	0.038	0.031	0.034	0.037	0.031	0.027	0.029	0.028	0.025	0.038	0.024	0.034	0.039
Monday	6	0.052	0.053	0.044	0.055	0.050	0.047	0.040	0.048	0.041	0.037	0.048	0.045	0.049	0.055	0.045
Monday	7	0.061	0.065	0.052	0.068	0.066	0.057	0.046	0.065	0.053	0.048	0.071	0.046	0.075	0.072	0.050
Monday	8	0.056	0.056	0.047	0.063	0.062	0.058	0.049	0.066	0.057	0.054	0.083	0.052	0.071	0.071	0.052
Monday	9	0.051	0.051	0.045	0.055	0.056	0.054	0.051	0.069	0.064	0.054	0.078	0.055	0.057	0.064	0.052
Monday	10	0.050	0.050	0.045	0.051	0.055	0.054	0.051	0.070	0.073	0.053	0.069	0.060	0.053	0.062	0.053
Monday	11	0.052	0.052	0.046	0.052	0.056	0.055	0.054	0.070	0.074	0.056	0.072	0.066	0.056	0.063	0.054
Monday	12	0.054	0.054	0.049	0.054	0.058	0.057	0.055	0.070	0.070	0.060	0.073	0.069	0.058	0.064	0.054
Monday	13	0.055	0.057	0.051	0.056	0.059	0.057	0.058	0.071	0.070	0.062	0.072	0.064	0.058	0.061	0.053
Monday	14	0.059	0.062	0.055	0.063	0.062	0.057	0.064	0.076	0.067	0.065	0.075	0.062	0.063	0.063	0.053
Monday	15	0.063	0.065	0.058	0.072	0.065	0.057	0.068	0.083	0.061	0.070	0.077	0.060	0.072	0.065	0.052
Monday	16	0.064	0.066	0.060	0.075	0.065	0.057	0.068	0.079	0.053	0.067	0.067	0.052	0.078	0.064	0.050
Monday	17	0.064	0.065	0.060	0.073	0.062	0.055	0.064	0.065	0.047	0.058	0.046	0.041	0.080	0.060	0.049
Monday	18	0.054	0.050	0.052	0.058	0.046	0.044	0.051	0.041	0.040	0.050	0.034	0.037	0.063	0.046	0.043
Monday	19	0.042	0.035	0.043	0.041	0.033	0.034	0.043	0.026	0.036	0.045	0.025	0.035	0.042	0.029	0.038
Monday	20	0.035	0.028	0.038	0.033	0.026	0.029	0.037	0.018	0.030	0.036	0.017	0.033	0.031	0.020	0.033
Monday	21	0.031	0.023	0.036	0.028	0.022	0.025	0.031	0.014	0.027	0.030	0.013	0.034	0.025	0.015	0.032
Monday	22	0.025	0.018	0.033	0.020	0.017	0.023	0.024	0.009	0.026	0.024	0.010	0.032	0.016	0.010	0.030
Monday	23	0.018	0.013	0.030	0.013	0.015	0.022	0.017	0.005	0.021	0.016	0.007	0.030	0.009	0.008	0.030
Tues/ Wed/Thurs	0	0.013	0.016	0.024	0.007	0.017	0.025	0.016	0.004	0.017	0.016	0.005	0.022	0.005	0.015	0.032
Tues/ Wed/Thurs	1	0.010	0.014	0.023	0.004	0.016	0.024	0.016	0.003	0.014	0.015	0.004	0.022	0.002	0.012	0.030
Tues/ Wed/Thurs	2	0.010	0.015	0.024	0.003	0.016	0.024	0.016	0.003	0.014	0.015	0.004	0.021	0.001	0.012	0.030
Tues/ Wed/Thurs	3	0.013	0.018	0.025	0.004	0.017	0.026	0.018	0.004	0.017	0.017	0.006	0.024	0.002	0.013	0.031
Tues/ Wed/Thurs	4	0.024	0.027	0.031	0.010	0.022	0.029	0.021	0.009	0.022	0.019	0.012	0.033	0.007	0.019	0.035
Tues/ Wed/Thurs	5	0.041	0.044	0.040	0.029	0.033	0.038	0.030	0.023	0.032	0.026	0.025	0.045	0.022	0.034	0.043
Tues/ Wed/Thurs	6	0.053	0.053	0.046	0.055	0.050	0.049	0.041	0.049	0.046	0.039	0.051	0.052	0.049	0.055	0.049
Tues/ Wed/Thurs	7	0.062	0.065	0.054	0.068	0.067	0.059	0.048	0.066	0.057	0.051	0.072	0.052	0.075	0.072	0.052
Tues/ Wed/Thurs	8	0.056	0.057	0.050	0.063	0.064	0.059	0.049	0.067	0.060	0.056	0.083	0.056	0.071	0.071	0.054
Tues/ Wed/Thurs	9	0.050	0.051	0.046	0.055	0.056	0.055	0.050	0.066	0.065	0.056	0.079	0.057	0.057	0.064	0.053

Day of Week	Hr	San Bernardino			San Diego			San Luis Obispo			Santa Barbara			Ventura		
		LD	LM	HH	LD	LM	HH	LD	LM	HH	LD	LM	HH	LD	LM	HH
Tues/ Wed/Thurs	10	0.049	0.049	0.046	0.050	0.054	0.054	0.052	0.066	0.067	0.054	0.070	0.060	0.052	0.061	0.053
Tues/ Wed/Thurs	11	0.050	0.051	0.047	0.051	0.056	0.055	0.053	0.067	0.071	0.057	0.072	0.064	0.054	0.062	0.053
Tues/ Wed/Thurs	12	0.052	0.053	0.049	0.053	0.058	0.056	0.056	0.069	0.067	0.060	0.071	0.062	0.056	0.063	0.053
Tues/ Wed/Thurs	13	0.054	0.056	0.051	0.055	0.059	0.055	0.060	0.071	0.065	0.063	0.072	0.060	0.057	0.061	0.051
Tues/ Wed/Thurs	14	0.058	0.062	0.054	0.063	0.062	0.056	0.063	0.076	0.064	0.064	0.075	0.058	0.063	0.063	0.050
Tues/ Wed/Thurs	15	0.062	0.065	0.057	0.072	0.065	0.055	0.069	0.084	0.058	0.067	0.076	0.052	0.071	0.065	0.049
Tues/ Wed/Thurs	16	0.064	0.067	0.059	0.074	0.065	0.055	0.070	0.081	0.050	0.064	0.065	0.044	0.078	0.063	0.046
Tues/ Wed/Thurs	17	0.064	0.066	0.058	0.073	0.063	0.054	0.063	0.067	0.045	0.056	0.045	0.036	0.079	0.060	0.044
Tues/ Wed/Thurs	18	0.055	0.052	0.050	0.061	0.047	0.043	0.053	0.044	0.039	0.050	0.036	0.034	0.065	0.047	0.040
Tues/ Wed/Thurs	19	0.044	0.037	0.041	0.044	0.033	0.033	0.044	0.029	0.034	0.044	0.026	0.031	0.044	0.031	0.034
Tues/ Wed/Thurs	20	0.038	0.029	0.037	0.036	0.026	0.028	0.038	0.021	0.028	0.037	0.019	0.029	0.034	0.021	0.030
Tues/ Wed/Thurs	21	0.033	0.023	0.033	0.031	0.021	0.025	0.032	0.016	0.026	0.031	0.015	0.031	0.028	0.016	0.029
Tues/ Wed/Thurs	22	0.027	0.017	0.029	0.022	0.017	0.022	0.025	0.010	0.023	0.025	0.011	0.027	0.018	0.011	0.028
Tues/ Wed/Thurs	23	0.020	0.012	0.025	0.014	0.014	0.021	0.018	0.006	0.019	0.018	0.008	0.026	0.010	0.008	0.030
Friday	0	0.014	0.016	0.025	0.008	0.018	0.027	0.016	0.004	0.016	0.016	0.006	0.024	0.006	0.016	0.033
Friday	1	0.011	0.014	0.024	0.005	0.017	0.026	0.016	0.003	0.014	0.016	0.005	0.022	0.003	0.013	0.031
Friday	2	0.010	0.014	0.024	0.004	0.017	0.027	0.016	0.003	0.014	0.016	0.005	0.021	0.002	0.012	0.031
Friday	3	0.013	0.017	0.026	0.005	0.018	0.028	0.017	0.004	0.017	0.016	0.006	0.025	0.003	0.014	0.032
Friday	4	0.021	0.024	0.030	0.009	0.021	0.031	0.020	0.007	0.022	0.020	0.011	0.033	0.007	0.019	0.036
Friday	5	0.035	0.037	0.038	0.026	0.032	0.040	0.027	0.018	0.031	0.025	0.022	0.043	0.020	0.032	0.042
Friday	6	0.046	0.046	0.044	0.048	0.047	0.050	0.038	0.042	0.045	0.038	0.046	0.050	0.043	0.052	0.049
Friday	7	0.055	0.056	0.050	0.061	0.060	0.058	0.044	0.058	0.054	0.046	0.068	0.051	0.067	0.068	0.052
Friday	8	0.052	0.052	0.048	0.057	0.058	0.058	0.048	0.061	0.059	0.053	0.079	0.056	0.064	0.069	0.054
Friday	9	0.049	0.048	0.046	0.052	0.055	0.056	0.049	0.064	0.065	0.054	0.079	0.062	0.054	0.062	0.053
Friday	10	0.050	0.050	0.047	0.051	0.055	0.056	0.052	0.068	0.070	0.053	0.071	0.063	0.053	0.061	0.054
Friday	11	0.052	0.053	0.050	0.054	0.058	0.058	0.054	0.070	0.072	0.058	0.074	0.066	0.057	0.064	0.054
Friday	12	0.054	0.055	0.051	0.056	0.060	0.058	0.056	0.072	0.070	0.059	0.073	0.061	0.059	0.064	0.053
Friday	13	0.056	0.058	0.053	0.059	0.061	0.057	0.060	0.074	0.068	0.064	0.073	0.058	0.061	0.065	0.052
Friday	14	0.059	0.063	0.056	0.066	0.063	0.056	0.064	0.079	0.066	0.066	0.073	0.056	0.065	0.065	0.050
Friday	15	0.060	0.066	0.058	0.071	0.065	0.055	0.067	0.083	0.058	0.067	0.074	0.052	0.071	0.065	0.049
Friday	16	0.061	0.066	0.058	0.070	0.064	0.054	0.068	0.078	0.051	0.064	0.062	0.045	0.075	0.063	0.046
Friday	17	0.060	0.064	0.056	0.068	0.060	0.050	0.062	0.064	0.047	0.057	0.046	0.038	0.074	0.059	0.043
Friday	18	0.055	0.053	0.050	0.060	0.048	0.041	0.056	0.048	0.039	0.050	0.036	0.035	0.064	0.046	0.040
Friday	19	0.048	0.043	0.043	0.048	0.035	0.031	0.047	0.033	0.032	0.046	0.028	0.031	0.048	0.032	0.034
Friday	20	0.043	0.035	0.038	0.039	0.027	0.025	0.042	0.025	0.028	0.038	0.022	0.029	0.037	0.022	0.029
Friday	21	0.039	0.029	0.034	0.035	0.023	0.021	0.036	0.019	0.024	0.032	0.017	0.029	0.032	0.017	0.027
Friday	22	0.033	0.022	0.029	0.029	0.020	0.019	0.028	0.014	0.021	0.027	0.014	0.026	0.024	0.012	0.027

Day of Week	Hr	San Bernardino			San Diego			San Luis Obispo			Santa Barbara			Ventura		
		LD	LM	HH	LD	LM	HH	LD	LM	HH	LD	LM	HH	LD	LM	HH
Friday	23	0.025	0.016	0.024	0.020	0.016	0.017	0.021	0.009	0.017	0.019	0.010	0.024	0.016	0.009	0.027
Saturday	0	0.020	0.024	0.034	0.015	0.026	0.043	0.018	0.007	0.027	0.022	0.013	0.039	0.011	0.024	0.043
Saturday	1	0.015	0.020	0.031	0.010	0.023	0.039	0.020	0.006	0.022	0.021	0.010	0.032	0.006	0.018	0.040
Saturday	2	0.013	0.019	0.029	0.007	0.022	0.037	0.020	0.005	0.020	0.022	0.009	0.030	0.004	0.016	0.038
Saturday	3	0.013	0.018	0.029	0.006	0.020	0.035	0.021	0.005	0.021	0.022	0.010	0.032	0.003	0.015	0.037
Saturday	4	0.015	0.020	0.030	0.007	0.022	0.036	0.022	0.007	0.023	0.024	0.014	0.040	0.005	0.017	0.038
Saturday	5	0.021	0.025	0.033	0.014	0.026	0.039	0.025	0.013	0.031	0.028	0.021	0.046	0.011	0.023	0.041
Saturday	6	0.030	0.032	0.038	0.024	0.032	0.045	0.032	0.024	0.039	0.035	0.035	0.053	0.021	0.033	0.045
Saturday	7	0.039	0.040	0.043	0.036	0.040	0.051	0.038	0.041	0.051	0.040	0.048	0.054	0.034	0.046	0.050
Saturday	8	0.046	0.047	0.048	0.048	0.048	0.056	0.047	0.053	0.055	0.046	0.059	0.057	0.046	0.057	0.053
Saturday	9	0.052	0.052	0.050	0.056	0.054	0.059	0.050	0.067	0.062	0.050	0.068	0.060	0.057	0.065	0.055
Saturday	10	0.056	0.056	0.053	0.062	0.058	0.060	0.054	0.078	0.069	0.053	0.070	0.059	0.065	0.071	0.056
Saturday	11	0.059	0.060	0.055	0.066	0.061	0.060	0.059	0.084	0.078	0.057	0.073	0.059	0.070	0.076	0.056
Saturday	12	0.061	0.063	0.057	0.068	0.063	0.058	0.060	0.082	0.070	0.059	0.074	0.056	0.072	0.074	0.054
Saturday	13	0.062	0.063	0.055	0.068	0.062	0.055	0.061	0.079	0.064	0.061	0.070	0.051	0.072	0.071	0.053
Saturday	14	0.062	0.063	0.055	0.068	0.061	0.051	0.060	0.074	0.061	0.061	0.068	0.048	0.072	0.068	0.050
Saturday	15	0.062	0.062	0.054	0.068	0.059	0.047	0.062	0.072	0.053	0.061	0.061	0.045	0.072	0.063	0.047
Saturday	16	0.061	0.060	0.052	0.067	0.057	0.043	0.061	0.066	0.050	0.059	0.059	0.041	0.072	0.059	0.044
Saturday	17	0.059	0.057	0.049	0.064	0.054	0.039	0.059	0.059	0.044	0.057	0.053	0.036	0.068	0.051	0.040
Saturday	18	0.055	0.051	0.044	0.057	0.047	0.033	0.053	0.050	0.037	0.052	0.046	0.033	0.059	0.041	0.035
Saturday	19	0.048	0.042	0.039	0.048	0.040	0.027	0.048	0.038	0.031	0.045	0.036	0.029	0.048	0.031	0.030
Saturday	20	0.043	0.037	0.035	0.042	0.035	0.023	0.043	0.032	0.029	0.041	0.031	0.029	0.040	0.024	0.027
Saturday	21	0.041	0.034	0.033	0.039	0.033	0.022	0.037	0.027	0.025	0.035	0.027	0.024	0.037	0.022	0.024
Saturday	22	0.037	0.029	0.030	0.034	0.031	0.021	0.028	0.018	0.021	0.029	0.023	0.023	0.031	0.019	0.023
Saturday	23	0.030	0.023	0.026	0.025	0.027	0.020	0.021	0.013	0.017	0.023	0.019	0.021	0.022	0.016	0.022
Holiday	0	0.018	0.020	0.026	0.013	0.023	0.029	0.018	0.006	0.012	0.020	0.010	0.020	0.009	0.019	0.032
Holiday	1	0.014	0.018	0.024	0.008	0.021	0.027	0.019	0.004	0.009	0.021	0.008	0.020	0.005	0.016	0.030
Holiday	2	0.012	0.017	0.024	0.006	0.020	0.027	0.019	0.003	0.011	0.019	0.006	0.018	0.003	0.014	0.029
Holiday	3	0.013	0.018	0.026	0.005	0.020	0.027	0.022	0.005	0.013	0.021	0.008	0.023	0.003	0.015	0.031
Holiday	4	0.019	0.024	0.029	0.008	0.023	0.030	0.022	0.008	0.015	0.022	0.012	0.028	0.007	0.018	0.032
Holiday	5	0.029	0.032	0.034	0.019	0.029	0.034	0.028	0.017	0.021	0.027	0.023	0.037	0.016	0.029	0.038
Holiday	6	0.036	0.038	0.037	0.035	0.040	0.042	0.034	0.030	0.031	0.031	0.034	0.042	0.031	0.042	0.043
Holiday	7	0.043	0.045	0.041	0.046	0.048	0.049	0.041	0.044	0.040	0.042	0.060	0.045	0.047	0.056	0.047
Holiday	8	0.047	0.048	0.043	0.048	0.050	0.050	0.046	0.055	0.046	0.048	0.073	0.051	0.051	0.059	0.049
Holiday	9	0.049	0.050	0.045	0.052	0.053	0.053	0.050	0.065	0.062	0.051	0.075	0.059	0.052	0.061	0.051
Holiday	10	0.053	0.053	0.047	0.057	0.058	0.056	0.052	0.076	0.072	0.053	0.071	0.058	0.059	0.066	0.053
Holiday	11	0.057	0.059	0.052	0.062	0.063	0.059	0.052	0.082	0.088	0.057	0.076	0.066	0.066	0.069	0.054
Holiday	12	0.060	0.063	0.053	0.065	0.065	0.060	0.058	0.086	0.085	0.059	0.079	0.070	0.068	0.072	0.055
Holiday	13	0.062	0.064	0.055	0.066	0.066	0.059	0.061	0.081	0.082	0.061	0.072	0.056	0.070	0.070	0.053
Holiday	14	0.063	0.066	0.056	0.068	0.065	0.058	0.059	0.076	0.075	0.060	0.073	0.060	0.071	0.068	0.053
Holiday	15	0.062	0.066	0.057	0.070	0.064	0.057	0.064	0.077	0.065	0.064	0.072	0.055	0.073	0.064	0.050
Holiday	16	0.062	0.063	0.057	0.069	0.060	0.053	0.068	0.072	0.057	0.060	0.061	0.050	0.073	0.061	0.049
Holiday	17	0.062	0.061	0.056	0.066	0.055	0.048	0.062	0.063	0.046	0.059	0.047	0.037	0.071	0.056	0.046
Holiday	18	0.056	0.053	0.052	0.058	0.045	0.042	0.053	0.044	0.039	0.053	0.038	0.036	0.061	0.045	0.041
Holiday	19	0.048	0.043	0.046	0.049	0.037	0.035	0.047	0.035	0.037	0.049	0.029	0.036	0.049	0.032	0.036
Holiday	20	0.043	0.034	0.041	0.043	0.030	0.030	0.041	0.027	0.028	0.040	0.024	0.032	0.041	0.024	0.033
Holiday	21	0.037	0.027	0.037	0.037	0.025	0.027	0.035	0.019	0.023	0.036	0.020	0.038	0.034	0.019	0.032
Holiday	22	0.031	0.021	0.033	0.030	0.022	0.025	0.027	0.014	0.022	0.028	0.017	0.034	0.025	0.014	0.031
Holiday	23	0.023	0.015	0.030	0.020	0.018	0.024	0.021	0.010	0.020	0.021	0.013	0.031	0.016	0.012	0.032

Appendix C:
Additional Temporal Profiles

Temporal profiles developed from the AgTool are applied as potential replacements when processing the emissions inventories for modeling using the SMOKE processor. This would apply for agriculturally related emissions with time-invariant temporal distributions, which includes the following emission source categories: food and agricultural processing, pesticides and fertilizers, farming operations, unpaved road dust, fugitive windblown dust, managed burning and disposal, and farming equipment.

Table L-14
Day-of-Week Temporal Profiles from the Agricultural Emissions Temporal and Spatial Allocation Tool (AgTool)

Code	M	T	W	TH	F	S	S
201	1	174	248	182	203	97	95
202	1	2	1	0	2	1	993
203	1	117	192	190	229	222	48
204	2	16	13	13	10	928	17
205	3	342	597	25	4	5	24
206	4	100	33	241	105	455	62
207	5	50	284	126	125	315	95
208	6	94	41	40	348	358	112
209	7	203	111	236	340	0	102
210	8	221	225	123	117	80	225
211	9	37	63	667	111	37	77
212	11	2	881	41	40	18	8
213	12	96	105	153	201	425	8
214	13	370	306	90	47	101	73
215	13	368	72	498	2	41	6
216	19	562	125	102	47	39	107
217	22	348	74	115	125	215	102
218	22	292	63	229	65	104	224
219	22	482	41	111	167	93	83
220	25	184	100	136	223	152	182
221	25	192	107	223	278	75	101
222	27	40	51	99	310	58	415
223	29	51	237	127	172	308	77
224	30	219	195	158	222	112	64
225	30	185	151	125	186	120	203
226	35	131	195	172	151	201	114
227	35	146	162	175	157	180	143
228	36	179	200	93	188	186	117
229	37	82	363	208	2	73	235

Code	M	T	W	TH	F	S	S
230	40	211	162	182	160	165	81
231	40	468	0	420	0	72	0
232	41	269	293	118	95	121	62
233	44	56	399	13	268	61	160
234	45	335	72	82	210	180	77
235	46	124	139	148	199	168	177
236	46	207	54	453	54	134	52
237	48	310	346	83	84	91	38
238	52	201	140	196	121	160	132
239	53	134	123	144	206	192	149
240	53	108	150	163	171	207	148
241	57	156	183	117	92	220	175
242	63	105	176	154	148	195	160
243	63	186	136	175	187	134	120
244	64	230	173	136	83	251	63
245	66	249	149	127	105	185	120
246	67	222	278	236	65	129	2
247	70	120	192	168	188	145	116
248	74	95	170	197	157	144	162
249	74	190	108	126	246	116	138
250	77	295	104	187	155	88	93
251	79	135	291	129	86	182	97
252	80	360	9	19	424	79	29
253	81	133	132	125	226	167	135
254	82	136	151	118	160	196	157
255	82	92	125	207	177	153	164
256	85	133	152	145	188	173	124
257	87	295	16	111	47	244	201
258	96	128	104	169	161	224	119
259	104	196	118	155	202	132	94
260	104	111	196	121	181	127	162
261	107	161	70	90	227	243	102
262	107	145	115	203	187	147	95
263	111	171	137	0	297	202	81
264	112	121	144	165	155	172	131
265	113	199	97	132	218	147	94
266	113	167	15	156	399	70	80
267	115	150	128	153	192	139	122
268	115	103	120	138	117	251	156
269	119	125	119	87	144	158	248
270	120	145	130	137	155	166	147
271	125	155	141	108	179	149	142
272	130	140	137	170	93	139	192

Code	M	T	W	TH	F	S	S
273	135	222	191	83	169	110	90
274	136	160	156	162	144	156	86
275	138	109	107	137	227	147	137
276	139	101	117	171	167	171	134
277	143	143	143	143	143	143	143
278	150	230	118	72	144	170	116
279	163	118	106	135	185	112	181
280	199	136	81	163	143	180	99
281	218	8	2	14	6	525	226
282	250	35	290	130	50	109	137
283	255	116	82	103	128	63	252
284	278	182	148	36	105	112	139
285	326	168	189	0	105	0	211
286	0	212	165	131	202	128	161
287	0	289	0	0	356	222	133
288	0	321	93	208	109	81	188
289	0	431	4	160	246	15	144
290	0	515	122	111	48	128	76
291	0	0	0	916	84	0	0
292	0	0	0	0	148	0	852
294	0	0	0	0	1000	0	0

Table L-15
Daily Temporal Profiles from the Agricultural Emissions Temporal and Spatial Allocation Tool (AgTool)

Code	0	1	2	3	4	5	6	7	8	9	10	11
201	0	0	0	0	0	10	102	2	26	358	259	134
202	0	0	0	5	3	2	5	59	44	38	28	640
203	1	0	0	0	10	162	64	51	139	270	115	46
204	1	0	0	0	0	1	139	405	79	126	69	54
205	1	3	6	2	3	8	1	2	5	29	73	112
206	2	5	0	4	22	5	6	8	26	31	88	90
207	2	3	0	0	37	177	45	57	167	203	123	102
208	2	0	0	0	0	20	1	498	9	15	28	8
209	2	0	0	12	54	3	41	471	18	105	94	31
210	2	4	2	4	4	3	17	40	60	137	87	178
211	3	2	3	2	0	2	6	12	43	75	220	413
212	4	5	0	0	6	220	16	73	212	321	135	6
213	4	159	11	187	7	0	0	16	71	536	0	1
214	5	5	5	7	6	13	6	91	50	29	237	161
215	8	5	19	15	44	48	35	44	88	109	96	100

Code	0	1	2	3	4	5	6	7	8	9	10	11
216	9	0	0	0	0	10	19	157	83	105	65	92
217	9	9	6	7	10	84	13	35	113	187	138	63
218	10	3	6	5	7	11	17	61	30	44	61	73
219	0	0	0	0	0	393	374	26	0	139	0	4
220	11	11	8	2	25	16	144	131	173	251	106	55
221	13	13	15	25	32	11	8	12	8	123	19	135
222	9	9	2	19	3	19	7	16	76	20	39	156
223	5	5	3	4	13	23	108	64	68	61	92	278
224	1	1	10	4	8	32	50	118	64	72	75	123
225	4	4	8	12	25	22	33	74	62	76	86	114
226	4	4	8	11	12	26	26	46	37	85	114	231
227	7	7	9	10	19	39	25	45	61	92	97	102
228	4	4	8	9	28	20	30	24	34	58	53	180
229	10	10	15	14	18	171	37	47	47	41	38	40
230	19	19	40	29	38	80	48	119	50	39	31	35
231	42	42	42	42	42	42	42	42	42	42	42	42
232	0	0	0	0	0	2	20	24	22	21	37	146
233	0	0	0	0	0	0	0	0	512	0	0	0
234	9	9	7	5	9	32	20	58	39	80	110	105
235	2	2	2	5	6	31	48	95	72	51	41	460
236	11	11	23	12	20	28	23	22	28	64	96	55
237	18	18	12	10	15	7	11	24	20	49	77	80
238	1	1	1	4	1	20	52	86	79	118	93	120
239	2	2	1	3	2	42	31	82	79	79	87	78
240	0	0	0	19	27	55	26	23	26	51	112	162
241	3	3	7	34	3	37	32	238	35	45	66	70
242	3	3	2	35	6	40	47	69	76	97	85	95
243	0	0	0	2	18	6	70	47	130	146	115	21
244	22	22	18	16	38	65	86	87	74	83	68	64
245	6	6	5	7	16	30	26	53	78	126	75	74
246	0	0	0	1	7	426	80	147	29	25	23	109
247	0	0	5	175	1	6	0	37	49	13	4	11
248	4	4	12	8	64	229	105	285	61	59	32	42
249	0	0	0	0	1	6	51	4	11	34	153	492
250	8	8	8	1	1	4	4	4	368	389	188	12
251	17	17	7	68	22	64	11	227	26	299	87	17
252	0	0	0	0	0	3	2	1	2	2	958	9
253	0	2	0	0	0	2	60	212	153	137	76	138
254	0	6	0	0	151	178	73	63	226	62	12	58
255	0	17	356	0	0	149	0	213	0	2	258	0
256	0	0	0	1	0	244	44	98	70	1	0	538
257	0	0	0	0	0	0	11	38	8	77	89	690
258	0	0	0	0	1	217	54	47	60	119	118	231

Code	0	1	2	3	4	5	6	7	8	9	10	11
259	0	0	0	0	8	312	108	95	177	227	73	0
260	0	0	0	0	77	0	1	18	74	134	241	243
261	0	0	0	0	0	1	10	58	48	373	106	114
262	0	0	0	0	0	3	2	20	7	113	26	792
263	0	0	0	0	0	72	919	0	0	9	0	0
264	0	0	0	0	0	75	0	618	307	0	0	0
265	0	0	0	0	0	89	14	0	0	0	0	897
266	0	0	0	0	0	92	0	263	71	187	123	70
267	0	0	0	0	0	377	95	0	0	32	0	495
268	0	0	0	0	0	772	22	0	0	0	0	0
269	0	0	0	0	0	795	121	7	1	16	9	22
270	0	0	0	0	0	0	67	0	9	371	397	127
271	0	0	0	0	0	0	495	0	31	269	0	0
272	0	0	0	0	0	0	929	34	0	0	0	37
273	0	0	0	0	0	0	0	1	0	0	0	997
274	0	0	0	0	0	0	0	6	24	368	49	198
275	0	0	0	0	0	0	0	46	483	33	11	12
276	0	0	0	0	0	0	0	864	0	0	0	0
277	0	0	0	0	0	0	0	0	42	75	167	483
278	0	0	0	0	0	0	0	0	0	84	93	823
279	0	0	0	0	0	0	0	0	0	0	0	0
280	0	0	0	0	0	0	0	0	0	0	0	0
281	0	0	0	0	0	0	0	0	0	0	0	1000
282	0	0	0	0	0	0	0	1000	0	0	0	0
283	0	0	0	0	0	0	1000	0	0	0	0	0
284	0	0	0	0	0	1000	0	0	0	0	0	0

Code	12	13	14	15	16	17	18	19	20	21	22	23
201	65	1	26	10	3	2	1	0	0	0	0	0
202	19	21	48	34	21	22	10	1	0	1	0	0
203	61	3	15	16	16	4	12	6	3	1	3	2
204	33	31	13	20	14	14	2	0	0	0	0	0
205	125	115	101	164	46	49	65	68	3	10	5	2
206	66	397	38	28	43	100	34	5	0	0	0	0
207	23	15	8	6	22	6	1	0	0	0	0	1
208	42	6	358	2	2	0	9	0	0	0	0	0
209	7	9	68	33	43	7	0	0	0	0	0	0
210	42	67	82	198	60	6	3	1	1	1	1	1
211	2	199	2	5	4	7	0	0	0	0	0	0
212	0	0	0	0	0	0	3	0	0	0	0	0
213	0	0	0	0	0	0	7	0	0	0	0	0
214	11	37	123	78	76	1	51	1	1	1	1	2
215	58	112	62	44	30	52	13	3	3	3	3	6

Code	12	13	14	15	16	17	18	19	20	21	22	23
216	15	19	73	308	32	6	2	4	1	0	1	0
217	57	58	25	40	44	45	30	4	5	4	3	13
218	88	56	119	265	18	3	108	3	1	3	3	6
219	11	1	2	15	33	2	0	0	0	0	0	0
220	56	4	1	4	1	0	0	0	0	0	0	0
221	6	47	157	65	26	96	154	7	6	6	6	8
222	44	277	29	52	176	37	2	2	2	1	1	2
223	59	38	56	34	38	22	14	5	1	1	2	5
224	130	51	72	63	61	24	8	2	16	2	11	1
225	72	84	86	92	80	33	12	7	3	4	3	4
226	83	67	71	91	57	12	4	4	1	2	3	2
227	73	120	66	66	72	45	19	7	5	5	5	5
228	122	60	128	104	67	29	22	3	2	4	4	3
229	45	22	27	57	13	3	305	4	6	5	5	20
230	75	49	84	80	64	27	22	21	12	10	9	1
231	42	42	42	42	42	42	42	42	42	42	42	42
232	32	41	17	219	406	5	4	4	0	1	0	0
233	0	0	488	0	0	0	0	0	0	0	0	0
234	136	66	131	41	89	12	16	9	9	0	7	1
235	48	29	19	20	34	17	9	8	1	0	0	0
236	75	53	105	105	146	58	13	11	8	10	14	9
237	54	38	59	177	120	20	10	35	38	44	39	26
238	71	56	132	73	42	27	8	4	2	3	3	1
239	85	78	76	67	142	38	15	4	1	2	2	1
240	192	112	85	60	22	8	1	12	6	0	0	1
241	64	43	166	68	52	16	4	5	1	1	4	0
242	80	78	105	42	48	56	12	4	1	15	2	0
243	62	64	247	42	22	4	2	0	0	0	1	0
244	61	34	32	51	105	25	17	10	2	2	6	12
245	33	44	63	118	131	12	8	2	68	8	8	4
246	2	29	53	6	45	0	0	0	0	17	0	0
247	250	0	1	0	439	0	0	9	0	0	0	0
248	10	71	3	4	8	0	0	0	0	0	0	0
249	8	40	7	15	167	8	0	1	0	0	0	0
250	1	1	1	1	1	0	0	0	0	0	0	0
251	4	4	60	15	0	0	0	1	2	25	15	12
252	3	3	2	3	3	8	2	0	0	0	0	0
253	58	47	61	25	13	7	9	1	0	0	0	0
254	9	7	39	21	80	15	0	0	0	0	0	0
255	0	0	0	0	0	0	4	0	0	0	0	0
256	2	0	0	0	0	2	0	0	0	0	0	0
257	18	14	14	10	21	2	8	0	0	0	0	0
258	0	82	0	54	17	0	0	0	0	0	0	0

Code	12	13	14	15	16	17	18	19	20	21	22	23
259	0	0	0	0	0	0	0	0	0	0	0	0
260	121	48	8	11	0	23	0	1	0	0	0	0
261	34	70	38	15	0	0	0	0	0	58	0	76
262	4	5	9	4	10	5	0	0	0	0	0	0
263	0	0	0	0	0	0	0	0	0	0	0	0
264	0	0	0	0	0	0	0	0	0	0	0	0
265	0	0	0	0	0	0	0	0	0	0	0	0
266	50	6	19	4	10	85	19	0	0	0	0	0
267	0	0	0	0	0	0	0	0	0	0	0	0
268	0	0	0	0	0	0	0	0	0	0	0	206
269	5	3	7	8	4	0	0	0	0	0	0	0
270	26	3	1	0	0	0	0	0	1	0	0	0
271	0	144	0	61	0	0	0	0	0	0	0	0
272	0	0	0	0	0	0	0	0	0	0	0	0
273	0	1	0	0	0	0	0	0	0	0	0	0
274	25	32	42	95	45	58	56	1	0	0	0	0
275	7	17	50	4	336	0	0	0	0	0	0	0
276	136	0	0	0	0	0	0	0	0	0	0	0
277	0	233	0	0	0	0	0	0	0	0	0	0
278	0	0	0	0	0	0	0	0	0	0	0	0
279	0	0	0	0	0	0	0	0	0	0	0	0
280	0	0	0	0	1000	0	0	0	0	0	0	0
281	0	0	0	0	0	0	0	0	0	0	0	0
282	0	0	0	0	0	0	0	0	0	0	0	0
283	0	0	0	0	0	0	0	0	0	0	0	0
284	0	0	0	0	0	0	0	0	0	0	0	0

OGV temporal profiles were constructed based on 2016 port activities of all vessels, compiled by an in-house section in CARB. Grouped by port areas, ships were counted over all vessel types at monthly and weekly intervals from which monthly and weekly profiles were derived (Table L-16 and Table L-17). Some profiles are either area- or inline specific, others will be used by both area and inline sources. Activity data was not available for all ports; a flat (emissions are spread evenly across the time period) monthly and daily profile was used for those ports. A flat profile was also used to represent the hourly variation for all OGV vessels at every port area/waters. The temporal profiles do not apply to OGV military, which assumes a flat at monthly, days of week, and hours of day intervals (see the profile labeled Elsewhere in the tables below).

Table L-16
OGV Monthly Profiles

Port areas/ waters	Profile ID	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Eureka	M_EKA	0.000	0.000	0.000	0.000	0.167	0.167	0.167	0.000	0.167	0.167	0.167	0.000
Hueneme	M_NTD	0.065	0.088	0.090	0.093	0.095	0.083	0.083	0.075	0.078	0.080	0.088	0.085
Carquinez	M_CAR	0.068	0.076	0.080	0.076	0.087	0.093	0.090	0.085	0.085	0.090	0.075	0.095
Oakland	M_OAK	0.083	0.079	0.082	0.083	0.094	0.084	0.087	0.090	0.079	0.082	0.079	0.079
Redwood City	M_RWC	0.055	0.018	0.091	0.091	0.127	0.073	0.055	0.127	0.091	0.091	0.036	0.145
Richmond	M_RCH	0.083	0.092	0.086	0.081	0.086	0.095	0.083	0.097	0.075	0.062	0.084	0.076
Sacramento	M_SAC	0.018	0.036	0.018	0.054	0.054	0.089	0.036	0.036	0.054	0.071	0.482	0.054
San Diego	M_SGQ	0.089	0.069	0.092	0.098	0.087	0.072	0.067	0.065	0.083	0.089	0.094	0.094
San Francisco	M_SFO	0.070	0.071	0.074	0.080	0.095	0.093	0.071	0.087	0.080	0.087	0.091	0.100
Stockton	M_SCK	0.083	0.088	0.083	0.074	0.111	0.101	0.060	0.101	0.055	0.083	0.092	0.069
Elsewhere	1	0.083	0.083	0.083	0.083	0.083	0.083	0.083	0.083	0.083	0.083	0.083	0.083
Waters of LA County+	M_6059	0.093	0.071	0.084	0.088	0.084	0.075	0.080	0.091	0.074	0.087	0.081	0.092
El Segundo*	M_ELS	0.104	0.055	0.084	0.093	0.086	0.066	0.075	0.104	0.066	0.090	0.075	0.104
Port of Los Angeles*	M_LAX	0.090	0.083	0.085	0.083	0.083	0.075	0.077	0.082	0.077	0.086	0.088	0.091
Port of Long Beach*	M_LGB	0.085	0.074	0.082	0.088	0.084	0.085	0.086	0.089	0.080	0.084	0.082	0.080

"+ Area only"

"* Inline only"

Table L-17
OGV Weekly Profiles

Port Areas/ Waters	Profile ID	Mon	Tue	Wed	Thu	Fri	Sat	Sun
Eureka	W_EKA	0.500	0.000	0.333	0.000	0.000	0.000	0.167
Hueneme	W_NTD	0.113	0.145	0.205	0.160	0.108	0.115	0.155
Carquinez	W_CAR	0.178	0.131	0.146	0.163	0.136	0.126	0.121
Oakland	W_OAK	0.156	0.175	0.174	0.127	0.079	0.128	0.161
Redwood City	W_RWC	0.109	0.127	0.200	0.091	0.218	0.109	0.145
Richmond	W_RCH	0.167	0.153	0.142	0.126	0.161	0.129	0.122
Sacramento	W_SAC	0.179	0.250	0.089	0.143	0.161	0.071	0.107
San Diego	W_SGQ	0.136	0.166	0.174	0.159	0.134	0.103	0.128
San Francisco	W_SFO	0.155	0.138	0.153	0.137	0.127	0.143	0.146
Stockton	W_SCK	0.152	0.147	0.106	0.157	0.161	0.106	0.171
Elsewhere	7	0.143	0.143	0.143	0.143	0.143	0.143	0.143
Waters of LA County+	W_6059	0.143	0.132	0.152	0.150	0.139	0.148	0.135
El Segundo*	W_ELS	0.137	0.137	0.154	0.148	0.137	0.145	0.143
Port of Los Angeles*	W_LAX	0.150	0.133	0.154	0.161	0.139	0.147	0.115
Port of Long Beach*	W_LGB	0.143	0.127	0.146	0.142	0.142	0.153	0.148

"+ Area only"

"* Inline only"

ATTACHMENT M
WEIGHT OF EVIDENCE DEMONSTRATION FOR SAN DIEGO COUNTY

Prepared by
California Air Resources Board
San Diego County Air Pollution Control District

March 2020

M.1 Introduction

M.1.1 Background

Ozone nonattainment areas are classified based on the severity of their ozone levels. This is determined using the area's design value. The design value is the three-year average of the annual fourth highest daily maximum eight-hour average ozone concentration at a monitoring site.

Effective on July 20, 2012, San Diego County (County) was designated by the United States Environmental Protection Agency (U.S. EPA) as a nonattainment area for the 2008 ozone standard of 0.075 parts per million (ppm), with a classification of Marginal and an attainment date of July 20, 2015. Then, effective June 3, 2016, U.S. EPA determined that the region had failed to attain by the marginal deadline and reclassified San Diego County as Moderate with an attainment deadline of July 20, 2018.

Effective August 3, 2018, the County was designated as a nonattainment area for the more health-protective 2015 ozone standard of 0.070 ppm, with a classification of Moderate and an attainment date of August 3, 2024.

Attainment dates for these two federal ozone standards are shown in Table M-1 below. The table indicates both the dates by which areas must be found to be in attainment, depending upon their classification; and the year by which each area's ozone design value must meet the respective ozone standard.

Table M-1
Attainment Dates for Ozone Standards by Classification

Classification	0.075 ppm Eight-Hour Ozone Standard		0.070 ppm Eight-Hour Ozone Standard	
	Attainment Date	Attainment Year	Attainment Date	Attainment Year
Marginal	July 20, 2015	2014	August 3, 2021	2020
Moderate	July 20, 2018	2017	August 3, 2024	2023
Serious	July 20, 2021	2020	August 3, 2027	2026
Severe	July 20, 2027	2026	August 3, 2033	2032
Extreme	July 20, 2032	2031	August 3, 2038	2037

For example, as a Moderate area for the 0.075 ppm standard, San Diego would need to attain that standard by July 20, 2018. Because July 20 falls in the middle of the high-ozone season, the attainment determination would be based upon ozone data from the three previous complete years of 2015, 2016, and 2017. For San Diego County to have met its Moderate area attainment date, its 2017 design value would have needed to meet the 0.075 ppm standard. For practical purposes, 2017 is referred to as the attainment year as a Moderate nonattainment area, as the 2017 design value was the basis for determining whether the area attained by July 20, 2018.

The region had a 2017 design value of 0.084 ppm, a 2018 design value of 0.084 ppm, and is followed by a preliminary 2019 design value of 0.082 ppm and therefore, has not attained the 0.075 ppm ozone standard by the Moderate attainment deadline. Furthermore, it is very unlikely that San Diego County will have a design value of 0.075 ppm or lower by 2020. Consequently, an area failing to attain by its Serious deadline would ordinarily be subject to reclassification by U.S. EPA to the next highest classification of Severe. Therefore, the San Diego Air Pollution Control District (SDAPCD) is seeking to reclassify the County as a severe nonattainment area for the 0.075 ppm standard. In addition, the SDAPCD is seeking a consistent (Severe) classification for the 0.070 ppm standard.

M.1.2 Weight of Evidence Requirement

For areas designated as Moderate or above nonattainment for the federal ozone standard, photochemical modeling is a required element of the State Implementation Plan (SIP) to determine whether existing and planned control strategies provide the reductions needed to meet the federal standard by the attainment deadline.

To address the uncertainties inherent to modeling assessments, U.S. EPA guidance, *Modeling Guidance for Demonstrating Air Quality Goals for Ozone, $PM_{2.5}$, and Regional Haze*, recommends that supplemental analyses accompany all model attainment demonstrations. Further, U.S. EPA guidance indicates that as an area approaches the target attainment date, ambient air quality and emissions data become an increasingly important element in demonstrating progress toward air quality goals.

When the primary model attainment demonstration is close to but fails to attain the National Ambient Air Quality Standards (NAAQS), U.S. EPA guidance recommends that states consider whether it is appropriate to perform an attainment demonstration using Weight of Evidence (WOE).

U.S. EPA guidance recommends a WOE analysis in cases for which future design values are close to the NAAQS, using the following criteria for a WOE attainment demonstration:

- A fully evaluated, high-quality modeling analysis that projects future values that are close to the NAAQS.
- A description and explanation of each of the individual supplemental analyses, preferably from multiple categories. Analyses that utilize well-established analytical procedures and are grounded with sufficient data should be weighted accordingly higher.
- A written description as to why the full set of evidence leads to a conclusive determination regarding the future attainment status of the area that differs from the results of the modeled attainment test alone.

The WOE analysis can include monitoring and emissions inventory trend analysis; review of the conceptual model for ozone formation in the nonattainment area; additional modeling metrics; alternative attainment test methods; and assessment of the efficacy of SIP-approved regulations, state-only regulations, and voluntary control measures. Considering this information and applying the criteria described in the guidance, the WOE analysis is then used to assess whether the planned emissions reductions will result in attainment of the ozone standard at the monitors that modeled ozone future design values higher than the ozone standards in the respective attainment years.

Photochemical modeling for the County has indicated that all sites will meet the 0.075 ppm standard by 2026 with a predicted 2026 design value of 0.0746 ppm, and the 0.070 ppm standard by 2032 with a predicted 2032 design value of 0.0709 ppm. The primary model attainment demonstration successfully attains the NAAQS by Severe classification deadlines.

The following Weight of Evidence demonstration includes:

- Detailed analyses of ambient ozone data;
- County level precursor emission trends;
- Conceptual model for elevated ozone in the County;
- Discussion of conditions that contribute to exceedances of ozone standards; and
- Evaluation of the progress towards attainment of the NAAQS by associated deadlines.

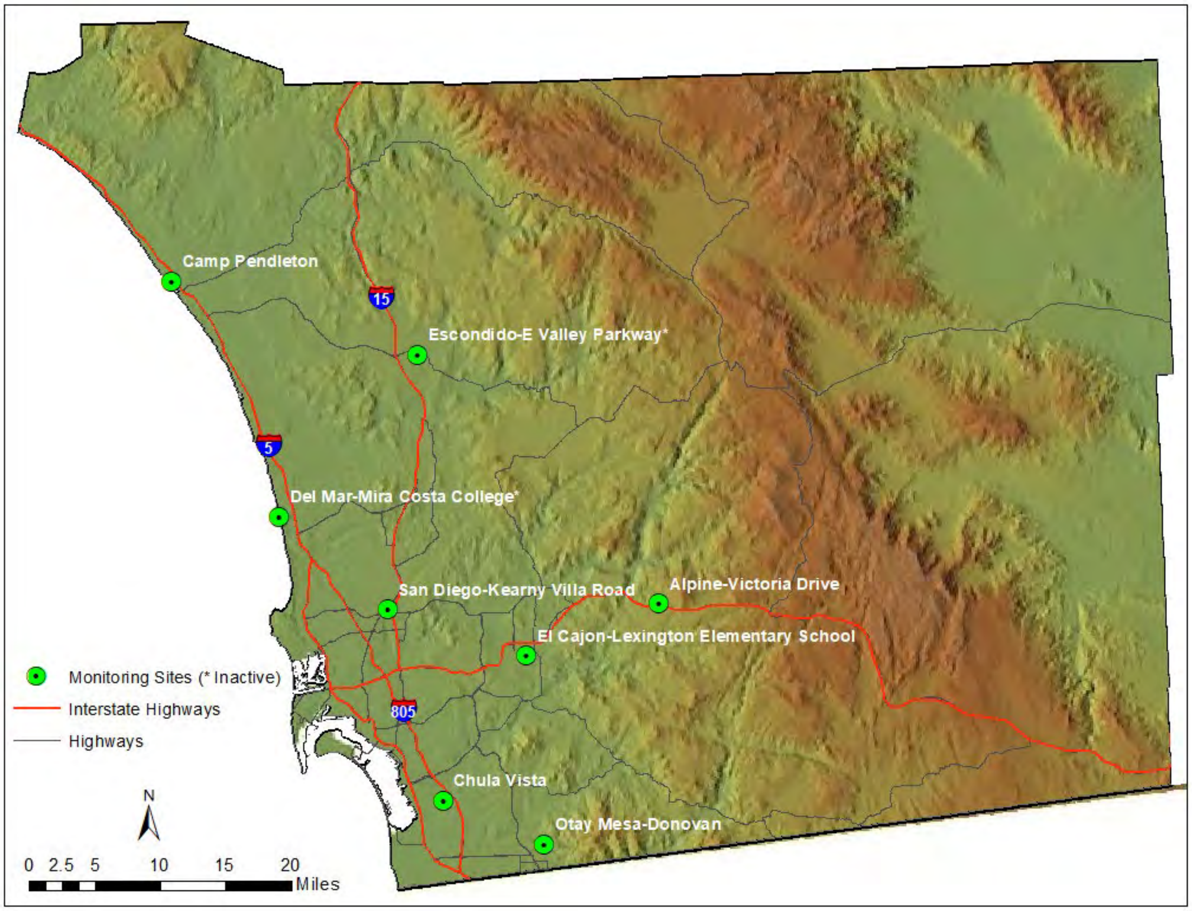
Air quality analyses show that measured ozone concentrations and emissions of ozone precursors in San Diego County have declined markedly since 2000 and indicate that the County will meet the 0.075 ppm and 0.070 ppm Severe classification attainment years of 2026 and 2032, respectively.

M.2 Area Description

The San Diego County Nonattainment Area encompasses all of San Diego County, as shown in Figure M-1. San Diego County is bordered on the west by the Pacific Ocean, on the north by Orange County and Riverside County, on the east by Imperial County, and on the south by Mexico. Approximately 3.3 million people reside within the County's 4,207 square miles as of the 2018 census estimate constituting the second most populous county in California, with an additional 2.0 million people (2018 estimate) residing just south of the border in the Tijuana, Mexico urban area. Numerous industrial and transportation facilities, multiple military installations, airports, and a major shipping port are located within the region.

The city of San Diego is situated on the coast about 100 miles south of Los Angeles within a hilly coastal plain roughly 15 miles wide. It is bounded by the Pacific Ocean coast to the west and peninsular ranges to the east. Most of the population resides in the western portion of the County, with over 95 percent of population within 20 miles of the coast as of the 2010 census.

Figure M-1
2019 Ozone Monitoring Sites in San Diego County



M.3 Monitoring Network

SDAPCD currently operates an active network of six ozone monitoring sites as shown in Figure M-1. Note that the Escondido site was temporarily shut down in August 2015, with a new station expected to be built nearby on the same property in 2020. Additionally, the Del Mar-Mira Costa College site was evicted in April 2017 and U.S. EPA approved permanent decommissioning. Monitors are sited to represent coastal, inland mesa, inland valley, and foothill regions. Similar to other coastal areas, there is typically a large gradient in ozone concentrations between the coastal and inland areas due to the difference in prevailing meteorological conditions, local pollution sources, and residence time in ozone formation which generally cause higher ozone concentrations inland.

The SDAPCD has divided San Diego County into four regions for ozone forecasting and analysis: coastal, inland mesa, inland valley, and foothill; with sites labeled in Table M-2. The coastal regions are represented by sites at Camp Pendleton, Del Mar, and Chula Vista with generally lower ozone values due to prevailing sea breezes and frequent coastal fog. However, Camp Pendleton tends to have slightly higher design values than other coastal sites due to occasional transport and influence from the South Coast Air Basin. Inland mesa sites are Otay Mesa and San Diego-Kearny Villa Road, situated to monitor for pollution transport from Mexico and the San Diego metropolitan area, respectively. El Cajon and Escondido sites cover the inland valley regions where ozone and precursors can build up and stagnate below the foothills. The El Cajon site is situated to monitor for San Diego metropolitan transport into the inland valley. The Escondido site is in the area of top 10 traffic counts for the county and is representative of much of the populated northern inland portions of the County.

As shown in Tables M-2 and M-3, the highest ozone concentrations are measured at the foothill Alpine-Victoria Drive site (also referred to as the Alpine site). The Alpine site is located about 26 miles from the Pacific coastline and about 25 miles east-northeast of downtown San Diego at an elevation of 2,057 feet. This site drives San Diego County’s eight-hour ozone design value (the three-year average of the fourth highest daily maximum eight-hour ozone concentrations) with the vast majority of all exceedance days occurring at the Alpine site. In contrast, the coastal region sites have significantly lower concentrations and only occasional exceedance days.

Table M-2
4th Highest Eight-Hour Average Ozone Values (ppm) at San Diego County Sites

Site Name	Region	2014 4th High	2015 4th High	2016 4th High	2017 4th High	2018 4th High	2019 4th High***
Alpine-Victoria Drive	Foothill	0.080	0.079	0.084	0.090	0.080	0.076
Camp Pendleton	Coastal	0.071	0.068	0.071	0.072	0.060	0.057
Chula Vista	Coastal	0.063	0.061	0.061	0.064	0.057	0.065
Del Mar	Coastal	0.073*	0.064*	0.064	0.057*	**	**
El Cajon-Combined	Inland Valley	0.067*	0.065*	0.072*	0.077*	0.066*	0.068
Escondido	Inland Valley	0.076	0.069	**	**	**	**
Otay Mesa-Combined	Inland Mesa	0.063*	0.069*	0.071*	0.071	0.063	0.060
San Diego-Kearny Villa	Inland Mesa	0.071	0.067	0.068	0.077	0.071	0.066

* No valid Design Value for this year
** Site inactive
*** Based on preliminary data for 2019 calculated for 0.070 ppm ozone standard. Data validated and into AQS as of April 2020

Table M-3
Ozone Design Values (ppm) at San Diego County Monitoring Sites

Site Name	2014 D.V.	2015 D.V.	2016 D.V.	2017 D.V	2018 D.V.	2019 D.V. ***	Meets 0.075 ppm Standard	Meets 0.070 ppm Standard
Alpine-Victoria Drive	0.079	0.079	0.081	0.084	0.084	0.082	No	No
Camp Pendleton	0.065	0.067	0.070	0.070	0.067	0.063	Yes	Yes
Chula Vista	0.062	0.061	0.061	0.062	0.060	0.062	Yes	Yes
Del Mar	*	*	0.067	*	**	**		
El Cajon-Combined	*	*	*	*	*	0.067	Yes	Yes
Escondido	0.072	0.072	**	**	**	**		
Otay Mesa-Combined	*	*	*	0.070	0.068	0.064	Yes	Yes
San Diego-Kearny Villa	0.068	0.068	0.068	0.070	0.072	0.071	Yes	No

* Insufficient data to determine Design Value
** Site inactive
*** Based on preliminary data for 2019 calculated for 0.070 ppm ozone standard. Data validated and into AQS as of April 2020

M.4 <u>Anthropogenic Emissions</u>

Ozone precursor emissions in San Diego County are predominantly from mobile sources. Table M-4 shows the annual ozone precursor emissions inventory for San Diego County calculated from the California Air Resources Board's (CARB) California Emissions Projection Analysis Model (CEPAM). This indicates that in 2019 mobile emissions sources (regional transportation, border traffic, off-road equipment, etc.,) were estimated to contribute approximately 64 tons per day (tpd) of oxides of nitrogen (NOx) and 41 tpd of reactive organic gasses (ROG) , accounting for nearly 91 percent of all anthropogenic NOx (71 tpd) and 40 percent of all anthropogenic ROG (104 tpd) emissions within the air basin. This reflects a decrease from 2000 estimates by 141 tpd of NOx (NOx declined by 67 percent) and 95 tpd of ROG (ROG declined by 35 percent). Stationary and areawide source emissions combined have been reduced by almost 10 tpd of NOx (60 percent NOx reduction) and 19 tpd of ROG (23 percent ROG reduction) since 2000.

Table M-5 and Figure M-2 illustrate the average daily emissions during the summer months, May to October when ozone exceedances are most frequent, from 2000 to 2019 alongside the ROG to NOx ratio calculated from the CEPAM inventory. Significant reductions have been made with stationary NOx, mobile NOx, and mobile ROG all decreasing by approximately two-thirds of their year 2000 emissions. Since year 2000, total summer emissions of NOx have decreased by approximately 66 percent with ROG abated by 48 percent. During this period, NOx concentrations have declined more rapidly than the ROG concentrations most likely due to a more NOx focused control strategy, leading to a

51 percent increase in the ROG to NOx Ratio. The trend in the ROG to NOx ratio indicates that the rate of ozone formation in the San Diego Air Basin (SDAB) is becoming increasingly NOx-limited in recent years.

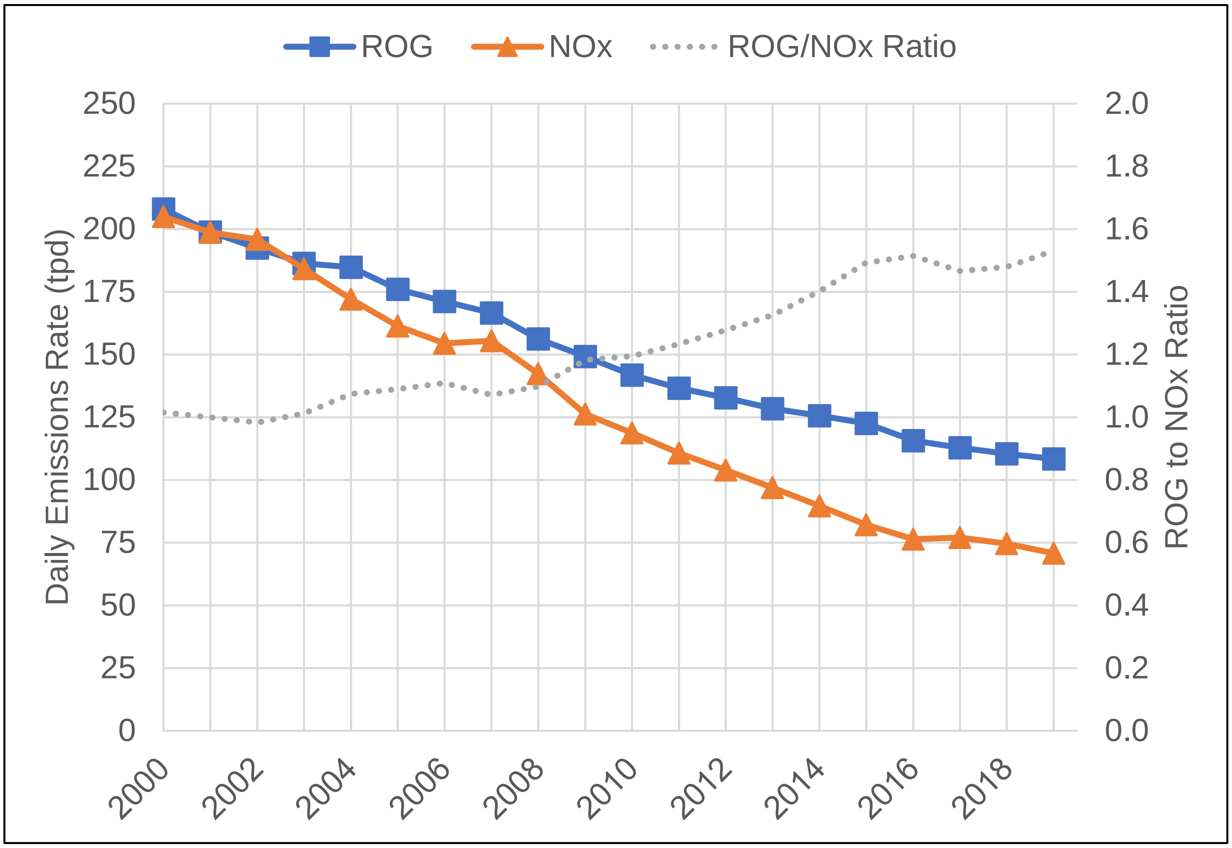
Table M-4
Annual Ozone Precursor Emissions Inventory of San Diego Air Basin

	2000	2005	2010	2015	2016	2017	2018	2019	2000-2019 Change
NOx (Tons Per Day)	212.01	165.88	121.16	82.87	77.04	77.24	74.74	70.83	-66.6%
Stationary % of NOx	6.2%	4.2%	3.6%	4.9%	5.2%	5.2%	5.4%	5.7%	-69.5%
Areawide % of NOx	1.4%	1.7%	2.5%	3.3%	3.4%	3.3%	3.4%	3.5%	-16.4%
Mobile % of NOx	92.4%	94.0%	93.8%	91.9%	91.3%	91.5%	91.2%	90.8%	-67.2%
ROG (Tons Per Day)	198.71	165.73	134.23	116.71	110.30	107.67	105.43	103.62	-47.9%
Stationary % of ROG	19.4%	22.9%	22.1%	25.2%	26.5%	26.2%	26.5%	26.8%	-27.9%
Areawide % of ROG	21.6%	24.3%	27.8%	31.7%	30.9%	31.8%	32.7%	33.5%	-19.2%
Mobile % of ROG	59.0%	52.8%	50.1%	43.1%	42.5%	42.0%	40.8%	39.7%	-64.9%

Table M-5
Summer Ozone Precursor Emissions Inventory of San Diego Air Basin

	2000	2005	2010	2015	2019	2000-2019 Change
NOx (Tons Per Day)	204.92	161.39	118.67	82.05	70.75	-65.5%
Stationary (Tons Per Day)	13.40	7.19	4.57	4.13	4.08	-69.5%
Areawide (Tons Per Day)	1.95	1.93	1.99	1.81	1.60	-17.8%
Mobile (Tons Per Day)	189.57	152.27	112.10	76.11	65.07	-65.7%
ROG (Tons Per Day)	208.02	175.94	141.82	122.49	108.35	-47.9%
Stationary (Tons Per Day)	38.16	37.51	29.27	28.93	27.22	-28.7%
Areawide (Tons Per Day)	41.93	40.01	36.53	36.30	34.13	-18.6%
Mobile (Tons Per Day)	127.93	98.43	76.01	57.26	47.00	-63.3%
ROG to NOx Ratio	1.02	1.09	1.20	1.49	1.53	50.9%

Figure M-2
Summer Inventory Trends of San Diego Air Basin Since 2000



M.5 Trends of Ambient Ozone Precursor Concentrations

Ambient air measurements of the primary ozone precursors, oxides of nitrogen and reactive organic gasses, are gathered at a special-purpose network of Photochemical Assessment Monitoring Stations (PAMS). The PAMS network is operated during the summer ozone season (typically from July through October). In addition to hourly NOx and meteorological measurements, multiple three-hour VOC samples are collected every three to six days. The VOC data discussed here are the sum of 55 PAMS targeted chemical species, called Non-Methane Organic Compounds (NMOC) which are considered important in the role of ozone photochemical processes. VOC and NOx data at PAMS sites in the County are analyzed where available from 2000 to the middle 2010s.

The VOC and NOx data analysis are restricted to only three sites due to the limited VOC data availability in the SDAB. Analysis is focused on the morning commute hours between 5 am and 8 am in the summer peak ozone season of July to September. The morning time period was selected because it represents the hours before photochemistry (and therefore ozone formation) is triggered, and the ambient concentrations of ozone precursors are usually at higher levels during this period.

Figures M-3 through M-5 show the VOC and NOx concentrations, as well as the VOC to

NOx ratios from 2000 to the middle 2010s at Camp Pendleton, El Cajon, and Alpine. In these figures, each data point represents an average of all available morning (5 am – 8 am) VOC and NOx concentrations from July to September for each year. The VOC concentration is the sum of direct measurements of 55 PAMS targeted NMOC species from the three-hour canister samples collected during 5 am to 8 am, and the daily value of NOx concentrations is the average of hourly measurements of NOx covering the same three-hour period.

All three sites show a downward trend in VOC and NOx concentrations from 2000 to the mid-2010s despite some year-to-year variations. This trend is due to the result of successful VOC and NOx emission control measures. For example, at the Alpine site, which is downwind of the San Diego metropolitan area and is also the ozone design site in the County, the VOC concentration decreased by 45 percent from 2000 to 2015, while the NOx concentration decreased by 65 percent for the same period. At the El Cajon-Redwood site, which is situated at the eastern edge of the San Diego metropolitan area, the VOC and NOx concentrations decreased by 40 percent and 50 percent, respectively, from 2000 to 2013. These reductions trend well when compared to the anthropogenic summer ozone precursor emissions inventory estimates with reductions of approximately 48 percent VOC and 66 percent NOx between 2000 and 2019. The fact that the NOx concentrations declined more rapidly than the VOC concentrations is most likely due to more NOx focused control strategies being advanced in recent years.

Figure M-3
July-September Means of VOC, NOx and their Ratios
at Camp Pendleton (5 am - 8 am)

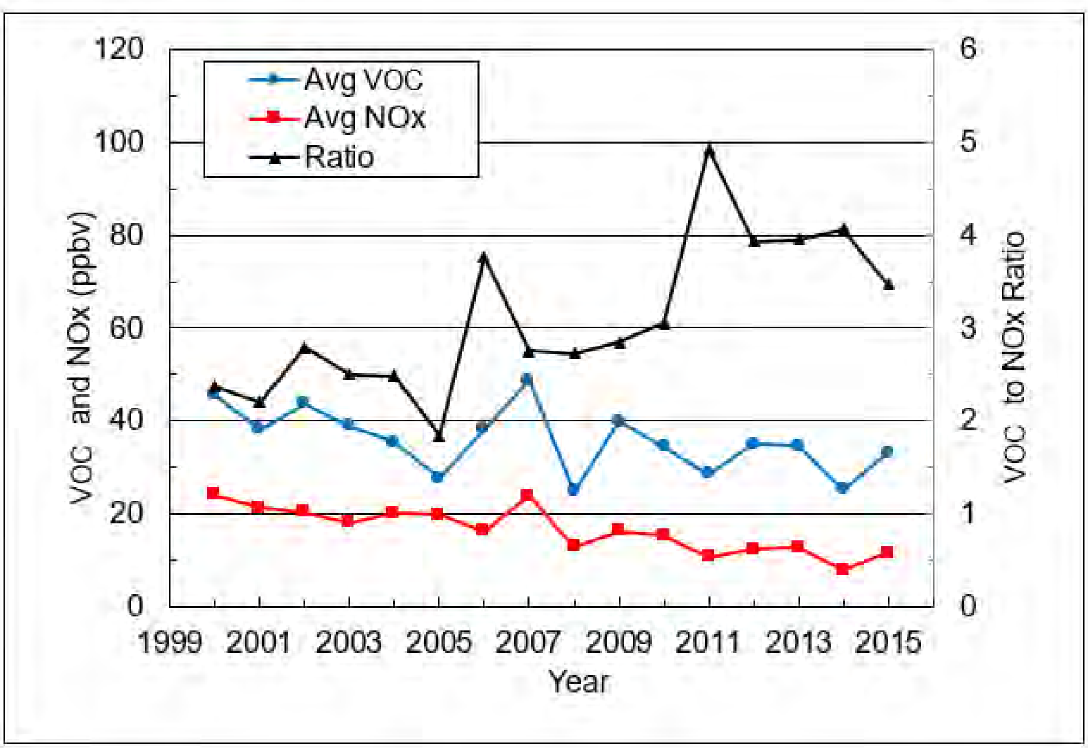


Figure M-4
July-September Means of VOC, NOx and their Ratios
at El Cajon-Redwood (5 am - 8 am)

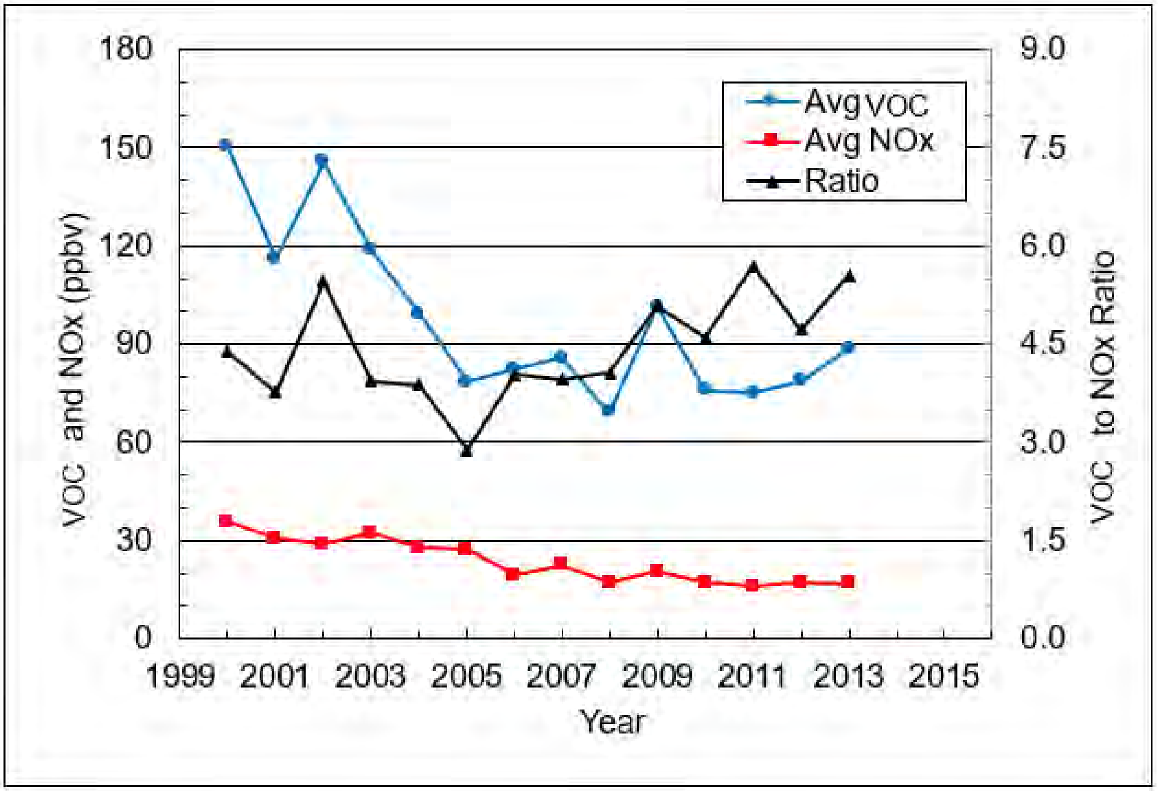


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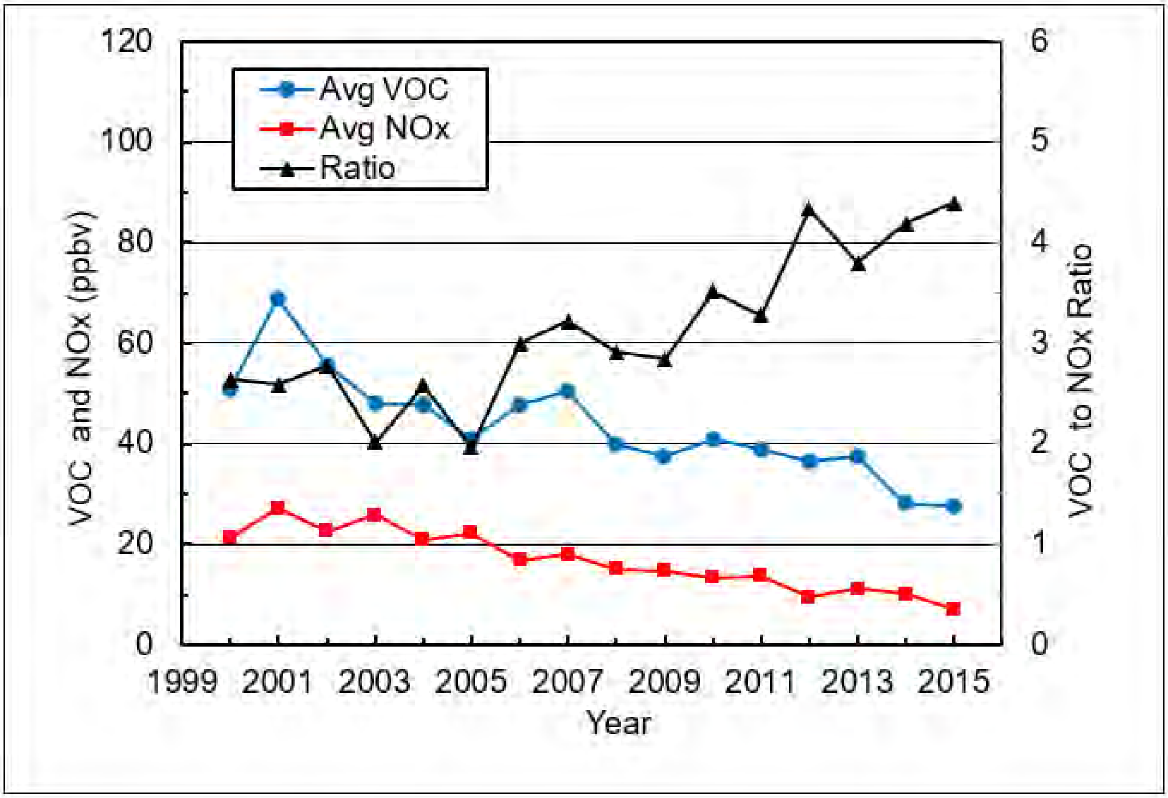
Figure M-5
July-September Means of VOC, NOx and their Ratios at Alpine (5 am - 8 am)



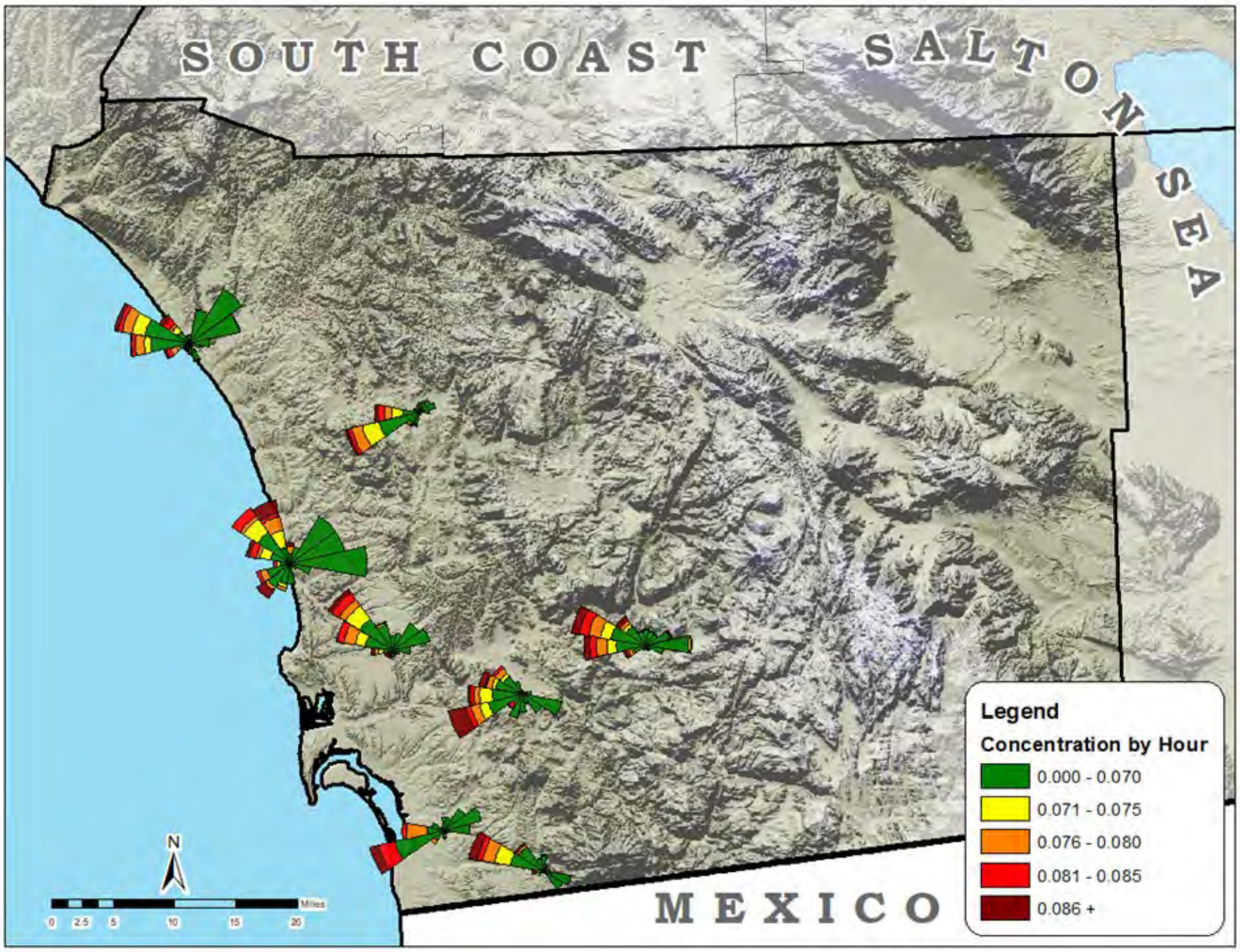
M.6 Conceptual Model

Local emissions and occasional transport of ozone and ozone precursors from the South Coast Air Basin and Mexico contribute to elevated ozone in San Diego County. Most days with elevated ozone concentrations occur during the late spring through early fall and under conditions that are conducive to photochemical production from accumulated local and regional precursor emissions.

In the spring, summer, and early fall, the predominant weather pattern of San Diego County consists of a marine sea breeze developing along the coastline pushing inland and up into the foothills during the daytime. After sunset, air over the land cools faster than over the ocean allowing for air to flow back toward the coastline at night. The sloping terrain from the mountain ranges westward to the coastal plain further promotes the flow of air from the inland/foothill areas back toward the coast at night. This diurnal (day/night) sea/land breeze circulation pattern moves air masses back and forth over the same populated areas of the County, accumulating emissions with each pass. Ozone exceedances can occur when these recirculated emissions build up and stagnate onshore under warm, sunny midday skies.

The pollution roses in Figure M-6 are a graphical representation of wind direction frequency and ozone concentrations at the ozone monitoring sites during days that had eight-hour averaged values exceeding 0.070 ppm between 2014 and 2019. These pollution roses show that the majority of ozone exceedance days occur with primarily northwesterly or westerly winds carrying ozone and precursors from along the coast and more densely urbanized areas in the coastal plains area of the County, eastward toward the inland regions. Further, during days with exceedances, periods of easterly or southerly winds rarely result in high ozone concentrations.

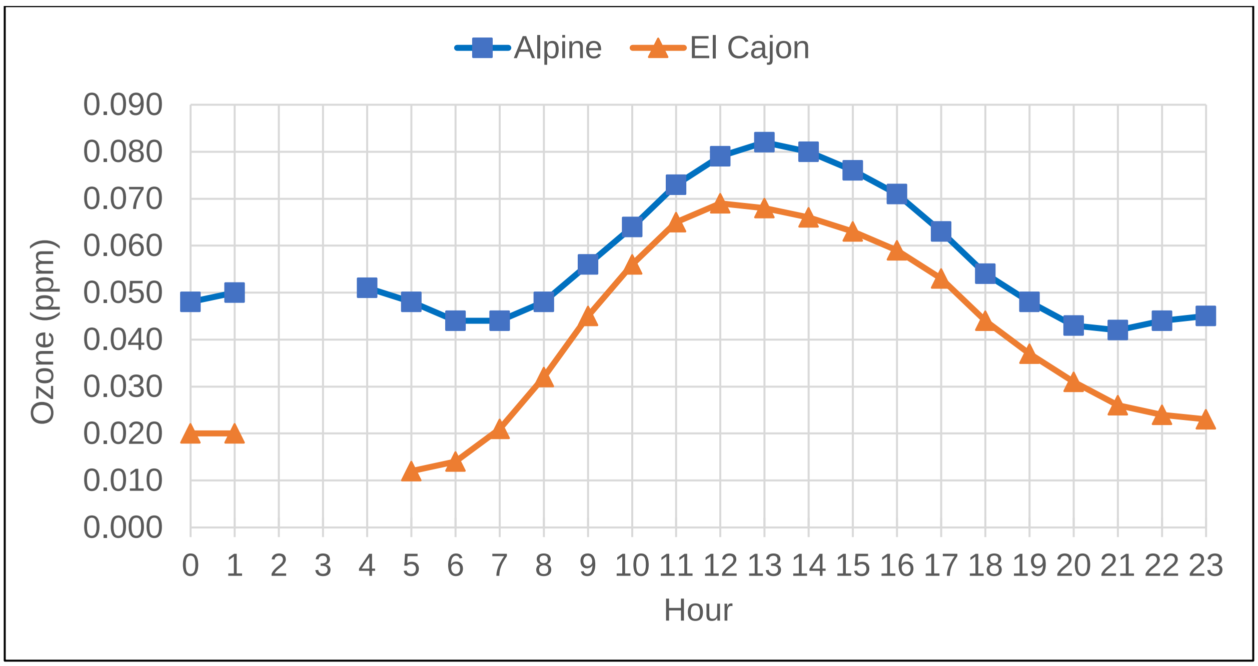
Figure M-6
Pollution Roses for Eight-Hour 0.070 ppm,
Ozone Exceedance Days in 2014-2019



Pollution roses represent hourly concentrations on eight-hour ozone exceedance days at each site. Hourly measurements on exceedance days can include values above and below the standard.

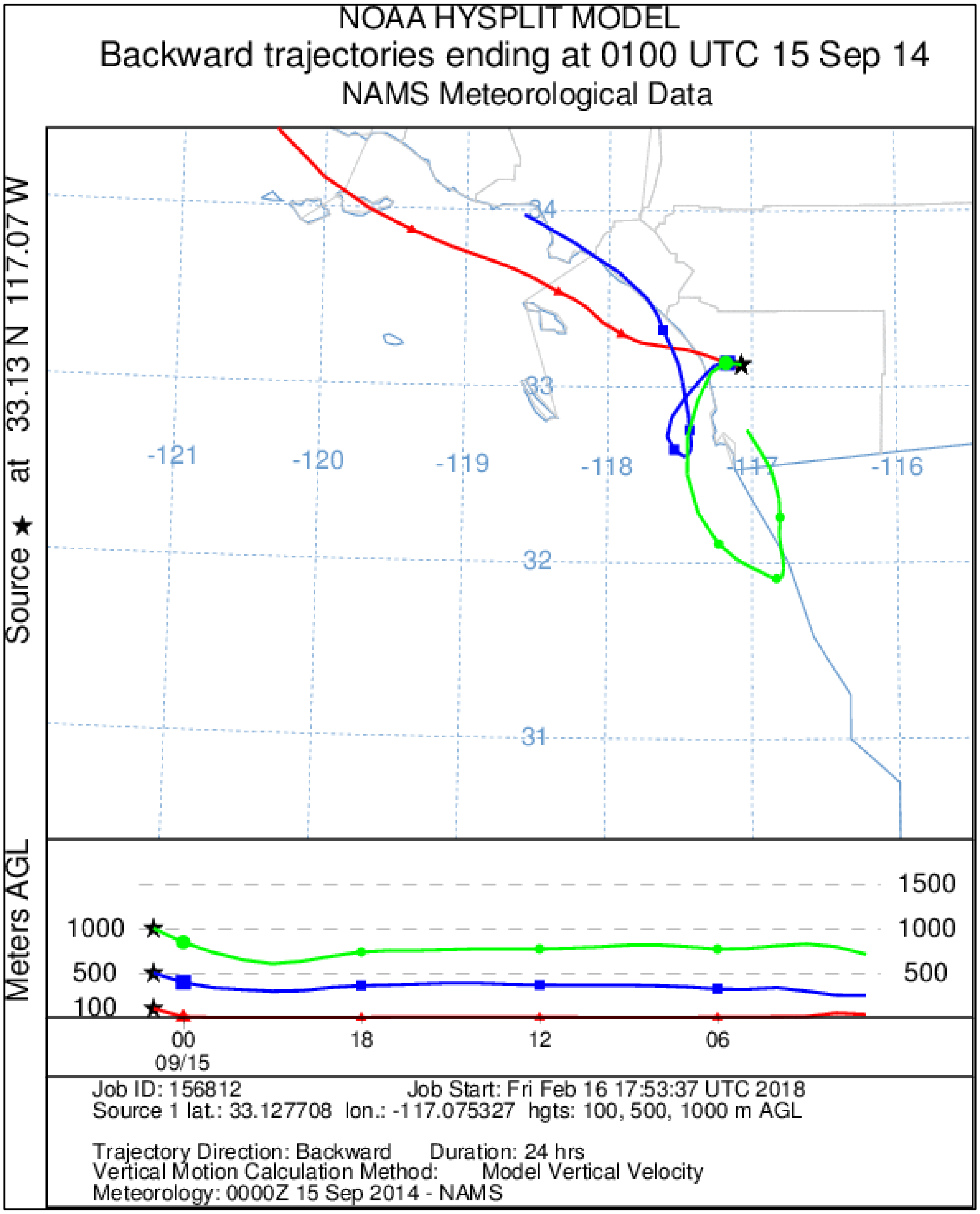
At the Alpine site, conditions leading to exceedances are generally driven by a combination of transported ozone and precursors from San Diego and the inland valley, diurnal cycling of ozone and precursors transported up and down the mountains due to the land/sea breeze, high overnight ozone concentrations due to limited NOx titration, and lower mixing heights. The diurnal chart in Figure M-7 displays averaged one-hour ozone concentrations at Alpine and El Cajon sites during exceedance days at Alpine during 2018-2019. Higher morning ozone baseline at Alpine is due to limited NOx titration in the foothills. Ozone concentrations increase in El Cajon and Alpine as ozone and precursors from San Diego are transported eastward by the sea breeze that develops as the land warms after sunrise. Ozone transported through the inland valley near El Cajon to the foothills peak about an hour later at Alpine due to the additional distance the air travels. The transported ozone and precursors add to the already high ozone in the foothills, further compressed within lower mixing heights to reach exceedance levels at Alpine. Then in the evening as the land cools, the pollution is blown westward back towards the sea with additional NOx in the valley to titrate ozone to lower concentrations in El Cajon, while a smaller secondary peak occurs in the early morning hours as the residual peak ozone pollution passes back through Alpine and the foothills.

Figure M-7
Average One-Hour Ozone During 0.070 ppm Eight-Hour Ozone Exceedance Days at Alpine in 2018-2019



As a case study, in Figure M-8, backwards trajectories ending at 01:00 UTC on September 15, 2014 (6 pm local time on September 14) for 100 m, 500 m, and 1000 m above ground for the Escondido site displays air transport from along the coast of the South Coast Air Basin. During this 24-hour period tracked over September 13-14, local time, the red 100 m trajectory originates from the coastal surface, bringing in fresh pollution from the coastal cities of Oceanside and Carlsbad. Aloft, and following the blue 500 m trajectory, air was transported from western Los Angeles area, southeastward along the coastline. This air appears to stagnate off the San Diego County coast, intermingling with the surrounding air mass before being pulled onshore towards Escondido during the afternoon. Further aloft, the green 1000 m trajectory suggests that air over the County moved southward mixing with pollution from Tijuana, Mexico before moving back northward along the coast toward Escondido. These air masses mixed with local sources as the surface boundary layer expanded from ample surface heating, generating a maximum hourly ozone reading of 0.099 ppm at 5 pm local time on September 14, 2014, contributing to the daily maximum eight-hour average exceedance of 0.076 ppm.

Figure M-8
HYSPLIT Back Trajectories for Escondido - 9/14/2014 Exceedance



Alternatively, when areas of high pressure build over inland areas and areas of lower pressure persist over the ocean, offshore winds can develop from the South Coast Air Basin and draw emissions from areas upwind into San Diego County. When this occurs, conditions are typically breezy further west off the coast with relatively stagnant conditions along the coast or inland in the County which can cause ozone exceedances. Localized near-surface wind eddies frequently occur along the coastline during these conditions which may also transport pollution from neighboring Tijuana, Mexico.

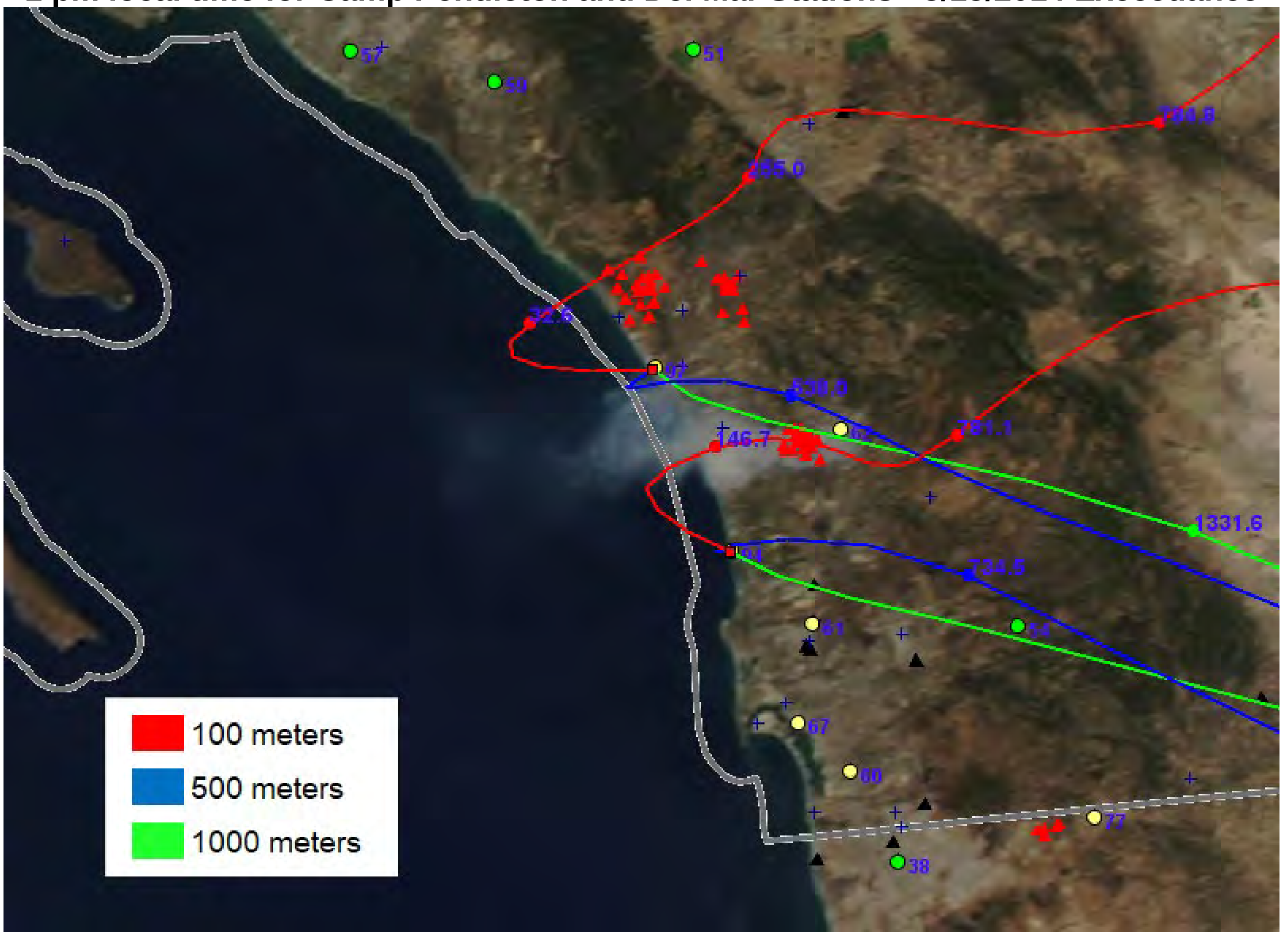
Prior studies have also found ozone and ozone precursor transport from outside the SDAB can significantly influence ozone levels within the air basin under many meteorological situations. The South Coast Air Basin can significantly impact ozone levels in the San Diego Air Basin through transport (CARB, 1989; CARB, 1996; CARB, 2001). Emissions from the greater Los Angeles area have been found to transport aloft into San Diego County then mix down to the surface (Bigler-Engler and Brown, 1995), or flow over the coastal waters and move into coastal areas with the daytime sea breeze (Kauper and Niemann, 1977). Additionally, due to the close proximity of Tijuana to San Diego, there is frequent transport of pollution to and from Mexico depending on local wind patterns within a shared air basin (Rivera et al., 2015).

Certain meteorological conditions promote wildfire outbreaks in the region which may also impact ozone levels. In the fall through spring, a system of high pressure can form northeast of San Diego County, over the Great Basin. During these months, temperatures throughout Southern California are typically warmer than those in the Great Basin. At times, air flowing clockwise around the Great Basin high pressure will be pushed westward through mountain passes into Southern California. The flow of air accelerates as it moves through mountain passes causing the air to warm and relative humidity to significantly decrease. The resultant strong, warm, and dry easterly downslope flow is termed a Santa Ana wind (See Figure M-9). Santa Ana winds, although only typically lasting for a few days at a time, significantly increase the risk of wildfire in San Diego County and other areas of Southern California. Wildfires, like other combustion sources, produce ozone precursors and can contribute to elevated ozone in adjacent and downwind areas. Offshore winds can also carry emissions from regional wildfires offshore, where they may accumulate. When onshore flow over San Diego County occurs, these accumulated wildfire emissions can be pushed into the County and aggravate ozone concentrations.

For instance, beginning on May 13, 2014 a multi-day Santa Ana wind event occurred across northern San Diego County with widespread hot and dry conditions initiating multiple fires across the area. The smoke from these fires initially blew out toward the Pacific Ocean. Figure M-10 shows the fires continued to develop and spread, then during early May 15th the surface winds shifted westerly, allowing smoke to move eastward through the County, while likely mixing with regional emissions and escalating hourly ozone levels up to 0.100 ppm at 2 pm local time in Del Mar on May 15, 2014. This contributed to the daily maximum eight-hour average exceedance of 0.087 ppm registered at both Del Mar and Camp Pendleton.

Figure M-9
Generalized Santa Ana Wind Surface Pressure Pattern

Figure M-10
MODIS Aqua Satellite Image with HYSPLIT Back Trajectories from 1 pm local time for Camp Pendleton and Del Mar Stations - 5/15/2014 Exceedance



M.7 Exceedance Trends and Meteorological Analysis

In 2019, San Diego Air Basin recorded 19 exceedance days based on the 0.070 ppm eight-hour ozone standard. Table M-6 shows the number of basin-wide exceedance days between 2000 and 2019 and ranks each year by color. Preliminarily, 2019 had the fewest exceedance days since before 2000. This is after a large spike of exceedance days in 2017, with 54 days recorded being atypical of the general declining trend.

Table M-6
Ranked Exceedance Days by Year

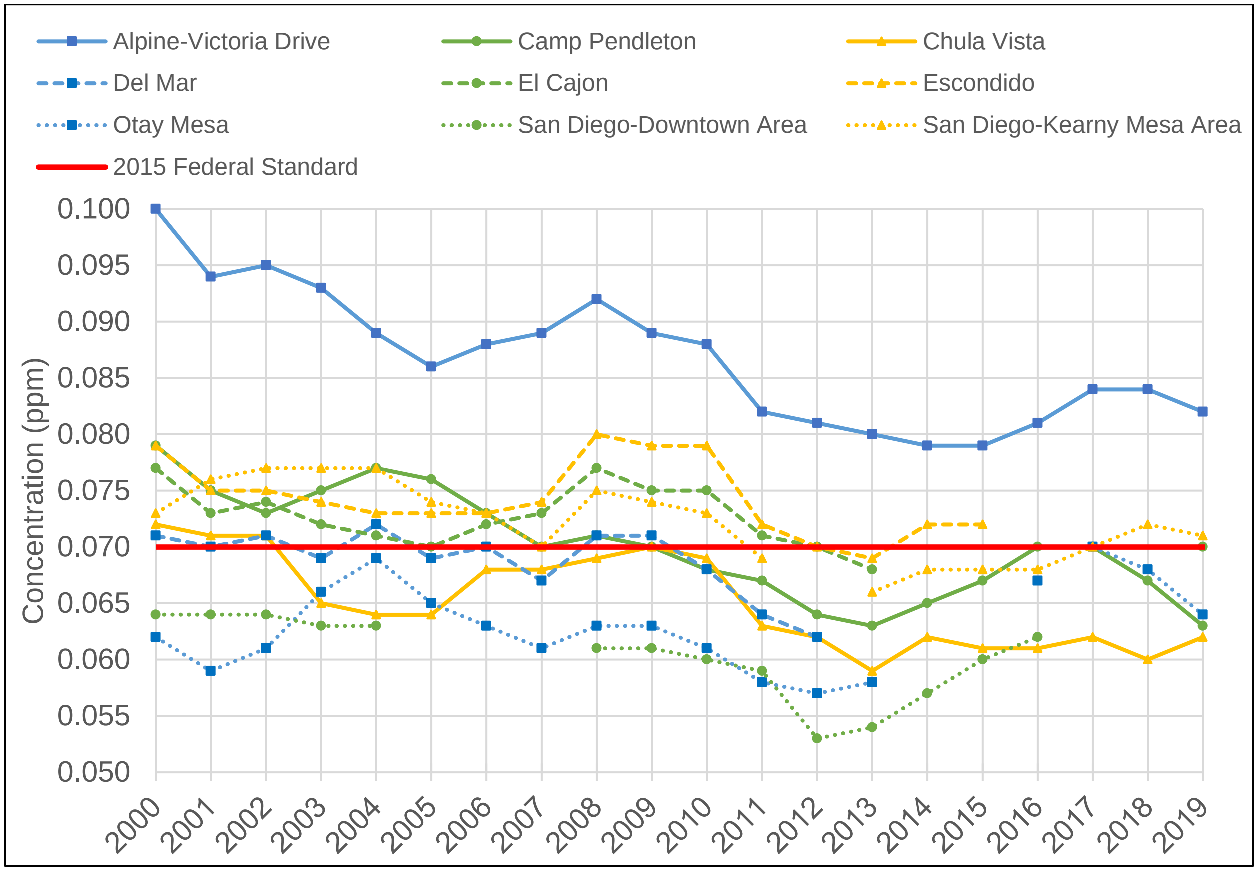
2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
72	59	54	57	41	45	68	48	65	43

2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
20	31	24	25	33	34	34	54	23	19

Rank color coded as: Max (72) Min (19)

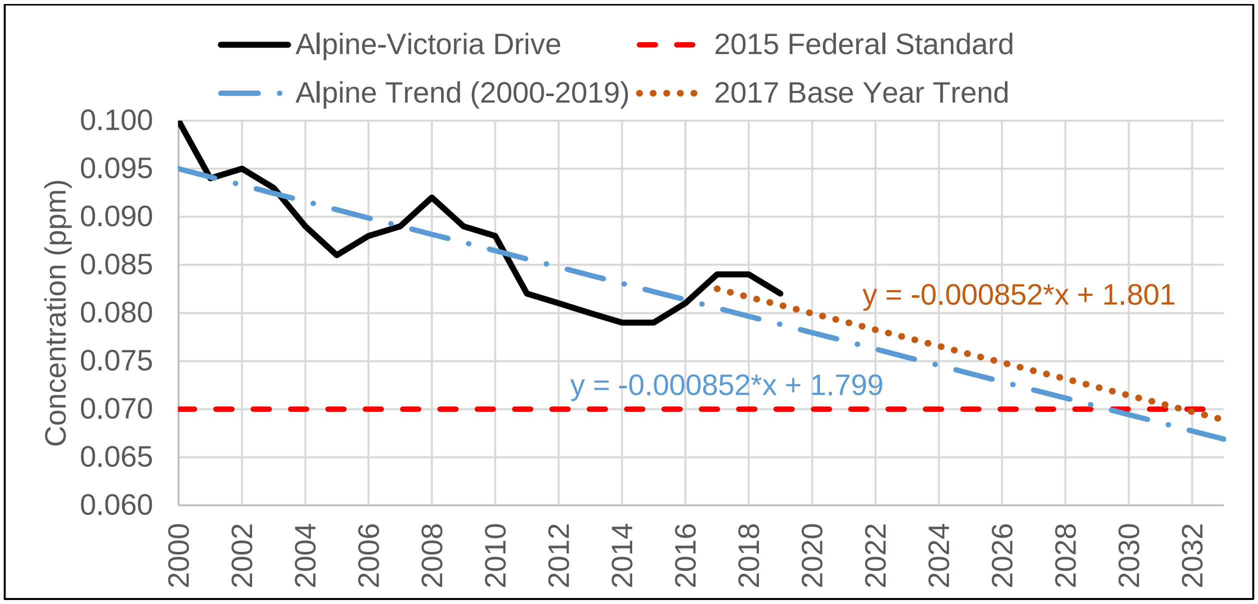
Ozone design values displayed in Figure M-11 show that the Alpine site is the only site significantly above the federal 0.075 ppm standard. All currently active sites except for the Alpine site and San Diego-Kearny Mesa Area (Kearny Villa Road site) meet the new 2015 federal ozone standard of 0.070 ppm. The recent increasing trend at the Alpine site is not unique among San Diego County sites and is similar to past cyclical fluctuations due to meteorology and other non-anthropogenic influences (most recently 2005-2008). While the long-term trend continues to decrease, the short-term increase after 2015 presents continuing significant challenges to near-term attainment of the 0.075 ppm and the 0.070 ppm standards.

Figure M-11
Ozone Design Values in San Diego County, 2000-2019



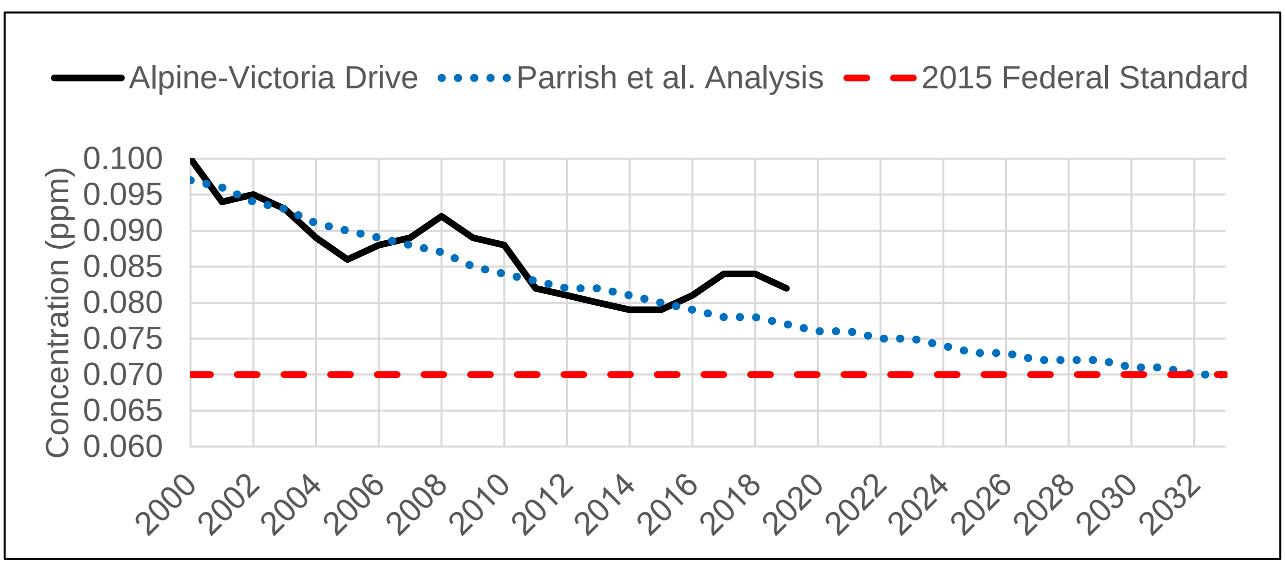
A trend line can be calculated through regression to determine when attainment might be expected, given a continuation of the recent rate of progress. The coefficient of determination (R^2) can be evaluated to statistically measure how well the equation matches the data and can predict future values. Based on design values for the Alpine site between the years 2000 to 2019, the Alpine trend line in Figure M-12 was calculated and found to have an R^2 value of 0.72 (ranging from 0 to 1), which is relatively high and suggests good fit. An additional estimate was calculated by adjusting the existing trend upward to the modelling base year design value for 2017, which is the average of the 2017-2019 design values based on 2015-2019 data. This 2017 base year trend line indicates an attainment year of 2032. Both analyses indicate that attainment of the 0.070 ppm standard can be expected by the 2032 deadline.

Figure M-12
Ozone Design Values at Alpine-Victoria Drive with Trend Lines



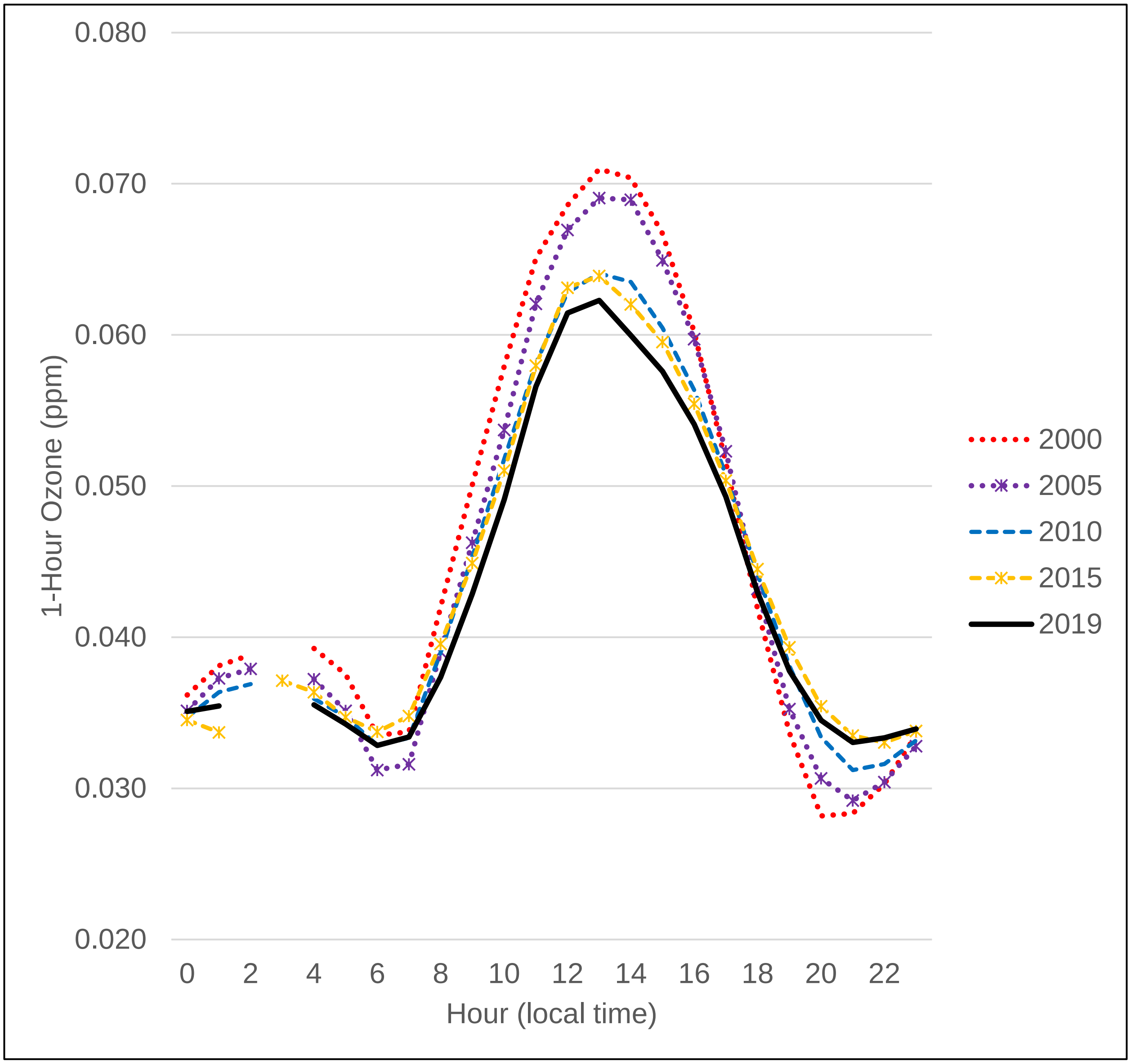
Research by Parrish et al. (2017) was conducted to project ozone design values in Southern California's Air Basins, including San Diego Air Basin. In their analysis, past efforts to reduce emissions across Southern California had "yielded approximately exponential decreases". The team derived equations through multivariate least squares analysis to project future design values, presuming that the "U.S. background ozone design value remains constant, and local emission control strategies can continue the exponential decreases of the anthropogenic ozone enhancements into the future." Based on their analysis, an approximate U.S. background ozone design value (estimated minimum ozone design value if all U.S. sourced anthropogenic ozone was removed) of 0.0620 ppm was calculated for the air basin and projected that SDAB would meet attainment of the 0.070 ppm standard in approximately 2032, as shown in Figure M-13.

Figure M-13
Ozone Design Values at Alpine-Victoria Drive with Parrish et al. Analysis



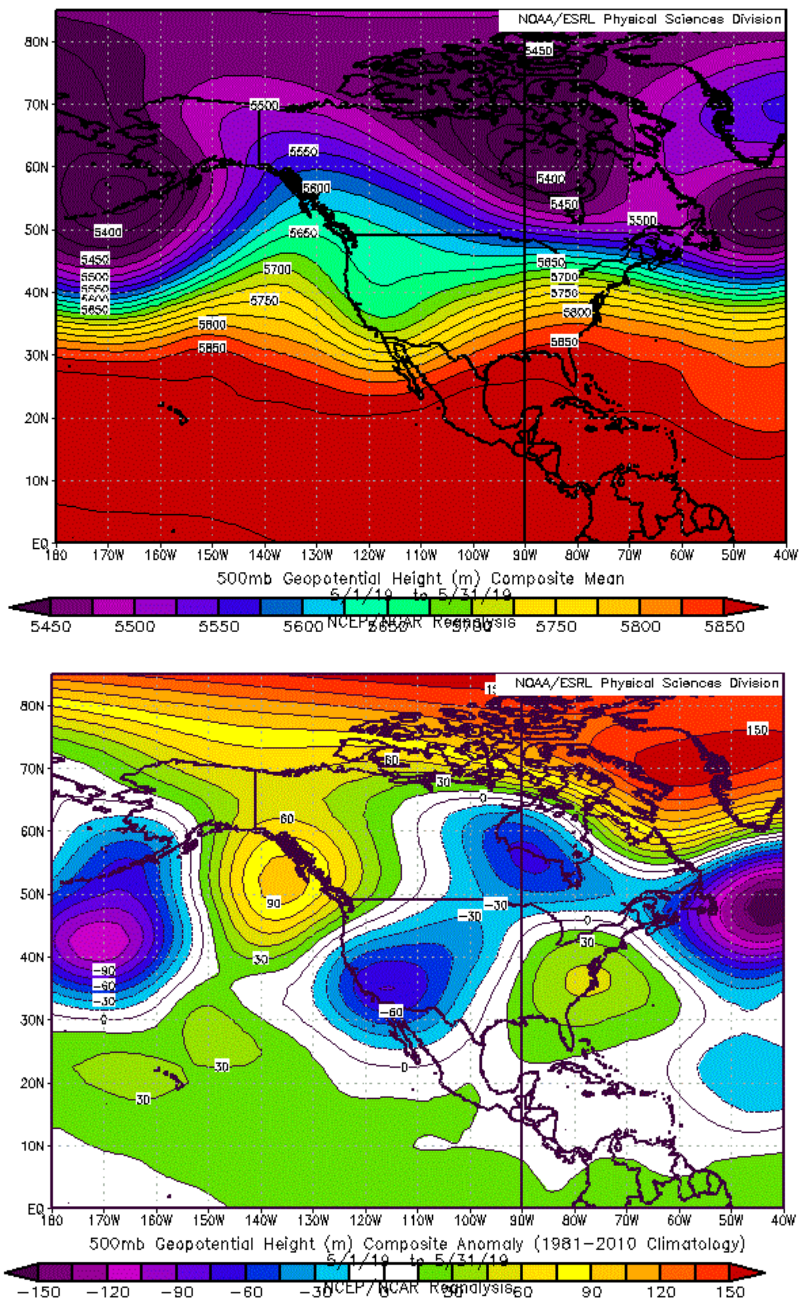
The diurnal pattern at the Alpine site as shown in Figure M-14 illustrates that the averaged one-hour ozone concentration continues to peak in the early afternoon (13-14 hour). The maximum one-hour average has decreased from 2000 to 2019 by 0.0087 ppm, or by about 0.00046 ppm per year. An early morning secondary maximum peak occurs around 3 am local time with minimal change in concentrations, but is limited in data quantity due to equipment auto-calibration occurring around this time. The evening ozone minimum around 20 hour indicates an inverse response, suggesting that reductions in NOx titration has kept ozone higher in the late evening during 2000-2019 with minimal change after 2010.

Figure M-14
Diurnal One-Hour Ozone Averages for April-September at Alpine-Victoria Drive



Synoptic weather patterns, large weather features typically on the scale of hundreds of kilometers, have a significant impact on ozone events. In the San Diego Air Basin, the majority of high ozone days occur with sunny skies, high pressure aloft, and warm surface conditions across the inland foothills. In analyzing monthly averaged 500 millibar (mb) level charts, examples shown in Figure M-15, for climatological geopotential height anomalies (deviations from the long-term average of the 500 mb altitude above mean sea level) and generalized flow patterns, months can be found that are likely to have above average counts of ozone exceedance days.

Figure M-15
Example Monthly Averaged 500 mb Synoptic Charts



Higher height anomalies tend to indicate more/stronger high pressure influence and possible stagnation across a region. In contrast, lower height anomalies suggest more active low pressure system influence in the region, which better mixes the air and clears surface pollution. These synoptic flow patterns can generally indicate where highs/lows aloft will tend to track, but there can be some exceptions. In general:

- High pressure ridges (Ridge) typically will lead to clearer skies with air sinking towards the ground - promoting surface stagnation and lower mixing levels, allowing pollution to build.
- Zonal flow (Zonal) allows pressure systems to track from west to east with systems typically less intense along the surface and can sometimes allow for periods with days of surface stagnation.
- Low pressure troughs (Trough) typically lead to active mixing and clearing of surface pollution, often resulting in below average number of exceedances for that month.

In addition to flow patterns, the magnitude of 500 mb geopotential height anomalies also add insight. High positive anomalies are correlated to surface conditions that are more conducive to producing high ozone levels, especially during periods with ridge flow. This correlation explains most but not all high ozone days and can only be used to indicate an increased probability of being above the monthly average. Conversely, negative anomalies correlate well with surface conditions and trough flow patterns that tend to produce fewer than average number of exceedances. Months with neutral 500 mb height anomalies, defined as between -20 to +20 meter monthly averages, typically experience near-average monthly number of exceedances.

Table M-7 compares the 2014 to 2019 county-wide exceedance days for the 0.070 ppm standard to the 2012-2016 average exceedance days; the 500 mb geopotential height anomaly; and dominant flow pattern for months that are prone to eight-hour ozone exceedances. In 2019, there were more months than typical with trough flow patterns which typically supports clearing out surface ozone and precursors relatively frequently while minimizing prolonged stagnant conditions for ozone buildup. Most months maintained a neutral to slightly positive 500 mb height anomaly. The height anomalies remained below 40 meters, suggesting periods of high pressure to be relatively moderate and shorter duration allowing for generally lesser periods of ozone buildup.

The year 2019 had two months (February and May) with trough patterns coinciding with strong negative 500 mb height anomalies (<-30 meters), which supported zero exceedances during these months. There were only two months in 2019 that experienced ridge patterns (July and August) which contributed to these months having the most exceedances during 2019. While July had a neutral 500 mb height anomaly, which typically suggests a near-average number of exceedances would be expected, there were double the average number of exceedances. These exceedances are attributed to short periods of high pressure influence spanning only a few days at a time contributing to the buildup of ozone and precursors, with the longest duration of buildup leading to 3 exceedances in a span of 4 days (July 12-15). During the first two-thirds of July, occasional fronts and shortwave impulses at the 500 mb level often moved through the region, providing ventilation and reducing ozone buildup at the surface. Beginning July 20, weak but persistent peripheral 500 mb high pressure influence provides for ozone favorable conditions to build max eight-hour average concentrations to greater than 0.060 ppm on July 22 and maintain high levels through the end of the month as three additional exceedances occurred.

The year 2018 had one month (July) with a ridge pattern coinciding with a positive 500 mb height anomaly (>30 meters), which supported more than double the average number of exceedances for the month. While conditions were sometimes favorable for ozone concentrations to build to exceedances, weather patterns did not allow for prolonged, sustained ozone buildups that frequently occurred in 2017. As a comparison, in June 2017 a stronger high pressure event occurred starting June 14th and persisted until June 30th. This pattern promoted light winds near the surface and mixing heights of less than 3000 feet. During this timeframe ten exceedance days were registered – 19 percent of 2017's total exceedances. In 2018, the longest duration of ozone buildup occurred July 24-27. Strong 500 mb high pressure built westward across the region supporting clear, stagnant conditions leading to four exceedances which was the most generated by any prolonged weather event during 2018. However, the strongest stagnant conditions did not persist for as long as in summer 2017, with weather allowing for air in the basin to ventilate and lessening ozone and precursor concentration buildup.

The year 2019 had the fewest number of exceedance days since before 2000. When comparing the frequency of exceedance days to previous years as well as synoptic meteorological conditions, the year 2019 had weather patterns supporting less ozone exceedance potential than in years 2014-2018. The year 2018 had weather patterns similar to years 2014-2016, while significantly, 2018 had fewer annual exceedances than occurred on average in 2014-2016.

Unlike 2018, the year 2017 featured a greater than average frequency of synoptic conditions supportive of high ozone conducive weather patterns. Weather patterns will contribute to inter-annual variability from year to year; so, it is important to always look at longer term trends. Overall, this analysis indicates that even under adverse meteorological conditions the general air quality trend continues to improve in San Diego County.

Table M-7
Eight-Hour Ozone Exceedance Days (0.070 ppm Standard)
Compared to Monthly Averaged 500 mb Charts

2014	Exceedances	Avg # of Exceedances (2012-2016)	Flow Pattern	Height Anomaly
Feb	0	1.2	Zonal	30~40 m
Mar	0	0.6	Zonal	30~40 m
Apr	3	4.0	Zonal	20~30 m
May	6	3.4	Trough	Neutral
Jun	2	4.6	Zonal	20~30 m
Jul	4	3.0	Ridge	Neutral
Aug	4	5.8	Trough	Neutral
Sep	5	4.0	Trough	Neutral
Oct	8	3.2	Ridge	40~50 m
	32	29.8		
2015				
Feb	1	1.2	Ridge	70~100 m
Mar	1	0.6	Trough	40~60 m
Apr	8	4.0	Trough	Neutral
May	2	3.4	Trough	-50~-40 m
Jun	7	4.6	Ridge	20~40 m
Jul	0	3.0	Trough	-30~20 m
Aug	6	5.8	Ridge	Neutral
Sep	7	4.0	Zonal	20~30 m
Oct	2	3.2	Trough	Neutral
	34	29.8		
2016				
Feb	5	1.2	Ridge	>80 m
Mar	1	0.6	Zonal	30~40 m
Apr	3	4.0	Trough	Neutral
May	0	3.4	Trough	-30~-40 m
Jun	9	4.6	Ridge	50~60 m
Jul	7	3.0	Trough	20~30 m
Aug	6	5.8	Trough	Neutral
Sep	1	4.0	Trough	Neutral
Oct	2	3.2	Zonal	40~50 m
	34	29.8		

Key:

Exceedances	Highlighted are <= half 2012-2016 avg days or 0
	Highlighted are >= double 2012-2016 avg days
Flow Pattern	Trough influenced
	Ridge influenced
Height Anomaly	< -30 meters
	> 30 meters

2017	Exceedances	Avg # of Exceedances (2012-2016)	Flow Pattern	Height Anomaly
Feb	0	1.2	Zonal	20~30 m
Mar	2	0.6	Zonal	70~80 m
Apr	8	4.0	Zonal	50~60 m
May	8	3.4	Trough	Neutral
Jun	12	4.6	Ridge	40~50 m
Jul	6	3.0	Ridge	20~30 m
Aug	8	5.8	Zonal	Neutral
Sep	3	4.0	Trough	Neutral
Oct	7	3.2	Zonal	50~60 m
	54	29.8		

2018				
Feb	2	1.2	Trough	Neutral
Mar	0	0.6	Zonal	Neutral
Apr	0	4.0	Zonal	30~40 m
May	2	3.4	Trough	Neutral
Jun	6	4.6	Trough	25~30 m
Jul	7	3.0	Ridge	30~40 m
Aug	2	5.8	Ridge	20~30 m
Sep	2	4.0	Zonal	20~40 m
Oct	2	3.2	Trough	Neutral
	23	29.8		

2019				
Feb	0	1.2	Trough	-70~-60 m
Mar	1	0.6	Zonal	Neutral
Apr	2	4.0	Trough	20~30 m
May	0	3.4	Trough	-75~-60 m
Jun	2	4.6	Trough	Neutral
Jul	6	3.0	Ridge	Neutral
Aug	4	5.8	Ridge	20~40 m
Sep	1	4.0	Trough	Neutral
Oct	3	3.2	Trough	20~30 m
	19	29.8		

Key:

Exceedances	Highlighted are <= half 2012-2016 avg days or 0
	Highlighted are >= double 2012-2016 avg days
Flow Pattern	Trough influenced
	Ridge influenced
Height Anomaly	< -30 meters
	> 30 meters

M.8 Conclusion

Reductions in ozone precursor emissions as discussed within the Trends of Ambient Ozone Precursor section (M.5), as well as reduced levels of ozone and ozone precursors upwind estimated in the Anthropogenic Emissions section (M.4), have led to lower ozone design values and fewer exceedance days since 2000. Ozone design values since year 2000, as shown in the Exceedance Trends and Meteorological Analysis section (M.7), indicate a generally decreasing design value trend with cyclical fluctuations due to meteorology and other non-anthropogenic influences in Figure M-11. Linear regression on design values for the Alpine-Victoria Drive monitoring site (Figure M-12) calculates attainment to occur by 2032. This analysis is further supported by independent research by Parrish et al. (2017) which also found attainment at the Alpine-Victoria Drive site to occur around year 2032 (Figure M-13). Diurnal one-hour ozone value averages during the ozone season (Figure M-14) indicate that the average ozone values at Alpine during peak hours have generally decreased since year 2000, but appear to have slowed in their rate of reduction during the past decade. Analysis of emissions inventory data indicates that the air basin is likely becoming increasingly NOx-limited due to the recent focus on NOx control strategies.

Alongside the generally declining trend in ozone concentrations, meteorology has a significant impact on ozone events. Emissions from within San Diego County and occasional transport from the South Coast Air Basin and Mexico can contribute to elevated ozone within the air basin. The Conceptual Model section (M.6) specifies several meteorological patterns that tend to promote ozone and precursor transport and ozone generation within the San Diego County. Most exceedances occur with strong high pressure influence aloft and hot, stagnant surface conditions over the air basin for a few days, trapping ozone and precursor concentrations allowing them to build up. Exceedances can occur over multiple days until the weather pattern changes allowing for ventilation and/or reduced ozone production in the air basin.

Through retrospective synoptic analysis, monthly ozone exceedances have been found to be strongly influenced by synoptic weather patterns impacting San Diego County between the months of February to October. Through analysis discussed for Table M-7, synoptic conditions were determined to be more supportive of 0.070 ppm ozone standard exceedances in 2017, which had the most exceedances since 2008, but was only tied for 6th most since the year 2000. Conversely, in the year 2019 the synoptic weather supported less ozone exceedance potential than in years 2014-2018, and had the fewest exceedances since at least 2000. This supports the expectation that ozone will continue to trend downward as the meteorological “high ozone” years are not experiencing as many exceedances as much of the early 2000s, and the meteorological “low ozone” years are also trending toward fewer exceedances.

Necessary improvements in reducing ozone concentrations to meet national ozone standards will require implementation of already programmed precursor emission reductions, both in San Diego County and throughout the region. Given the number of exceedance days in the last six years, it is evident that San Diego County will not attain the 0.075 ppm ozone standard before the Serious attainment deadline of 2020. However, air quality analyses indicate that San Diego County should be able to meet the 0.075 ppm standard by 2026, and the 0.070 ppm standard by 2032 (the attainment year deadlines for Severe nonattainment areas).

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ATTACHMENT N
VMT OFFSET DEMONSTRATION FOR SAN DIEGO COUNTY

Prepared by
California Air Resources Board
San Diego County Air Pollution Control District

March 2020

N.1 Introduction

The California Air Resource Board (CARB) has prepared this vehicle-miles traveled (VMT) emissions-offset demonstration for the 8-hour ozone National Ambient Air Quality Standards (NAAQS) as required by Section 182(d)(1)(A) of the federal Clean Air Act (CAA), which applies to areas classified as severe or extreme nonattainment of the NAAQS. This document is in accordance with the U.S. Environmental Protection Agency's (U.S. EPA) August 2012 guidance entitled *Implementing Clean Air 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.*[185]

This demonstration shows that the *8-Hour Ozone Plan* prepared by the San Diego Air Pollution Control District (District) comply with CAA §182(d)(1)(A). It also shows that emissions of volatile organic compounds (VOC) with controls and VMT growth are less than they were in the plan base year. Thus this demonstrates that the identified transportation control strategies and measures are sufficient to offset the growth in emissions.

N.2 2008 and 2015 Ozone Standards

In 2008, U.S. EPA revised the 8-hour ozone NAAQS to a level of 0.075 parts per million (73 FR 16436, March 27, 2008). The San Diego Air Basin (Air Basin) was classified as a Moderate nonattainment area. Later, on August 23, 2019 (Effective date September 23, 2019), U.S.EPA reclassified the Air Basin from a Moderate to a Serious nonattainment area because the region did not meet the NAAQS by the July 20, 2018 attainment deadline for Moderate nonattainment areas. The District is voluntarily requesting a reclassification to Severe nonattainment, or a "bump-up" because it foresees that the region will not meet the NAAQS by the July 20, 2021 attainment deadline for Serious nonattainment areas. Thus, the San Diego Air Basin is subject to the requirements of CAA Section 182(d)(1)(A) for the 2008 75 ppb ozone NAAQS.

In 2015, U.S. EPA revised the 8-hour ozone NAAQS to a level of 0.070 parts per million (80 FR 65292). The San Diego Air Basin was classified as a Moderate nonattainment area. The District is voluntarily requesting a bump-up to Severe nonattainment because, again, it foresees that the region will not attain the Moderate or Serious classifications by 2023 or 2026, respectively. Therefore, the District has determined to pursue one joint State Implementation Plan (SIP) at the Severe classification. Therefore, the San Diego Air Basin is subject to the requirements of CAA Section 182(d)(1)(A) for the 2015 70 ppb ozone NAAQS.

N.3 U.S. EPA Guidance on VMT Offset Requirement

In their 2012 guidance, U.S.EPA indicated that technology improvements such as vehicle technology improvements, motor vehicle fuels, and other control strategies that are transportation related could be used to offset emissions increases from VMT. The guidance also set forth a methodology for demonstrating achievement of the VMT offset requirement. The projected attainment year emissions, assuming no new control measures and no VMT growth, are to be compared with projected actual attainment year emissions that include new control measures and VMT growth. If the latter number is smaller than the former, then no additional transportation control measures or transportation control strategies would be required.

The guidance recommends that the base year used in the VMT offset demonstration be the base year used in the attainment demonstration for the ozone NAAQS. The base year for the 2008 75 ppb ozone standard is 2011 and for the 2015 70 ppb ozone standard is 2017.

N.4 Transportation Control Strategies and Transportation Control Measures

By listing them separately, CAA §182(d)(1)(A) differentiates between transportation control strategies (TCSs) and transportation control measures (TCMs), both of which can be used as options to offset increased emissions from growth in VMT per the provisions of CAA §182(d)(1)(A) and U.S.EPA's 2012 guidance. Since 1990, when this requirement was established, California has adopted a substantial number of enforceable TCSs—more than enough to meet the requirement to offset increased emissions from VMT growth. Appendix A-1 is a list of the State's mobile source TCSs adopted since 1990 as adopted by CARB. Since 1990, the metropolitan planning organization (MPO) within the San Diego air district has included projects within its federal Transportation Improvement Program documentation to implement San Diego region-specific TCMs that provide emissions reductions. The list of these measures and projects are provided in Appendix A-2.

N.5 Methodology

The following calculations are based on U.S.EPA's 2012 guidance. This demonstration includes two sets of calculations. For the 75-ppb ozone NAAQS demonstration, 2011 serves as the base year and 2026 is the projected attainment year. For the 70-ppb ozone NAAQS, 2017 is the base year and 2032 is the attainment year.

This analysis uses California's motor vehicle emissions model, EMission FACtor (EMFAC)[186]. EMFAC2017 was approved for use in SIPs and transportation conformity by U.S. EPA on August 15, 2019[187]. The EMFAC model estimates the emissions from two combustion processes: running exhaust and start exhaust, and four evaporative processes: hot soak, running losses, diurnal, and resting losses. Emissions from running exhaust, start exhaust, hot soak, and running losses are a function of how much a vehicle is driven. Emissions from these processes are directly related to VMT, trips, and starts. These processes are included in the calculation of the emissions levels used in the VMT offset demonstration. Emissions from resting loss and diurnal loss processes are not related to VMT, trips or vehicle starts and are not included in the analysis because these emissions occur whether or not the vehicle makes a trip (i.e., a start). In addition, The Safer Affordable Fuel-Efficient (SAFE) Vehicles Rule Part One: One National Program impacts some of the underlying assumptions in the EMFAC2017 model. Hence the emissions output from the EMFAC2017 model were adjusted to account for the impacts of this rule[188].

EMFAC combines VMT and speed distributions from the San Diego Association of Governments' (SANDAG) *San Diego Forward: The 2019 Federal Regional Transportation Plan* starts data based on household travel surveys, and vehicle population data from the

California Department of Motor Vehicles with corresponding emission rates to calculate emissions.

N.5.1 Analysis using 2011 as the Base Year

Step 1. Provide the emissions levels for the 2011 base year.
Table N-1 shows the VOC emissions for the calendar year 2011 from the EMFAC2017 model.

Table N-1
Base Year (2011) VMT and Emissions

Description	VMT (miles/day)	VOC (tons/day)
2011 Vehicle Miles Traveled and On-Road Emissions	82,640,000	33

Step 2. Calculate three emissions levels in the 2026 attainment year.

(1) Calculate emissions levels with the motor vehicle control program frozen at 2011 levels and with projected VMT in the attainment year. This represents what the emissions in the attainment year would have been if TCSs and TCMs had not been implemented after 2011.

(2) Calculate emissions levels with the motor vehicle control program frozen at 2011 levels and assuming VMT do not increase from 2011 levels.

(3) Calculate an emissions level that represents emissions with full implementation of all TCSs and TCMs since 2011, which represents the projected future-year emissions inventory in the attainment year.

Calculation 1. Calculate the emissions in the attainment year assuming no new measures since the base year with growth in VMT.
To perform this calculation, CARB staff identified the on-road motor-vehicle control programs adopted since 2011 and adjusted the EMFAC2017 output to reflect the VOC emissions levels in 2026 without the benefits of the post-2011 control programs. The projected VOC emissions are 12 tons per day.

Calculation 2. Calculate the emissions with no growth in VMT.
EMFAC2017 allows the user to input different VMT values. As such, CARB ran EMFAC2017 for calendar year 2026 with the 2011 VMT level of 82,640,000 miles per day. The VOC emissions associated with the 2011 VMT level is 11 tons per day.

Calculation 3. Calculate emission reductions with full implementation of TCSs and TCMs.
CARB calculated the VOC emission levels for 2026 assuming the benefits of the post-2011 motor vehicle control program and the projected VMT levels in 2026 using EMFAC2017. The projected VOC emissions levels is 10 tons per day.

VOC emissions for the three sets of calculations described above are provided in Table N-2.

Table N-2
VOC Emissions Calculations for Attainment Year (2026)

Calculation Number	Description	VMT (miles/day)	VOC (tons/day)
1	Emissions with motor vehicle control program frozen at 2011 levels (VMT at 2026 projected levels)	87,279,127	12
2	Emissions with motor vehicle control program frozen at 2011 levels (VMT at 2011 levels)	82,640,000	11
3	Emissions with full motor vehicle control program in place (VMT at 2026 projected levels)	87,279,127	10

As provided in the 2012 U.S.EPA guidance, to determine compliance with CAA §182(d)(1)(A), the Calculation 3 emissions levels should be less than the Calculation 2 emissions levels:

VOC: 10 < 11 tons per day

N.5.2 Analysis using 2017 as the Base Year

As mentioned above, this analysis is for the federal 8-hour NAAQS (70 ppb ozone standard) and the attainment year is 2032.

Step 1. Provide the emissions levels for the 2017 base year.
Table N-3 shows the VOC emissions for calendar year 2017 from the EMFAC2017 model.

Table N-3
Base Year (2017) VMT and Emissions

Description	VMT (miles/day)	VOC (tons/day)
2017 Vehicle Miles Traveled and On-Road Emissions	83,216,584	18

Step 2. Calculate three emissions levels in the 2032 attainment year.

(1) Calculate emissions levels with the motor vehicle control program frozen at 2017 levels and with projected VMT in the attainment year. This represents what the emissions in the attainment year would have been if TCSs and TCMs had not been implemented after 2017.

(2) Calculate emissions levels with the motor vehicle control program frozen at 2017 levels and assuming VMT do not increase from 2017 levels.

(3) Calculate an emissions level that represents emissions with full implementation of all TCSs and TCMs since 2017.

Calculation 1. Calculate the emissions in the attainment year assuming no new measures since the base year with growth in VMT.
To perform this calculation, CARB staff identified the on-road motor vehicle control programs adopted since 2017 and adjusted the EMFAC2017 output to reflect the VOC emissions levels in 2032 without the benefits of the post-2017 control programs. The projected VOC emissions are 10 tons per day.

Calculation 2. Calculate the emissions with no growth in VMT.
EMFAC2017 allows the user to input different VMT values. CARB ran EMFAC2017 for calendar year 2032 with the 2017 VMT level of 83,216,584 miles per day. The VOC emissions associated with the 2017 VMT level are 9 tons per day.

Calculation 3. Calculate emissions reductions with full implementation of TCSs and TCMs.
CARB calculated the VOC emission levels for 2032 assuming the benefits of the post-2017 motor vehicle control program and the projected VMT levels in 2032 are calculated using EMFAC2017. The projected VOC emissions levels are 8 tons per day.

VOC emissions for the three sets of calculations described above are provided in Table N-4.

Table N-4
VOC Emissions Calculations for Attainment Year (2032)

Calculation Number	Description	VMT (miles/day)	VOC (tons/day)
1	Emissions with motor vehicle control program frozen at 2017 levels (VMT at 2032 projected levels)	91,751,136	10
2	Emissions with motor vehicle control program frozen at 2017 levels (VMT at 2017 levels)	83,216,584	9
3	Emissions with full motor vehicle control program in place (VMT at 2032 projected levels)	91,751,136	8

As provided in the 2012 U.S.EPA guidance, to determine compliance with CAA §182(d)(1)(A), Calculation 3 emissions levels should be less than the Calculation 2 emissions levels:

VOC: 8 < 9 tons per day

N.6 Summary

The previous sections provide an analysis to demonstrate compliance with CAA §182(d)(1)(A). To further illustrate the demonstration, Figures N-1 and N-2 graphically display the emissions benefits of the motor vehicle control programs in offsetting VOC emissions resulting from VMT increases in the San Diego Air Basin for the 2008 75 ppb ozone standard and the 2015 70 ppb ozone standard, respectively. The left-most bar (in purple) in each figure shows the emissions in the base year (2011 for 75 ppb, 2017 for the 70 ppb standard). The set of three bars on the right in each figure show the emission levels in the attainment year (2026 for the 75 ppb standard, 2032 for the 70 ppb standard).The bars on the right represent the emissions if no further motor vehicle controls after the base year and with projected VMT increases (red bar), the emissions if VMT does not increase from base-year levels and there are no TCSs or TCMs after the base year (green bar), and the emission levels with all the existing motor vehicle control programs in place with projected VMT increases (blue bar). Based on the 2012 U.S.EPA guidance, if the blue bar is lower than the green bar, then the identified TCSs and TCMs are sufficient to offset the growth in emissions.

Figure N-1
VOC Emissions (75 ppb) Using SANDAG's "San Diego Forward: The 2019 Federal Regional Transportation Plan" VMT

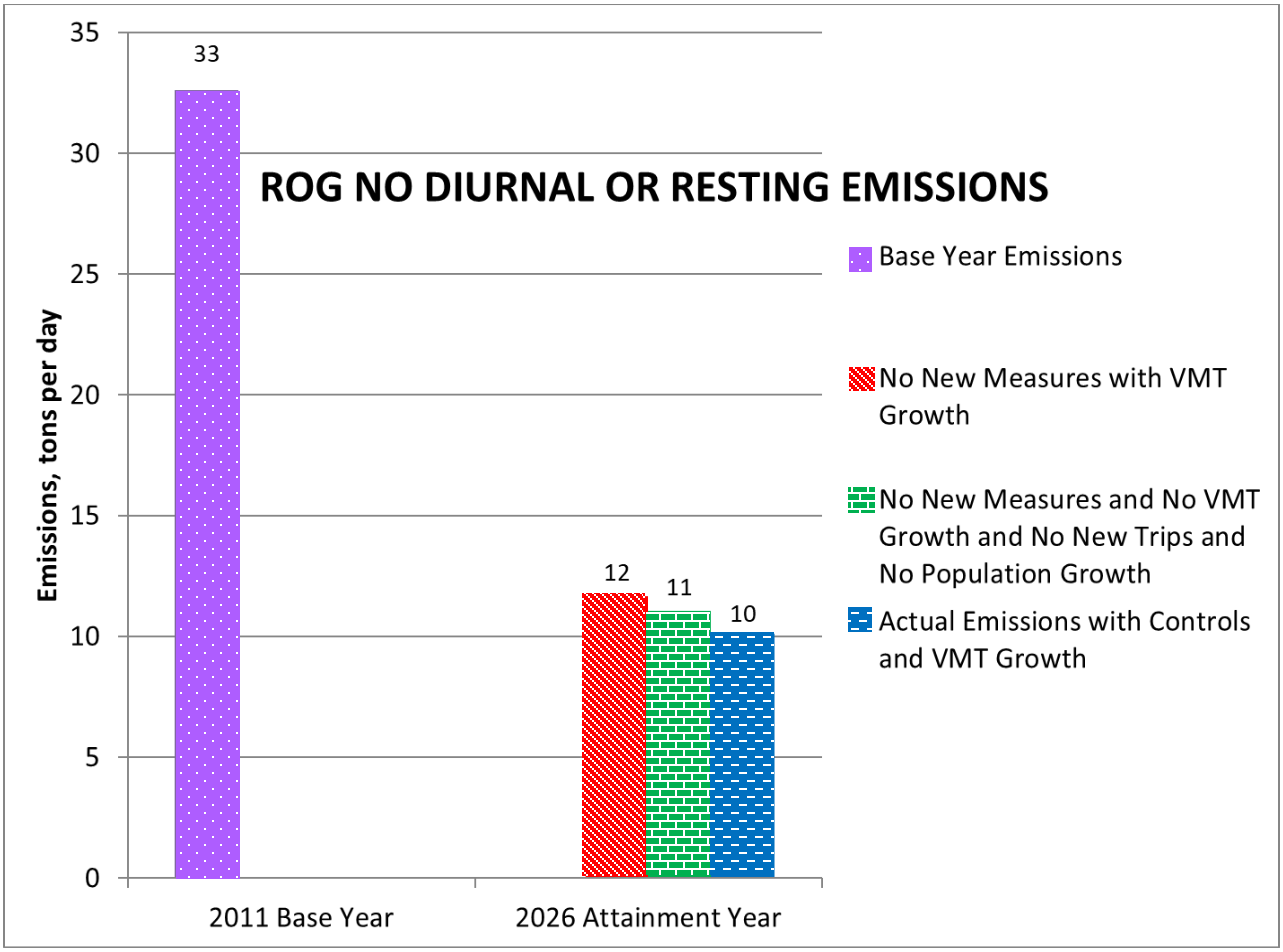
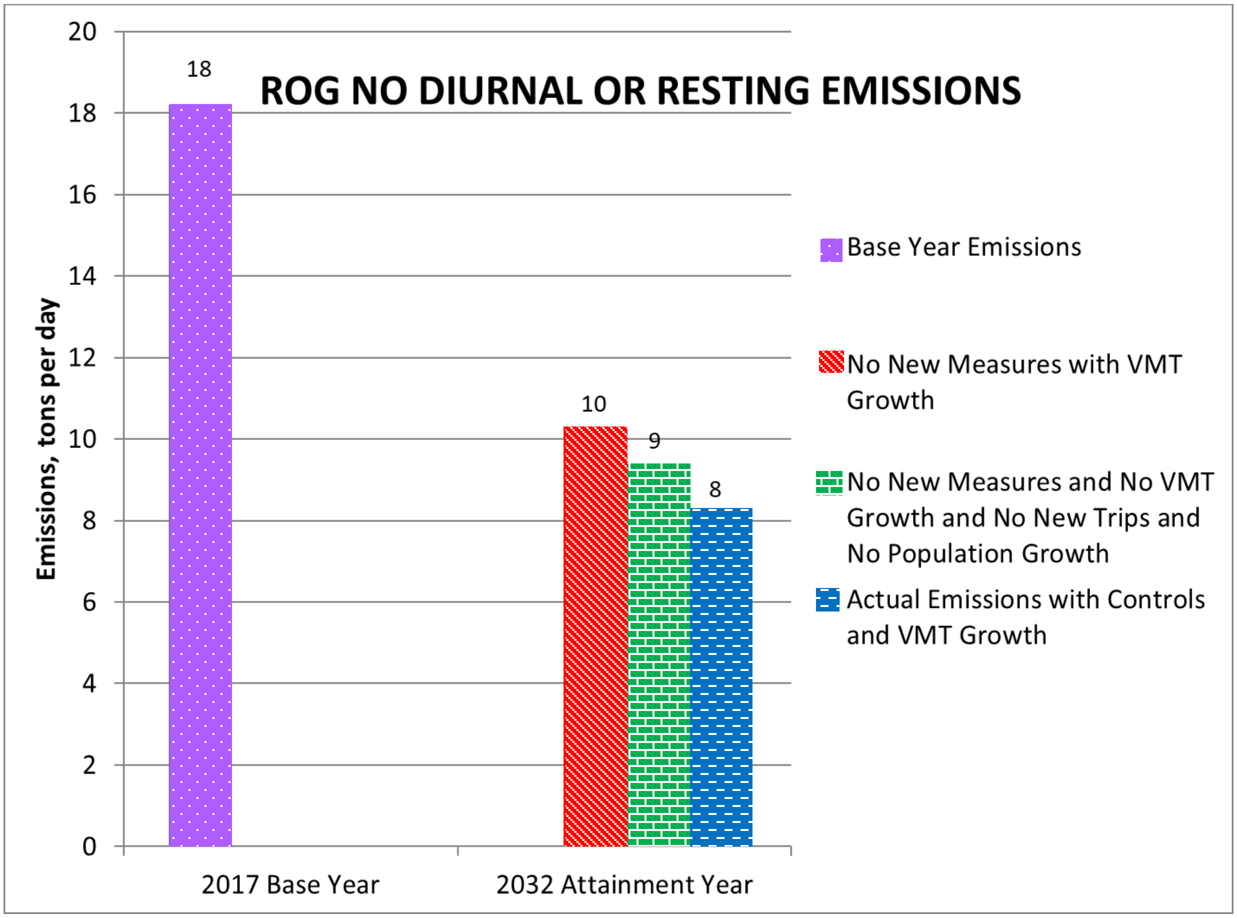


Figure N-2
VOC Emissions (70 ppb) Using SANDAG's "San Diego Forward: The 2019 Federal Regional Transportation Plan" VMT



Appendix A-1:
State of California Motor Vehicle Control Program (1990-Present)

Table N-5 Transportation Control Strategies Adopted by the California Air Resources Board since 1990		
Measure	**Hearing Date**	**Category**
California Reformulated Gasoline (CalRFG), Phase I. T 13, CCR, 2251.5	9/27/1990	Fuels
California Reformulated Gasoline, Phase II. T 13, CCR, 2250, 2255.1, 2252, 2260 - 2272, 2295	11/21/1991	Fuels
Wintertime Gasoline Program. T 13, CCR, 2258, 2298, 2251.5, 2296	11/21/1991	Fuels
Wintertime Oxygenate Program. T 13, CCR, 2258, 2251.5, 2263(b), 2267, 2298, 2259, 2283, 2293.5	9/9/1993	Fuels
Diesel Fuel Certification Test Methods. T 13, CCR, 1956.8(b), 1960.1(k), 2281(c), 2282(b), (c) and (g)	10/24/1996	Fuels
Diesel Fuel Test Methods. T 13, CCR, 1956.8(b), 1960.1(k), 2281(c), 2282(b), (c) and (g)	10/24/1996	Fuels
1997 Amendments to Onboard Diagnostics, Phase II, Technical Status. T 13, CCR, 1968.1, 2030, 2031	12/12/1996	On-Road
Low Emission Vehicles Standards (LEV 2) and Compliance Assurance Program (CAP 2000). T 13, CCR,1961 & 1962 (both new); 1900, 1960.1, 1965, 1968.1, 1976, 1978, 2037, 2038, 2062, 2101, 2106, 2107, 2110, 2112, 2114, 2119, 2130, 2137-2140, 2143-2148	11/5/1998	On-Road
Exhaust Standards for (On-Road) Motorcycles. T 13, CCR, 1900, 1958, 1965	12/10/1998	On-Road
Light-and Medium Duty Low Emission Vehicle Alignment with Federal Standards. Exhaust Emission Standards for Heavy Duty Gas Engines. T 13, CCR, 1956.8 &1961	12/7/2000	On-Road

Table N-5 Transportation Control Strategies Adopted by the California Air Resources Board since 1990		
Measure	**Hearing Date**	**Category**
Heavy Duty Diesel Engine Standards for 2007 and Later. T 13, CCR, 1956.8 and incorporated test procedures	10/25/2001	On-Road
Low Emission Vehicle Regulations. T 13, CCR, 1960.1,1960.5, 1961, 1962 and incorporate test procedures and guidelines	11/15/2001	On-Road
2003 Amendments to On-Board Diagnostic II Review Amendments. T 13, CCR, 1968.1, 1968.2, 1968.5	4/25/2002	On-Road
CaRFG Phase 3 Amendments. T 13, CCR, 2261, 2262, 2262.4, 2262.5, 2262.6, 2262.9, 2266.5, 2269, 2271, 2272, 2265, and 2296	7/25/2002	Fuels
Adoption of Minor Amendments to the Low-Emission Vehicle Regulations. T 13, CCR, 1961, 1965, 1978, and the incorporate test procedures	12/12/2002	On-Road
Incorporation of Federal Exhaust Emission Standards for 2008 and Later Model-Year Heavy Duty Gasoline Engines and the Adoption of Minor Amendments to the Low-Emission Vehicle Regulations. T 13, CCR, 1956.8 and documents incorporated by reference	12/12/2002	On-Road
CaRFG Phase 3 Amendments (specifications for De Minimis Levels of Oxygenates and MTBE Phase Out Issues). T 13, CCR, 2261, 2262.6, 2263, 2266.5, 2272, 2273, 2260, 2273.5	12/12/2002	Fuels
Specifications for Motor Vehicle Diesel Fuel. T 13 & T17, CCR, 1961, 2281, 2282, 2701, 2284, 2285, 93114, and incorporated test procedures	7/24/2003	Fuel
California Reformulated Gasoline, Phase 3. T 13, CCR, 2260, 2262, 2262.4, 2262.5, 2262.6, 2262.9, 2263, 2265 (and the incorporated “California Procedures”), and 2266.5	11/18/2004	Fuels

Table N-5
Transportation Control Strategies
Adopted by the California Air Resources Board since 1990

Measure	Hearing Date	Category
On-Board Diagnostic System Requirements for 2010 and Subsequent Model-Year Heavy-Duty Engines (HD OBD). T 13, CCR, 1971.1	7/21/2005	On-Road
Requirements to Reduce Idling Emissions from New and In-Use Trucks, Beginning in 2008. T 13, CCR, 1956.8, 2404, 2424, 2425, and 2485 and the incorporated document	10/20/2005	On-Road
Mobile Cargo Handling Equipment at Ports and Intermodal Rail Yard. T 13, CCR, 2479	12/8/2005	On-road and Off-road
Evaporative and Exhaust Emission Test Procedures. T 13, CCR, 1961, 1976, 1978	6/22/2006	On-road
Heavy-Duty In-Use Compliance Regulation. T 13, CCR, 1956.1, 1956.8, and documents incorporated by reference	9/28/2006	On-Road
2007 Amendments to On-Board Diagnostic II. T 13, CCR, 1968.2, 1968.5, 2035, 2037 and 2038	9/28/2006	On-Road
Phase 3 Reformulated Gasoline (Ethanol Permeation) T 13, CCR, 2260, 2261, 2262, 2263, 2264, 2265, 2266, 2270, 2271, and 2273	6/14/2007	Fuel
2007 Amendments to Heavy-Duty In-Use Compliance Regulation. T 13, CCR, 1956.1, 1956.8, and documents incorporated by reference	12/6/2007	On-Road
Port Truck Modernization T 13, CCR, 2027	12/6/2007	On-Road
Cleaner In-Use Heavy-Duty Trucks (Truck and Bus Reg) T 13, CCR, 2025	12/11/2008	On-Road
2010 Amendments to On-Board Diagnostic II. T 13, CCR, 1968.2, 1968.5, 2035, 2037 and 2038	5/28/2009	On-Road
Plug-In Hybrid Electric Vehicle Test Procedure Amendments. T 13, CCR, 2032, 1900, 1962, 1962.1	5/28/2009	On-Road

Table N-5 Transportation Control Strategies Adopted by the California Air Resources Board since 1990		
Measure	**Hearing Date**	**Category**
2010 Amendments to On-Board Diagnostic System Requirements for Heavy-Duty Engines (HD OBD). T 13, CCR, 1971.1 and 1971.5	5/28/2009	On-Road
Truck and Bus Regulation 2010. T13, CCR, 2025	12/16/2010	On-Road
2011 Amendments to Heavy-Duty In-Use Compliance Regulation. T 13, CCR, 1956.1, 1956.8, and documents incorporated by reference	6/23/2011	On-Road
Amendments to Mobile Cargo Handling Equipment at Ports and Intermodal Rail Yard. T 13, CCR, 2479	9/22/2011	On-Road
Advanced Clean Cars T 13, CCR, 1900, 1956, 1960, 1961, 1962, 1965, 1968, 1976, 1978, 2037, 2038, 2062, 2112, 2139, 2140, 2145, 2147, 2235, 2300, 2302, 2303, 2304, 2306, 2307, 2308, 2309, 2310, 2311, 2312, 2313, 2314, 2315, 2316, 2317, and 2318	1/26/2012	On-Road
Zero Emission Vehicle Standards for 2009 through 2017 models. T 13, CCR, 1962.1, 1962.3	1/26/2012	On-Road
2012 Amendments to On-Board Diagnostic II. T 13, CCR, 1968.2, 1968.5, 2035, 2037 and 2038	1/26/2012	On-Road
Emergency Regulatory Amendments to the Tractor-Trailer Greenhouse Gas Regulation T 17, CCR, 95307	2/29/2012	On-Road
2013 Amendments to On-Board Diagnostics (OBD I and II) Regulations T 13, CCR, 1968.2, 1971.1	8/23/2012	On-Road
2013 Amendments to Heavy Duty On Board Diagnostic Requirements	8/23/2012	On-Road

Table N-5 Transportation Control Strategies Adopted by the California Air Resources Board since 1990		
Measure	**Hearing Date**	**Category**
Low Emission Vehicle III Greenhouse Gas and Zero Emission Vehicle Regulation Amendments for Federal Compliance Option T 13, CCR, 1900, 1956.8, 1960.1, 1961, 1961.2, 1961.3, 1962.1, 1962.2, 1976	11/15/2012	On-Road
Heavy-Duty Greenhouse Gas Phase 1: On-Road Heavy Duty Greenhouse Gas Emissions Rule, Tractor-Trailer Rule, Commercial Motor Vehicle Idling Rule, Optional Emission Standards, Heavy-Duty Hybrid-Electric Vehicle Certification Procedure T 13, CCR, 1900, 1956.	12/12/2013	On-Road
Heavy-Duty Hybrid-Electric Vehicle Certification Procedure T 13, CCR, 1900, 1956.8, 2036, 2037, 2112, 2139, 2140, 2147, 2485, T 17, CCR, 95300, 95301, 95302, 95303, 95305, 95660, 95661, 95662, 95663, 95664	12/12/2013	On-Road
Amendments to Low Emission Vehicle III Criteria Pollutant Requirements for Light-and Medium-Duty Vehicles the Hybrid Electric Vehicle Test Procedures, and the Heavy-Duty Otto-Cycle and Heavy-Duty Diesel Test Procedures T 13, CCR, 1900, 1956.8, 1961.2, 1962.2, 1965, 1976, 1978	10/23/2014	On-Road
2014 Amendments to Zero Emission Vehicle Regulation T 13, CCR, 1962.1, 1962.2	10/23/2014/5/21/2015	On-Road
Amendments to the Heavy-Duty Vehicle Inspection Program and Periodic Smoke Inspection Program T13, CCR, 2180.1, 2181, 2182, 2183, 2185, 2186, 2187, 2190, 2191, 2192, 2193, 2194	5/28/2018	On-Road
Innovative Clean Transit Regulation T13, CCR, 2023, 2023.1, 2023.2, 2023.3, 2023.4, 2023.5, 2023.6, 2023.7, 2023.8.2023.9, 2023.10, 2023.11	12/14/2018	On-Road

Table N-5 Transportation Control Strategies Adopted by the California Air Resources Board since 1990		
Measure	**Hearing Date**	**Category**
Zero-Emission Airport Shuttle Regulation T17, CCR, 95690.1, 95690.2, 95690.3, 95690.4, 95690.5, 95690.6, 95690.7, 95690.8	6/27/2019	On-Road

Appendix A-2:
Adopted Transportation Control Measures

Table N-6 TCM REPORT - SANDAG 2018 RTIP					
LEAD AGENCY	**PROJECT ID**	**PROJECT TITLE**	**PROJECT DESCRIPTION / STATUS**	**Open to Traffic Date[1]**	**Expected Close Out Date[1]**
Caltrans	CAL09	Interstate 5 - HOV/Managed Lanes	Construct High Occupancy Vehicle (HOV)/Managed Lanes on I-5; construct Phase 1: Construct HOV from Lomas Santa Fe to Birmingham and replace San Elijo Bridge; Construct Phase 2: construct HOV lanes and soundwall on private property from Birmingham to Palomar Airport Rd; Construct Phase 3: Construct HOV lanes and soundwalls on private property from Palomar Airport Rd to SR-78.	Mar-20	
Caltrans	CAL09A	I-5 Lomas Santa Fe Interchange/HOV lanes	Construct interchange and High Occupancy Vehicle (HOV) lane.	Sep-09	
Caltrans	CAL09C	I-805 Direct Access Ramp and HOV at Carroll Canyon	Construct Direct Access Ramps (DARs) and HOV lanes to Carroll Canyon Road on I-805 and extend Carroll Canyon Road as a four-lane arterial from Scranton Road to Sorrento Valley Road.	Apr-14	

Table N-6 TCM REPORT - SANDAG 2018 RTIP					
LEAD AGENCY	**PROJECT ID**	**PROJECT TITLE**	**PROJECT DESCRIPTION / STATUS**	**Open to Traffic Date[1]**	**Expected Close Out Date[1]**
Caltrans	CAL18B	I-15 Managed Lanes- South Segment and Mira Mesa Transit Center	Construct managed lanes, south segment including Direct Access Ramps and BRT Station: construct auxiliary lane along northbound I-15 from Pomerado Rd. overcrossing to Carroll Canyon Rd. overcrossing, construct transit center at Miramar College near Hillery Dr.	Jun-11	
Caltrans	CAL67	State Route 94 Corridor Improvements	Engineering study for various corridor improvements to include Managed Lanes(ML)/Bus Rapid Transit(BRT) lanes and connectors between SR 94 and I-805; future phases are outside of RTIP cycle, but included in the long range Regional Plan.		Dec-25
Caltrans	CAL78B	I-805 HOV/Managed Lanes - North	Preliminary engineering for construction of managed lanes; design and construct Phase 1 - one High Occupancy Vehicle (HOV) lane in the median in each direction including the south facing Direct Access Ramps at Carroll Canyon Rd. Phase 1 Post Miles 23.7-27.6.	Sep-16	

Table N-6
TCM REPORT - SANDAG 2018 RTIP

LEAD AGENCY	PROJECT ID	PROJECT TITLE	PROJECT DESCRIPTION / STATUS	Open to Traffic Date[1]	Expected Close Out Date[1]
Caltrans	CAL78C	I-805 HOV/Managed Lanes - South	Environmental document for I-805 widening in San Diego, Chula Vista, and National City from Palomar Street to State Route 94; design and construct 2 High Occupancy Vehicle (HOV) lanes in the median of I-805 including a Direct Access Ramp (DAR) and a transit station at Palomar Street; design and construct one auxiliary lane on northbound I-805 from Grove Street to 16th Street in National City; design and construct one auxiliary lane on southbound I-805 from 20th Street to Plaza Boulevard in National City; design one HOV lane in each direction from Hilltop Drive to Landis Street and a direct HOV connector from I-805 to I-15.	Jan-17	
Caltrans	CAL277	I-15/SR 78 HOV Connectors	Preliminary engineering for northbound I-15 to westbound SR-78 and eastbound SR-78 to southbound I-15 HOV connectors and operational improvements.	Oct-27	
Caltrans	CAL277A	SR 78/I-5 HOV Connector	Environmental studies and preliminary engineering for high-occupancy vehicle/managed lanes direct connectors at SR 78 to I-5.		Jun-35

Table N-6 TCM REPORT - SANDAG 2018 RTIP					
LEAD AGENCY	**PROJECT ID**	**PROJECT TITLE**	**PROJECT DESCRIPTION / STATUS**	**Open to Traffic Date[1]**	**Expected Close Out Date[1]**
Caltrans	CAL278	SR78 HOV/Managed Lanes	Environmental studies and preliminary engineering for high-occupancy vehicle/managed lanes.		Dec-30
Caltrans	CAL330	SR-15 Commuter Bike Facility (part of Lump Sum V14)	Construct Class 1 bicycle facility.		Mar-21
Caltrans	CAL386	National City - SRTS Ped Enhancements (part of Lump Sum V14)	In the city of National City SRTS Ped Enhancements.		Dec-20
Caltrans	CAL410	Chula Vista - At 4 intersections (part of Lump Sum CAL105)	Install Ped Crossing and protected left-turn phase.		Dec-22
Caltrans	CAL411	Chula Vista - On Palomar St between Industrial Blvd to Broadway (part of Lump Sum CAL105)	Install Bike Lanes and Sidewalks.		Dec-22
Caltrans	CAL412	El Cajon - Washington Ave., Chase Ave., El Cajon Blvd., and Main St. (part of Lump Sum CAL105)	Installation of a traffic signal interconnect fiberoptic cable system to implement coordination timing and the installation of street lighting.		Dec-22
Caltrans	CAL413	La Mesa - Signalized intersections on various corridors (part of Lump Sum CAL105)	Upgrade fiber optic traffic signal interconnect system including installation of: cable, controllers, BBS, monitoring devices, and related communication equipment to improve safety and operations via optimized traffic signal timing and coordination.		Dec-23

Table N-6 TCM REPORT - SANDAG 2018 RTIP					
LEAD AGENCY	**PROJECT ID**	**PROJECT TITLE**	**PROJECT DESCRIPTION / STATUS**	**Open to Traffic Date[1]**	**Expected Close Out Date[1]**
Caltrans	CAL414	National City - Signalized intersections along various corridors within City limits (part of Lump Sum CAL105)	Upgrade fiber optic traffic signal communication system including installation of: conduit, cable, radios, controllers, and related communication equipment to improve safety and operations via optimized traffic signal timing and coordination.		Dec-22
Caltrans	CAL415	National City - Signalized Intersections on various corridors (part of Lump Sum CAL105)	Install LED luminaire safety lighting at signalized intersections and pedestrian level LED street lighting at midblock crosswalks with additional pedestrian safety enhancements at select midblock locations.		Dec-23
Caltrans	CAL416	National City - Various Intersections (part of Lump Sum CAL105)	Installing pedestrian crossings at signalized intersections and necessary related access and equipment improvements.		Dec-22
Caltrans	CAL418	San Diego County - Wintergardens Blvd. from Woodside Ave to Lemoncrest Dr in the unincorporated community of Lakeside in San Diego County. (part of Lump Sum CAL105)	Construct sidewalk, curb, gutter, curb ramps, driveways, bike lanes, stripes, pavement markings and a traffic signal modification on Wintergardens Blvd.		Dec-23
Caltrans	CAL420	Santee - Around Santana High School (part of Lump Sum CAL105)	Install streetlights.		Dec-23

Table N-6 TCM REPORT - SANDAG 2018 RTIP					
LEAD AGENCY	**PROJECT ID**	**PROJECT TITLE**	**PROJECT DESCRIPTION / STATUS**	**Open to Traffic Date[1]**	**Expected Close Out Date[1]**
Caltrans	CAL435	In San Diego County, on various routes at various locations. (part of Lump Sum CAL46I)	In San Diego County, on routes 5, 15, 75, and 163 at various locations. Construct and upgrade curb ramps, driveways and sidewalks to comply with ADA standards.		Dec-20
Caltrans	CAL444	Chula Vista - Various locations citywide. (part of Lump Sum CAL105)	Install pedestrian countdown signals.		Dec-20
Caltrans	CAL445	Chula Vista - Various locations west of I-805 and east of I-5 to City Limits and signals along Main St. (part of Lump Sum CAL105)	Retiming of traffic signals and installation of fiber optic/ethernet communication system.		Dec-20
Caltrans	CAL447	El Cajon - Washington Avenue between Third Street and Dehesa Road. (part of Lump Sum CAL105)	Reconfigure lane geometry from four travel lanes to three, add a two-way left-turn lane, bicycle lanes, and install roadway segment lighting.		Dec-20
Caltrans	CAL449	Encinitas - North Coast Highway 101 from Jasper Street to Phoebe Street. (part of Lump Sum CAL105)	North Coast Highway 101 from Jasper Street to Phoebe Street - Install a HAWK beacon.		Dec-20

Table N-6 TCM REPORT - SANDAG 2018 RTIP					
LEAD AGENCY	**PROJECT ID**	**PROJECT TITLE**	**PROJECT DESCRIPTION / STATUS**	**Open to Traffic Date[1]**	**Expected Close Out Date[1]**
Caltrans	CAL450	Encinitas - Corridors of 2nd St, Birmingham Dr, Coast Highway 101, El Camino Real, Encinitas Blvd, Garden View Rd, Leucadia Blvd, Mountain Vista Dr, Olivenhain Rd, Quail Garden Dr, Santa Fe Dr, Via Cantebria, Village Park Wy, and Vulcan Ave/San Elijo Ave. (part of Lump Sum CAL105)	Install LED luminaire safety lighting at signalized intersections and LED street lighting along project corridors.		Dec-20
Caltrans	CAL452	National City - Sweetwater Road from Plaza Bonita Road/Stockman to Plaza Bonita Centerway. (part of Lump Sum CAL105)	Install pinned raised median and street lighting.		Dec-20

Table N-6 TCM REPORT - SANDAG 2018 RTIP					
LEAD AGENCY	**PROJECT ID**	**PROJECT TITLE**	**PROJECT DESCRIPTION / STATUS**	**Open to Traffic Date[1]**	**Expected Close Out Date[1]**
Caltrans	CAL453	National City - Signalized intersections on corridors: 8th St, 18th St, 30th St/Sweetwater Rd, Bay Marina Dr/Mile of Cars Wy, Division St, Euclid Ave, National City Blvd, Plaza Blvd/Paradise Valley Rd, etc. (part of Lump Sum CAL105)	Install pedestrian countdown signal heads and ADA-compliant pedestrian push buttons.		Dec-20
Caltrans	CAL455	National City - Thirty-two (32) signalized intersections - Tidelands Ave/19th St, Palm Ave/16th St, and on the following corridors: 8th St, 18th St, 30th St/Sweetwater Rd, Bay Marina Dr/Mile of Cars Wy/24th St, etc. (part of Lump Sum CAL105)	Install LED luminaire safety lighting.		Dec-20
Caltrans	CAL456	San Diego - University Avenue between Fairmount Avenue and Euclid Avenue. (part of Lump Sum CAL105)	Implement Complete Street measures including raised medians with pedestrian refuges, roundabouts, and wider sidewalks.		Dec-20

Table N-6 TCM REPORT - SANDAG 2018 RTIP					
LEAD AGENCY	**PROJECT ID**	**PROJECT TITLE**	**PROJECT DESCRIPTION / STATUS**	**Open to Traffic Date[1]**	**Expected Close Out Date[1]**
Caltrans	CAL457	San Diego County - Jamacha Boulevard between Sweetwater Road and Gillespie Drive, adjacent the Spring Valley Shopping Center, in the unincorporated community of Spring Valley. (part of Lump Sum CAL105)	Construct raised median and install traffic signal with striping, raised pavement markers, signage, and continental crosswalk striping.		Dec-20
Caltrans	CAL458	San Diego County - Woodside Ave from Marilla Dr to Chestnut St in the unincorporated community of Lakeside. (part of Lump Sum CAL105)	Construct sidewalks, bike lanes, and advanced dilemma zone detection with signal coordination.		Dec-20
Caltrans	CAL462	In San Diego County, at various locations. (part of Lump Sum CAL46A)	In San Diego County, at various locations. Repair and install Vehicle Detection Stations (VDS) elements including Microwave Vehicle Detections Systems (MVDS) and loop detectors.		Dec-22
Caltrans	CAL463	In San Diego County, at various locations. (part of Lump Sum CAL46A)	In San Diego County, at various locations. Update Microwave Vehicle Detection System (MVDS) elements for traffic flow monitoring and data collections.		Dec-20

Table N-6 TCM REPORT - SANDAG 2018 RTIP					
LEAD AGENCY	**PROJECT ID**	**PROJECT TITLE**	**PROJECT DESCRIPTION / STATUS**	**Open to Traffic Date[1]**	**Expected Close Out Date[1]**
Caltrans	CAL468	In San Diego County - Route 5/8 Separation to Route 5/76 Separation (part of Lump Sum CAL46A)	In San Diego County, from 0.6 mile south of Route 5/8 Separation to 1.5 miles north of Route 5/76 Separation. Install VDS, CMS, CCTV, Ramp Metering, Traffic Signal and Fiber Optic Network elements. (PM: R19.5 / R55.4)		Dec-21
Caltrans	CAL476	In San Diego and Lemon Grove - at various locations, west of 47th Street OC to west of College Avenue UC. (part of Lump Sum CAL46B)	In the cities of San Diego and Lemon Grove, at various locations from 0.2 mile west of 47th Street Overcrossing to 0.6 mile west of College Avenue Undercrossing. Construct MVPs, pave areas beyond gore, upgrade guardrail, install concrete barrier/crash cushions, relocate irrigation/electrical equipment and upgrade curbramps to current ADA standards.		Sep-26
Caltrans	CAL480	San Diego and Lemon Grove - Pedestrian curb ramps and sidewalks (part of Lump Sum CAL46I)	In and near the cities of San Diego and Lemon Grove, from 32nd Street Undercrossing to Bancroft Drive Undercrossing. Construct and upgrade pedestrian curb ramps and sidewalks to meet current standards.		Jun-22

Table N-6 TCM REPORT - SANDAG 2018 RTIP					
LEAD AGENCY	**PROJECT ID**	**PROJECT TITLE**	**PROJECT DESCRIPTION / STATUS**	**Open to Traffic Date[1]**	**Expected Close Out Date[1]**
Caltrans	CAL483	SHOPP Multiple Objective - Asset Management Pilot Program	In the city of San Diego, from Sorrento Valley Road to Del Mar Heights Road, Construct rumble strips on both shoulders, rehabilitate bike path, install fiber optic cable/CCTVs and rehabilitate 48 inch culvert. Asset Management Pilot Project.		Apr-26
Caltrans	CAL497	City of San Diego - ADA Curb Ramps (part of Lump Sum CAL46I)	In the city of San Diego, from Mission Center Road to College Avenue. Construct and upgrade pedestrian curb ramps to meet ADA standards. Replaced damaged sidewalk and install accessible pedestrian signals.		Jan-27
Caltrans	CAL498	Various cities - Curb ramps, pedestrian signal heads, push buttons, relocate pull boxes, light poles, and controller cabinet. (part of Lump Sum CAL46I)	In various cities, from Main Street/Auto Park Drive Undercrossing to Market Street Overcrossing. Construct and upgrade pedestrian curb ramps to meet ADA standards. Replace pedestrians signal heads, push buttons and relocated pull boxes, light poles and controller cabinet.		Dec-25

Table N-6 TCM REPORT - SANDAG 2018 RTIP					
LEAD AGENCY	**PROJECT ID**	**PROJECT TITLE**	**PROJECT DESCRIPTION / STATUS**	**Open to Traffic Date[1]**	**Expected Close Out Date[1]**
Caltrans	CAL503	Advanced Technology Corridors at Border Ports of Entry Pilot Project	In San Diego County and Imperial County on various routes at various locations, Install Intelligent Technology Statewide Border Wait Time System, Implement a fiber optic cable network to facilitate an advanced traveler information and border wait time system connecting the entire San Diego and Imperial border network.SD County: Route 5, 805, 905 & 188IMP County: Route 7, 111 & 186.		Dec-22
Caltrans	CAL512	Barona Band of Mission Indians - The intersection of Ashwood Street/Wildcat Canyon Road and Willow Road. (part of Lump Sum CAL105)	Install high visibility crossings and advanced stop bars; install bike lane stripping, edge-lines and centerlines; construct sidewalks and curb ramps; install pedestrian signal head and safety lighting system.		Dec-23
Caltrans	CAL513	Chula Vista - Pedestrian Interval Operations (part of Lump Sum CAL105)	Install LEED Pedestrian Interval Signals.		Jan-23
Caltrans	CAL514	El Cajon - Jamacha Road and 2nd Street, from Washington Avenue to Broadway. (part of Lump Sum CAL105)	Install raised medians, high visibility pedestrian crossings at signalized intersections, curb extensions, and pedestrian crossings at the uncontrolled locations (with enhanced safety features).		Dec-23

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LEAD AGENCY	**PROJECT ID**	**PROJECT TITLE**	**PROJECT DESCRIPTION / STATUS**	**Open to Traffic Date[1]**	**Expected Close Out Date[1]**
Caltrans	CAL515	El Cajon - Madison Avenue from N. Johnson Avenue to 670 Ft. east of N. 2nd Street (part of Lump Sum CAL105)	Install Class 2 bike lanes, uncontrolled pedestrian crossing, and street lighting.		Dec-23
Caltrans	CAL516	Encinitas - N. Coast Highway 101 corridor from Basil Street to El Portal Street (part of Lump Sum CAL105)	Install pedestrian hybrid beacon (HAWK).		Dec-23
Caltrans	CAL517	Encinitas - Tree-block corridor of Santa Fe Drive from Gardena Road to Bonita Drive. Santa Fe Drive intersects with four streets along the corridor. Gardena Road, Arcadia Road, Nardo Road, and Bonita Drive. (part of Lump Sum CAL105)	Install sidewalk/pathway and install pedestrian hybrid beacon (HAWK).		Dec-23

Table N-6 TCM REPORT - SANDAG 2018 RTIP					
LEAD AGENCY	**PROJECT ID**	**PROJECT TITLE**	**PROJECT DESCRIPTION / STATUS**	**Open to Traffic Date[1]**	**Expected Close Out Date[1]**
Caltrans	CAL518	Encinitas - El Camino Real approximately 350 Ft. south of Via Molena between the shopping centers of Encinitas Market Place and Encinitas Village. (part of Lump Sum CAL105)	Install a pedestrian staggered mid block crosswalk (2-crossing) with pedestrian hybrid beacon to connect pedestrians and bicycles to the east and west sides of El Camino Real.		Dec-23
Caltrans	CAL519	La Mesa - Various signalized intersections, including La Mesa Blvd/Glen St., Lemon Ave/Bancroft Dr., Spring St,/La Mesa Blvd, 70th/University, Lake Murray/Dallas St, Lake Murray/Aztec Dr. Murray Dr./Hospital Ring, Fletcher Pkwy/Trolley Ct/Parks Avenue. (part of Lump Sum CAL105)	Install pedestrian countdown signal heads, ADA-compliant pedestrian pushbuttons, and upgrade traffic signal controllers.		Dec-23
Caltrans	CAL520	La Mesa - El Cajon Boulevard from Jessie Avenue to Williams Avenue. (part of Lump Sum CAL105)	Install a HAWK signal and curb extensions.		Dec-23

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LEAD AGENCY	**PROJECT ID**	**PROJECT TITLE**	**PROJECT DESCRIPTION / STATUS**	**Open to Traffic Date[1]**	**Expected Close Out Date[1]**
Caltrans	CAL521	La Mesa - Various Locations citywide. (part of Lump Sum CAL105)	Install Rectangular Rapid Flashing Beacons (RRFBs), high visibility crosswalks, and pedestrian curb ramps.		Dec-23
Caltrans	CAL524	Oceanside - Signalized intersections along the corridors of Coast Hwy 101, El Camino Real, College Blvd, Oceanside Blvd Mission Ave, Douglas Dr., Vandergrift Blvd, Mesa Dr., North Santa Fe, Cannon Rd, Rancho Del Oro Rd, and Lake Blvd. (part of Lump Sum CAL105)	Install pedestrian countdown signal heads, ADA-compliance pedestrian pushbuttons, and upgrade traffic signal improvements.		Dec-23
Caltrans	CAL526	San Diego - Two hundred fifteen (215) intersections throughout the city. (part of Lump Sum CAL105)	Install pedestrian countdown signal heads.		Dec-23

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LEAD AGENCY	**PROJECT ID**	**PROJECT TITLE**	**PROJECT DESCRIPTION / STATUS**	**Open to Traffic Date[1]**	**Expected Close Out Date[1]**
Caltrans	CAL527	San Diego - Various locations, including Skyline Drive and Woodman Street, West Mission Bay Drive & Ingraham Street On-Ramp, North Torrey Road N/O Callan Road, Via de la Melodia & Smythe Avenue, Sabre Springs Parkway S/O Evening Creek Drive South. (part of Lump Sum CAL105)	This project involves extending existing guardrails, installing end terminals or crash cushions and widening sidewalks to provide adequate access.		Dec-23
Caltrans	CAL547	I-805/SR 94/SR 15 Transit Connection	Design and right of way for two High-Occupancy Vehicle lanes and transit connectors between I-805 and SR 15 for northbound to northbound and southbound to southbound HOV and Rapid BRT connection.	Apr-30	

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LEAD AGENCY	**PROJECT ID**	**PROJECT TITLE**	**PROJECT DESCRIPTION / STATUS**	**Open to Traffic Date[1]**	**Expected Close Out Date[1]**
Caltrans	CAL549	Corridor System Management Plan (CSMP) - High Speed Transit/I-15 (part of Lump Sum V20)	In the San Diego Region a comprehensive integrated management plan for increasing transportation options, decreasing congestion, and improving travel time in the I-15 Corridor from SR 76 to I-805. A CSMP includes all travel modes in a defined corridor - highways and freeways, parallel and connection roadways, public transit (bus, bus rapid, light rail, intercity rail) and bikeways.		Jun-28
Caltrans	CAL550	Comprehensive Multimodal Corridor Plan (CMCP) - High Speed Transit/SR 52/SR 67 (part of Lump Sum V20)	In the San Diego Region a comprehensive integrated management plan for increasing transportation options, decreasing congestion, and improving travel times in the SR-52/SR-67 Corridor on SR 52 from I-5 to Sr 67 and along SR 67 from SR 52 to SR 78. A CMCP includes all travel modes in a defined corridor - highways and freeways, parallel and connection roadways, public transit (bus, bus rapid transit, light rail, intercity rail) and bikeways.		Jun-28

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LEAD AGENCY	**PROJECT ID**	**PROJECT TITLE**	**PROJECT DESCRIPTION / STATUS**	**Open to Traffic Date[1]**	**Expected Close Out Date[1]**
Caltrans	CAL551	Corridor System Management Plan (CSMP) - High Speed Transit/SR-94 (part of Lump Sum V20)	In the San Diego Region a comprehensive integrated management plan for increasing transportation options, decreasing congestion, and improving travel times along the SR 94 corridor from I-5 to SR 125. A CSMP includes all travel modes in a defined corridor - highways and freeways, parallel and connection roadways, public transit (bus, bus rapid transit, light rail, intercity rail) and bikeways.		Jun-28
Caltrans	CAL552	Corridor System Management Plan (CSMP) - Purple Line/I-805 (part of Lump Sum V20)	In the San Diego Region, a comprehensive integrated management plan for increasing transportation options, decreasing congestion, and travel times in the I-805 corridor from the I-5/805 merge to the international border. A CSMP includes all travel modes in a defined corridor - highways and freeways, parallel and connection roadways, public transit (bus, bus transit, light rail, intercity rail) and bikeways.		Jun-28

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LEAD AGENCY	**PROJECT ID**	**PROJECT TITLE**	**PROJECT DESCRIPTION / STATUS**	**Open to Traffic Date[1]**	**Expected Close Out Date[1]**
Caltrans	CAL553	Corridor System Management Plan (CSMP) - SPRINTER/Palomar Airport Road/SR 78/SR 76 (part of Lump Sum V20)	In the San Diego Region, a comprehensive integrated management plan for increasing transportation options, decreasing congestion, and improving travel time between the I-5 and the I-15 freeways along the SR 76, SRA 78, Palomar Airport Road and the SPRINTER rail corridor. A CSMP includes all travel modes in a defined corridor - highways and freeways, parallel and connection roadways, public transit (bus, bus transit, light rail, intercity rail) and bikeways.		Jun-28
Caltrans	CAL554	Corridor System Management Plan - Blue Line Express/I-5 South (part of Lump Sum V20)	In the San Diego Region, a comprehensive integrated management plan for increasing transportation options, decreasing congestion, and improving travel time in the Blue Line/I-5 South Corridor & Palomar Street Rail Crossing. A CSMP includes all travel modes in a defined corridor - highways and freeways, parallel and connecting roadways, public transit (bus, bus rapid transit, light rail, intercity rail) and bikeways.		Jun-28

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LEAD AGENCY	**PROJECT ID**	**PROJECT TITLE**	**PROJECT DESCRIPTION / STATUS**	**Open to Traffic Date[1]**	**Expected Close Out Date[1]**
Carlsbad, City of	CB36	Carlsbad Boulevard Realignment	Study the realignment of Carlsbad Blvd including the relocation of the southbound lanes of Carlsbad Blvd to the east and the construction of complete street and multi use trail improvements along the coastal corridor.		Jun-22
Carlsbad, City of	CB43	ADA Improvements	In Carlsbad, construct Priority Level 1 and Priority Level 2 ADA Improvements per the City of Carlsbad Transition Plan for Public Rights-of-way.		Jun-22
Carlsbad, City of	CB44	Traffic Signal - RAMS	City of Carlsbad annual operations and maintenance cost share for the Regional Arterial Management System, (RAMS).		Jun-22
Carlsbad, City of	CB45	Carlsbad Boulevard and Tamarack Avenue Pedestrian Improvement Project (part of Lump Sum V17)	Reconfigure the intersection and the approaches to the intersection and provide enhanced facilities for pedestrians, transit users and bicyclists.		Dec-19
Carlsbad, City of	CB46	Terramar Area Complete Street Improvements	In Carlsbad, construct complete street improvements including the reconfiguration of the curbline and the addition of medians, pedestrian crossings and parkway improvements.		Jun-22

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LEAD AGENCY	**PROJECT ID**	**PROJECT TITLE**	**PROJECT DESCRIPTION / STATUS**	**Open to Traffic Date[1]**	**Expected Close Out Date[1]**
Carlsbad, City of	CB47	Carlsbad Village Drive and Grand Avenue Improvements	In Carlsbad, provide mid-block pedestrian crossing improvements and sidewalk/parkway improvements at the approaches to the railroad track crossings.		Dec-23
Carlsbad, City of	CB48	Chestnut Avenue Complete Street Improvements Valley Street to I-5	In Carlsbad, complete street improvements including sidewalk improvements and traffic calming features such as bulb outs and medians.		Jun-22
Carlsbad, City of	CB49	Kelly Drive and Park Drive Complete Street Improvements	In Carlsbad, complete street improvements including new curblines, sidewalk and multi use trail improvements and traffic calming features such as bulb outs and medians.		Dec-22
Carlsbad, City of	CB50	Valley Street Complete Street Improvements	In Carlsbad, improve the right of way to include Class 1 dedicated bike paths, pedestrian paths and crossings, curbline bulbouts, tree wells, and parking.		Jun-22
Carlsbad, City of	CB51	Adaptive Traffic Signal Program	In Carlsbad, construct fiber optic communications upgrades and install traffic measuring systems and adaptive signal control systems to implement adaptive traffic signal control along these roadways.		Jun-22
Carlsbad, City of	CB53	Carlsbad Blvd. Pedestrian Roadway Lighting	In Carlsbad, install pedestrian roadway lighting.		Dec-22

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LEAD AGENCY	**PROJECT ID**	**PROJECT TITLE**	**PROJECT DESCRIPTION / STATUS**	**Open to Traffic Date[1]**	**Expected Close Out Date[1]**
Carlsbad, City of	CB55	Christiansen Avenue Improvements	In Carlsbad, construct new curbline, sidewalk and parkway improvements.		Dec-22
Carlsbad, City of	CB56	Chestnut Avenue Complete Street Improvements - I-5 to the Railroad	In Carlsbad, prepare a project study report to identify the scope of work for the construction of complete street improvements including traffic calming and pedestrian improvements.		Dec-22
Chula Vista, City of	CHV33	School Zone Traffic Calming Program	Field identification and installation/ construction of traffic calming devices in public school zones, such as traffic control devices (for example, flashing beacons), signs, striping and minor street improvements.		Dec-25
Chula Vista, City of	CHV34	Neighborhood Traffic and Pedestrian Safety Program	Provide community outreach and education regarding traffic/ safety hazards; install and construct traffic calming and pedestrian safety measures; prepare plans to recommend pedestrian safety improvements and ADA compliance.		Dec-25
Chula Vista, City of	CHV39	Traffic Signal System Optimization	Upgrade traffic signal coordination at locations identified by the City's Traffic Monitoring Program in order to reduce congestion and intersection delays, coordinate regional traffic through the Regional Arterial Management System.		Dec-25

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LEAD AGENCY	**PROJECT ID**	**PROJECT TITLE**	**PROJECT DESCRIPTION / STATUS**	**Open to Traffic Date[1]**	**Expected Close Out Date[1]**
Chula Vista, City of	CHV51	Cross Gutter Replacement	Reconstruct the steep cross gutters at several intersections throughout the city in order to increase vehicle safety and reduce congestion caused by vehicles slowing down; Americans with Disabilities Act (ADA)-compliant pedestrian improvements will also be constructed.		Dec-21
Chula Vista, City of	CHV53	Bikeway Master Plans (part of Lump Sum V17)	Update the Citywide Bikeway Master Plan and prepare a bikeway feasibility study for Broadway. Includes preparation of a Multi-Modal Pedestrian/ bikeway Master Plan.		Sep-20
Chula Vista, City of	CHV58	New Sidewalk Construction	Design and construction of sidewalk and other pedestrian improvements in areas without existing sidewalk.		Dec-25
Chula Vista, City of	CHV60	Traffic Signal Upgrades	Modifications at these intersections will allow motorists to safely maneuver left turns into the intersection with a protected phase, and improve signal visibility by installing signal standards with mast arms. This will enhance traffic safety, reduce broadside accidents, potentially decrease delays and improve air quality.		Dec-25

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LEAD AGENCY	**PROJECT ID**	**PROJECT TITLE**	**PROJECT DESCRIPTION / STATUS**	**Open to Traffic Date[1]**	**Expected Close Out Date[1]**
Chula Vista, City of	CHV70	Bikeway Design and Construction	Construction of Bike Lane. Phase I from C to G Street is funded entirely by TransNet. ATP Grant will apply to Phase II (FY17/18) from G Street to Main Street		Dec-21
Chula Vista, City of	CHV75	ADA Curb Ramps	Installation of American with Disabilities Act-compliant ramps at missing locations in accordance with the City's priority list.		Dec-16
Chula Vista, City of	CHV76	F Street Promenade Streetscape Master Plan (part of Lump Sum V12)	Prepare a streetscape master plan based on complete streets principles and produce preliminary design drawings - SANDAG Board approved TransNet/ATP swap on November 21, 2014 for $491,000.		Aug-18
Chula Vista, City of	CHV80	Third Avenue Streetscape Project Phase III	Continuation of pedestrian and bicycle enhancement facilities (north of Phase II project).		Dec-21
Chula Vista, City of	CHV82	Palomar Street and Orange Avenue Sidewalk Improvements	Installation of missing curb, gutter and sidewalk along the south side of Palomar St. and the north side of Orange Ave and upgrade of traffic signal at Palomar and Orange.		Dec-21
Chula Vista, City of	CHV83	Local Street Utility Undergrounding Districts	Associated work required to convert overhead utility lines to underground; includes traffic lighting and signal relocation/installation, pedestrian infrastructure.		Dec-21

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LEAD AGENCY	**PROJECT ID**	**PROJECT TITLE**	**PROJECT DESCRIPTION / STATUS**	**Open to Traffic Date[1]**	**Expected Close Out Date[1]**
Chula Vista, City of	CHV84	Retiming of Traffic Signals and Installation of Fiber Optic/Ethernet	Retiming of traffic signals between I-5 and I-805, signals east of I-805 along Main Street, and installation of fiber optic/ Ethernet systems along several corridors to comply with the 2014 CA Manual of Uniform Traffic Control Devices.		Dec-18
Chula Vista, City of	CHV85	East "H" Street Sidewalk Improvements	Install missing and replace damaged curb, gutter, and sidewalks, install a raised median and bike lanes, and provide pavement overlay greater than 1 inch. The project will also remove overgrown trees, and provide decorative vegetation and wall treatment along the corridor.		Jun-20
Chula Vista, City of	CHV86	Third Avenue Streetscape Improvement Project (TASIP - STL406) Phase III (part of Lump Sum V10)	TASIP Phase III, proposes traffic calming measures from 100+/- feet north of F Street (end of Phase II) to E Street. Proposed measures include, but are not limited to medians, bulb-outs and decorative pavers; expanded bicycle parking; marked bicycle routes; drought tolerant landscaping; street trees; energy-efficient lighting; wayfinding/informational signs; and street furnishings.		Dec-20

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LEAD AGENCY	PROJECT ID	PROJECT TITLE	PROJECT DESCRIPTION / STATUS	Open to Traffic Date[1]	Expected Close Out Date[1]
Coronado, City of	COR04	Street and Road Preventive Maintenance; Minor Drainage Repair	In Coronado, citywide annual preventive maintenance program that slurry seals approximately one-seventh of City streets on a rotating basis. Slurry sealing extends the life of the road by protecting it from oxidation and revitalizes old bituminous-wearing surfaces to make slippery surfaces. Pavement markings are also repainted, improving visibility at night and enhancing pedestrian and bicyclist safety.		Dec-30
Coronado, City of	COR07	Street and Road Major Rehabilitation; Major Drainage; Traffic Operations	In Coronado, as-needed city wide rehabilitation of roadways including removal and replacement of severely damaged areas, grinding and overlays of 1 1/2". Pavement markings are also repainted, improving visibility at night and enhancing pedestrian and bicyclist safety.		Dec-30
Coronado, City of	COR20	Coronado Seniors Out and About Volunteer Driver Program (part of Lump Sum V16)	The services will include a volunteer driver program that will allow seniors to schedule a ride to help them access destinations.		Dec-18

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LEAD AGENCY	**PROJECT ID**	**PROJECT TITLE**	**PROJECT DESCRIPTION / STATUS**	**Open to Traffic Date[1]**	**Expected Close Out Date[1]**
Coronado, City of	COR21	Comprehensive Active Transportation Strategy (part of Lump Sum V17)	The Coronado Comprehensive Active Transportation Strategy (CATS) will help develop a complete multi-modal transportation network in Coronado that accommodates the needs of all users and modes.		Nov-18
Coronado, City of	COR23	Neighborhood Lighting & Street Improvements Along Third and Fourth Streets	This project will design neighborhood lighting and street improvements along Third and Fourth Street from Orange Avenue to Alameda. Street improvements will include items such as bulb-outs to enhance pedestrian crossings which will encourage more pedestrian and transit use. The project will also improve street/pedestrian lighting along the corridor.		Dec-19
Coronado, City of	COR24	Congestion Relief Traffic Analysis	In Coronado, on Silver Strand Blvd from Tulagi Rd to Avenue De Las Arenas, adaptive signal traffic flow system improvements.		Dec-20
Del Mar, City of	DM06	Sidewalk, Street, and Drainage Improvements	Pedestrian, bicycle, roadway, and drainage improvements along Camino del Mar, Jimmy Durante Boulevard, and Via de la Valle.		Dec-24

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LEAD AGENCY	**PROJECT ID**	**PROJECT TITLE**	**PROJECT DESCRIPTION / STATUS**	**Open to Traffic Date[1]**	**Expected Close Out Date[1]**
Del Mar, City of	DM07	Civic Center Bike Locker Project (part of Lump Sum V17)	With the construction of the City's new Civic Center near completion, it is an ideal time to install convenient, secure and innovative bike lockers within the sites parking structure. By installing duel entry, blue tooth enabled bike locker, employees and residents and visitors will be able to store their bike with ease via their smart phone while they complete their work day or visit the various attractions throughout the City.		Dec-19
El Cajon, City of	EL06	Traffic Signals Projects	New, upgrade or modification of traffic signals and Traffic Management Center, including rewire, modifications, replacement of signal interconnect cable, wireless video monitoring cameras and other necessary equipment; funds for ongoing RAMS maintenance support costs.		Dec-25
El Cajon, City of	EL11	Sidewalk and other Repairs	Repair broken sidewalk, installation of new sidewalk, driveway, ramps, etc.		Dec-25
El Cajon, City of	EL29	Traffic Safety/Calming	El Cajon; install traffic safety and calming improvements such as street striping, stop signs, speed cushions, and radar speed feedback signs.		Jun-25

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LEAD AGENCY	**PROJECT ID**	**PROJECT TITLE**	**PROJECT DESCRIPTION / STATUS**	**Open to Traffic Date[1]**	**Expected Close Out Date[1]**
El Cajon, City of	EL33	El Cajon Transit Center Transit-Supportive Land Use and Mobility Plan (part of Lump Sum V10)	The project would comprehensively analyze the study area surrounding the El Cajon Transit Center to plan a new vision for the area to include transit-supportive land use, improved mobility options, and an enhanced public realm which will result in a general plan amendment, rezone, and specific plan to facilitate smart growth development, mobility improvements, and public facilities.		Jun-18
El Cajon, City of	EL38	Active Transportation Plan (part of Lump Sum V17)	This effort will develop an Active Transportation Plan for the City of El Cajon. Key deliverables will include a Sidewalk/Pedestrian Master Plan, an update to the 2011 Bicycle Master Plan. incorporation and prioritization of the findings from the City's ongoing Safe Routes to School program, and refinement of the conceptual mobility improvements found in the City's Transit District Specific Plan.		Jun-22

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LEAD AGENCY	**PROJECT ID**	**PROJECT TITLE**	**PROJECT DESCRIPTION / STATUS**	**Open to Traffic Date[1]**	**Expected Close Out Date[1]**
Del Mar, City of	EL39	El Cajon Bicycle Parking Enhancement Project (part of Lump Sum V17)	The El Cajon Bicycle Parking Enhancement Project will install bicycle racks throughout El Cajon's bicycle network. The Bicycle racks will provide cyclists with safe, secure, and convenient parking for end- of-trip storage and enhance regional and local bicycle networks.		Jan-23
El Cajon, City of	EL40	El Cajon Transit Center Community Connection Improvements (part of Lump Sum V10)	This project is the first phase of proposed improvements that will revitalize the Transit District by creating a sense of place and providing a direct link to transit by installing elements that will encourage smart growth such as wide sidewalks, enhanced crosswalks, thematic lighting, LID basins, streets trees, site furniture, a roundabout, bulb-outs, signage, and Class I bikeway approaches along Johnson Ave.		Dec-23

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LEAD AGENCY	**PROJECT ID**	**PROJECT TITLE**	**PROJECT DESCRIPTION / STATUS**	**Open to Traffic Date[1]**	**Expected Close Out Date[1]**
El Cajon, City of	EL41	Main Street - Green Street Gateway (part of Lump Sum V10)	Main St. is the primary access from the Transit Center to downtown El Cajon. To revitalize the corridor into an attractive "urban-forest" gateway, tree-lined widened sidewalks and Class IV bikeways, LID planters, signage, thematic site furnishing, and lighting are proposed. Also, upgraded bike and ped links to the transit center along Marshall will transform the corridor into an accessible and multi-modal Ave.		Dec-22
Encinitas, City of	ENC17	Safe Routes to School Sidewalk Program	In Encinitas, at various locations throughout the City; installation of pathways to include curb, gutter, drainage improvements and landscaping which will provide connectivity.		Dec-25
Encinitas, City of	ENC19	Traffic Safety/Calming	Various improvements including pedestrian and bicycle improvements.		Dec-25

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LEAD AGENCY	**PROJECT ID**	**PROJECT TITLE**	**PROJECT DESCRIPTION / STATUS**	**Open to Traffic Date[1]**	**Expected Close Out Date[1]**
Encinitas, City of	ENC20	North Coast Highway 101 Beautification	Design/construct comprehensive streetscape improvements: new curb, gutter, and landscaping; pedestrian facilities on both sides of the street; dedicated buffered bicycle lanes; lane reconfiguration (including a reduction in the number of vehicular travel lanes in each direction); and, between four or six roundabouts to facilitate traffic calming and more efficiently move vehicular traffic.		Dec-25
Encinitas, City of	ENC28	Traffic Signal Modifications	In Encinitas and the San Diego region; City's annual operations and maintenance cost share for the Regional Arterial Management System (RAMS) to enhance inter-jurisdictional coordination of traffic signals along major streets/arterial corridors throughout the San Diego region.		Dec-25
Encinitas, City of	ENC46	El Portal Pedestrian and Bike Underpass (part of Lump Sum V14)	Construct a grade-separated pedestrian and bike underpass beneath the LOSSAN rail corridor, and will provide pedestrian, bike, and crosswalk improvements in order to connect adjacent active transportation routes to the facility.		Dec-20

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LEAD AGENCY	**PROJECT ID**	**PROJECT TITLE**	**PROJECT DESCRIPTION / STATUS**	**Open to Traffic Date[1]**	**Expected Close Out Date[1]**
Encinitas, City of	ENC47	Santa Fe Drive ATP Corridor Improvements (part of Lump Sum V14)	In Encinitas, on Santa Fe Drive between Windsor Drive and El Camino Real; construct sidewalk, curb, gutter and ramps, pavement widening and installation of new bike lanes and pedestrian improvements.		Jun-21
Escondido, City of	ESC39	Traffic Signals	Construction of new signals and modification of existing signals citywide; signals will be constructed in accordance with the adopted traffic signal priority list. With these funds new signals are anticipated at Rock Springs/Lincoln Ave, Rock Springs/Mission Ave., Metcalf/Mission, and traffic signal modification at Mary Lane/Bear Valley Pkwy.		Jun-25
Escondido, City of	ESC43	Escondido Creek Bikeway Missing Link (part of Lump Sum V12)	Construct Class I and Class II bike facilities that connect the Escondido Creek Trail and Inland Rail Trail.		Dec-19

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LEAD AGENCY	**PROJECT ID**	**PROJECT TITLE**	**PROJECT DESCRIPTION / STATUS**	**Open to Traffic Date[1]**	**Expected Close Out Date[1]**
Escondido, City of	ESC44	Escondido Transit Center Active Transportation Connections (part of Lump Sum V10)	The project connects the ETC to grocery, commercial, residential and office centers to the west by constructing a bridge for pedestrians over the Spruce Street Creek and by providing bike lanes between Tulip and Quince Street with connection of the ETC to the Mercado/Grand Avenue Smart Growth Project Area to the southeast with bike lanes along Quince Street.		Dec-19
Escondido, City of	ESC45	Escondido Creek Trail Signalized Bike/Ped Crossing at El Norte Parkway Project (part of Lump Sum V17)	Provide active transportation connectivity for the Escondido Creek Trail by installing a pedestrian signal and pedestrian refuge across El Norte Parkway, including a decorative trail overhead signage structure in addition to a bridge across Escondido Creek.		Dec-19
Escondido, City of	ESC46	Escondido Creek Trail Bike Path Improvements (part of Lump Sum V14)	This project closes gaps on approximately 2.5 miles of the Escondido creek trail bike path by adding lighting, ped signals, crosswalks, ramps and signage to 7 intersections. The project's construction limits are the Escondido creek trail bike path between Juniper Street and Citrus Avenue.		Jun-21

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LEAD AGENCY	**PROJECT ID**	**PROJECT TITLE**	**PROJECT DESCRIPTION / STATUS**	**Open to Traffic Date[1]**	**Expected Close Out Date[1]**
Escondido, City of	ESC47	Quince & Tulip Pedestrian Signals	Installation of pedestrian signals along the Escondido Creek Bike Path at Quince and Tulip.		Jun-24
Escondido, City of	ESC48	Grand Avenue Complete Streets Improvement Project, Phase 1 (part of Lump Sum V10)	The project creates a pedestrian-friendly, aesthetically appealing streetscape in the heart of Escondido's historic Town Center to enhance the vibrancy of downtown. Lane reduction on Grand Ave provides the opportunity to widen sidewalks to expand outdoor dining; install curb bulbouts to reduce pedestrian crossing distances and calm traffic; add diagonal parking and enhance pedestrian-scale lighting.		Jun-25
Imperial Beach, City of	IB12	Major Street Improvements	Work includes but not limited to overlay greater than 1", new sidewalks, curbs and gutters, ramps, and storm drain.		Jun-25
Imperial Beach, City of	IB18	Imperial Beach Boulevard Safe Routes to School (part of Lump Sum V14)	Design and construct pedestrian, bicycle, pavement, traffic calming, storm water drainage, and green street improvements.		Jun-20

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LEAD AGENCY	**PROJECT ID**	**PROJECT TITLE**	**PROJECT DESCRIPTION / STATUS**	**Open to Traffic Date[1]**	**Expected Close Out Date[1]**
Imperial Beach, City of	IB19	IB Biking Education, Encouragement, and Awareness Campaign (part of Lump Sum V17)	The EEA Campaign will create a partnership with the City of Imperial Beach and the San Diego County Bicycle Coalition to build a positive multimedia, informational and outreach campaign to market new biking infrastructure and destination opportunities, increase bike use, teach bike safety skills, educate businesses and residents, and promote active transportation choices in Imperial Beach. The campaign will include fun mini events, bicycle rodeos, community bike rides and a free Open Streets event.		Dec-19
La Mesa, City of	LAM27	Rides4Neighbhors (part of Lump Sum SAN213)	City of La Mesa - Volunteer Driver Transportation Service - develop, coordinate, and implement new service provide assistance for essential medial shopping needs.		Dec-25
La Mesa, City of	LAM33	Curb and Gutter, Sidewalk, Ped Ramps	Remove and replace identified and prioritized tripping hazards; installation of and replacement of pedestrian ramps, in order to comply with the Americans with Disabilities Act; replace or install new sidewalks, curbs and gutters.		Jul-23

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LEAD AGENCY	**PROJECT ID**	**PROJECT TITLE**	**PROJECT DESCRIPTION / STATUS**	**Open to Traffic Date[1]**	**Expected Close Out Date[1]**
La Mesa, City of	LAM34	Street Lights	Installation of new street lights and street light upgrades to bring completed underground districts and other streets up to current city lighting standards.		Jul-23
La Mesa, City of	LAM37	Traffic Signal Upgrades	Traffic signal upgrades including protected left turns, overhead signals in lieu of island signals and pedestrian ramps for improved pedestrian access.		Jul-23
La Mesa, City of	LAM39	Traffic Calming Improvements & Active Transportation Improvements	Implement traffic calming measures including signage and striping, speed humps and other tools in locations throughout the City in accordance with the City's Neighborhood Traffic Management Program.		Jul-23
La Mesa, City of	LAM46	Regional Arterial Management System (RAMS)	Regional traffic signal connection.		Jul-23

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LEAD AGENCY	**PROJECT ID**	**PROJECT TITLE**	**PROJECT DESCRIPTION / STATUS**	**Open to Traffic Date[1]**	**Expected Close Out Date[1]**
La Mesa, City of	LAM47	North Spring Street Smart Growth Corridor (part of Lump Sum V10)	Enhancements include A vital pedestrian connection at I-8 with ADA ramps, high visibility cross walks, lighting, & safety fencing; A Class III bicycle route with sharrow markings along the corridor; A pedestrian railroad crossing connecting Spring Street to a proposed private development, new sidewalk along Nebo Drive, and a new pedestrian crossing at Nebo Drive and University Avenue - providing a linkage to the regional transit center and civic services located downtown.		Dec-19
La Mesa, City of	LAM48	West La Mesa Pedestrian and Bicycle Connectivity Project	Enhance safety in West La Mesa by completing more than 4.8 miles of bicycle and pedestrian enhancements linking four schools and a City park. An educational campaign will further promote active transportation as a viable mode.		Jun-19

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LEAD AGENCY	**PROJECT ID**	**PROJECT TITLE**	**PROJECT DESCRIPTION / STATUS**	**Open to Traffic Date[1]**	**Expected Close Out Date[1]**
La Mesa, City of	LAM49	Complete Streets Integrated Design Manual (part of Lump Sum V10)	This project will evaluate the City's Complete Streets policies, update them, as needed and integrate them with the engineering design principles in one, easy to use, coordinated Complete Streets Integrated Design Manual. By integrating Complete Streets policies with engineering requirements, the city will ensure that Completes Streets policies will be applied to every development project.		Dec-20
La Mesa, City of	LAM50	University Avenue Corridor - Bike Network and Pedestrian Improvements (part of Lump Sum V17)	The will fill critical gaps in the Currently Adopted Regional Bike Network by providing class II bike lanes on University Avenue from 69th Street to Harbinson Avenue (connecting to the end of the soon to be completed University Bikeway project by SANDAG) and from La Mesa Boulevard to Baltimore Avenue. Additionally, this project will construct new pedestrian ramps and sidewalks improving safe access for walking and biking.		Dec-20

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LEAD AGENCY	**PROJECT ID**	**PROJECT TITLE**	**PROJECT DESCRIPTION / STATUS**	**Open to Traffic Date[1]**	**Expected Close Out Date[1]**
La Mesa, City of	LAM51	Massachusetts Avenue and Blackton Drive - Bike Connectivity and Intersection Improvements (part of Lump Sum V17)	This project will fill a gap in the City of La Mesa Bike Network by installing a northbound Class II bicycle lane on the east side of Massachusetts Avenue between Blackton Drive and University Avenue. Additionally, this project would construct new pedestrian ramps, a crosswalk, and medians at the intersection of Massachusetts Avenue and Blackton Drive. This project would improve access for people walking and biking, vehicular sight distance, and overall safety of the project area.		Jun-21
Lemon Grove, City of	LG18	Traffic Improvements (Congestion Relief)	Median installation for safety improvement or left turn movement, new traffic signals, passive permissive left turn installation, signal removal for congestion relief reasons, traffic signal upgrades, intersection lighting, traffic signal coordination, traffic signal interconnection/optimizatio n, and traffic related infrastructure installation.		Jun-23

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LEAD AGENCY	**PROJECT ID**	**PROJECT TITLE**	**PROJECT DESCRIPTION / STATUS**	**Open to Traffic Date[1]**	**Expected Close Out Date[1]**
Lemon Grove, City of	LG20	Street Improvements (Congestion Relief - Non CI)	This project involves roadway rehabilitation (grinding and overlay, new structural pavement, or new overlay 1-inch thick or greater) of several streets within the city. Streets were prioritized for work based on levels of deterioration identified in the Pavement Management System; Sidewalk Rehabilitation: this annual project adds sidewalks, widens sidewalks, removes and/or replaces various sidewalk locations and installs Americans with Disabilities Act (ADA) compliant curb ramps throughout the city; Street Improvements: this as needed project would widen or install curb/gutter, sidewalk, curb ramps.		Jun-23
Lemon Grove, City of	LG23	Broadway Downtown Village Specific Plan (DVSP) Expansion (part of Lump Sum V10)	The expansion would consider promoting mixed-use with increased residential densities and commercial intensities within the proposed boundaries consistent with the adopted Downtown Village Specific Plan.		May-18

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LEAD AGENCY	PROJECT ID	PROJECT TITLE	PROJECT DESCRIPTION / STATUS	Open to Traffic Date[1]	Expected Close Out Date[1]
Lemon Grove, City of	LG24	ADA Transition Plan (part of Lump Sum V17)	The project consists of a comprehensive evaluation and documentation of City policies, programs and facilities to determine the extent to which individuals with disabilities may be restricted in their access to City services, activities and facilities. A document will be produced to provide guidance for the implementation of necessary program and facility modifications over the next several years. The City's assessment will identify and correct those policies and practices that are inconsistent with the requirements of Title II of the ADA. The City will institute a number of programs to increase pedestrian accessibility via capital improvement projects and will continue to monitor these programs in order to meet its overall goals based upon a priority system. The plan will include cost estimates for implementation. The plan will be integrated into the CIP with a timeline for implementation.		Sep-19

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LEAD AGENCY	**PROJECT ID**	**PROJECT TITLE**	**PROJECT DESCRIPTION / STATUS**	**Open to Traffic Date[1]**	**Expected Close Out Date[1]**
Lemon Grove, City of	LG25	Lemon Grove Smart Growth General Plan Update and Implementation Project (part of Lump Sum V10)	This project will produce a Program Environmental Impact Report (PIER) for the City's General Plan Update (GPU), Downtown Specific Plan, and Climate Action Plan (CAP) as an element in the GPU. It includes additional technical support for the GPU and CAP leading to the PEIR. These three planning efforts expedite the City's implementation of the smart growth projects through the CEQA review process.		Dec-21
National City, City of	NC04	Traffic Signal Install/Upgrade	Install and/or upgrade traffic signal/coordination at locations identified by the City's Traffic Monitoring Program in order to reduce congestion and intersection delays; coordinate regional traffic through the Regional Arterial Management System.		Dec-25
National City, City of	NC15	Citywide Safe Routes to Schools	Traffic calming and pedestrian safety/access enhancements for several schools on the eastside of the City.		Dec-25
National City, City of	NC22	El Toyon - Las Palmas Bicycle Corridor (part of Lump Sum V14)	The 1.75 mile El Toyon-Las Palmas Bicycle Corridor project in the National City SMART Foundation's Plan to improve the pedestrian and bicycling environment in National City.		Jun-21

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LEAD AGENCY	PROJECT ID	PROJECT TITLE	PROJECT DESCRIPTION / STATUS	Open to Traffic Date[1]	Expected Close Out Date[1]
National City, City of	NC23	Westside Mobility Improvement Project (part of Lump Sum V10)	Enhance bicycling and pedestrian connections in the Downtown and Westside Specific Plan areas and encourage smart growth development through the following improvements: completing the missing Class II bicycle facilities, bicycle racks, trash/recycling receptacles, intersection curb bulb-outs at key intersections, ADA-compliant curb ramps at intersections with improved crosswalks, traffic circles at ten intersections, public art within the traffic circles, decorative street lighting along the Wilson Avenue and 14th Street community corridors, and communications support system.		Jun-18
National City, City of	NC25	Downtown-Westside Wayfinding and Community Gateways (part of Lump Sum V10)	The project includes the installation of new wayfinding/gateway signs throughout the Downtown and Westside Communities. The goal of the primarily pedestrian-oriented signs is to direct area residents, visitors, and workers to popular destinations, schools, transit stations, and parks.		Mar-18

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LEAD AGENCY	**PROJECT ID**	**PROJECT TITLE**	**PROJECT DESCRIPTION / STATUS**	**Open to Traffic Date[1]**	**Expected Close Out Date[1]**
National City, City of	NC26A	Sweetwater River Bikeway/30th Street Bicycle Facility Improvements (part of Lump Sum V14)	The project will provide nearly one mile of Class II and Class III bicycle facilities, per the City's Bicycle Master Plan and will include bicycle detector loops, bicycle boxes, and decreased lane widths for vehicles.		Jun-19
National City, City of	NC28	Citywide Midblock Crossing Enhancements Project (part of Lump Sum V17)	The project will generally provide additional pedestrian level lighting enhancements at 14 existing midblock pedestrian crossing locations throughout the City; Specific improvements will include new solar powered lights at 10 intersections and curb bulbouts, enhanced crosswalk striping, and upgrades to curb ramp to be ADA compliant at 4 intersections.		Jun-18

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LEAD AGENCY	**PROJECT ID**	**PROJECT TITLE**	**PROJECT DESCRIPTION / STATUS**	**Open to Traffic Date[1]**	**Expected Close Out Date[1]**
National City, City of	NC29	National City 24th Street Transit Oriented Development Overlay (part of Lump Sum V10)	The project would comprehensively analyze the study area surrounding the 24th Street Transit Center to plan a new vision for the area to include transit-supportive land use, improved mobility and parking options, and an enhanced public realm. The project will result in a general plan amendment, rezone, smart growth and public mobility improvements, and a program level environmental clearance.		Dec-21
National City, City of	NC31	Division Street - Euclid to Harbison Bicycle Improvements (part of Lump Sum V17)	This project will build upon the recently constructed, and State ATP Cycle 1 funded, Division Street Road Diet project, and complete a Division Street road diet from Euclid Avenue to Harbison Avenue. The project will reduce street from four to two lanes with a center turning lane; the project will also include a Class II buffered bike lane on each side of the road while maintaining parking; and add a pedestrian crossing with curb-extensions and LED illuminated signs at the intersection of Division Street at Drexel Avenue.		Dec-20

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LEAD AGENCY	**PROJECT ID**	**PROJECT TITLE**	**PROJECT DESCRIPTION / STATUS**	**Open to Traffic Date[1]**	**Expected Close Out Date[1]**
National City, City of	NC33	National City Boulevard Inter City-Bike Connection (part of Lump Sum V17)	The project will provide nearly.2 miles of enhanced (buffered) bike lanes along 33rd Street from Hoover Avenue to National City Boulevard. The project will implement nearly .4 miles of class II facilities along National City Boulevard from 33rd Street to C Street. the project will include traffic calming features, decreased lane widths, bike/pedestrian improvements at freeway on/off ramps, bike boxes, lighting, and pedestrian safety enhancements. The project improves safety for people waking and biking.		Jun-22
National City, City of	NC34	Waterfront to Homefront Connectivity Study (part of Lump Sum V17)	This study will take a holistic look at connections between the people of National City and the waterfront. The I-5 and the "waterfront" industrial areas have been a barrier to free movement from the "homefront" of the residents in National City to destinations of employment and recreation. The Study will look at connecting transit, bike and walking facilities with new technologies of car share, bikeshare, NEV, shuttles, electric bikes and ride hailing to lower GHG and VMT.		Dec-19

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LEAD AGENCY	**PROJECT ID**	**PROJECT TITLE**	**PROJECT DESCRIPTION / STATUS**	**Open to Traffic Date[1]**	**Expected Close Out Date[1]**
National City, City of	NC35	National City Bicycle Parking Enhancements (part of Lump Sum V17)	The project will install custom bike corrals throughout the city. The corrals will consist of a 12 foot by 6 foot concrete pad with custom bookend bike racks. The design intent is to provide bike parking for cyclists using their own bike (i.e. the bookend bike racks), while also providing space between the bookend bike racks for dockless bike share bikes. The project will provide quality end-of-trip facilities.		Dec-20
National City, City of	NC36	Roosevelt Avenue Corridor Smart Growth Revitalization Project (part of Lump Sum V10)	This project provides streetscape, lighting, signage, mobility options, urban greening, stormwater runoff and parking to encourage adjacent development and to improve this high visibility edge of downtown as seen from I-5. Future buildout will include a multi-use path & NEV shuttle route, once ROW & utility undergrounding can be secured as called for in the Specific Plan.		Dec-21

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LEAD AGENCY	PROJECT ID	PROJECT TITLE	PROJECT DESCRIPTION / STATUS	Open to Traffic Date[1]	Expected Close Out Date[1]
National City, City of	NC37	Sweetwater Road Protected Bikeway (part of Lump Sum V10)	The project will provide nearly 1.2 miles of protected bike facilities along Sweetwater Road and extend the Class 1 bike path on Plaza Bonita Road to Sweetwater Road (0.4 miles). The project will include a road diet, bicycle-friendly intersection improvements, and pedestrian enhancements. The proposed bicycle facilities will directly link the City's bike network to the regional network.		Dec-22
National City, City of	NC38	National City Bike Wayfinding (part of Lump Sum V14)	The project will install more 100 bicycle wayfinding signs at decision points throughout the City's recently constructed bicycle network.		Sep-22
National City, City of	NC39	Central Community Mobility Enhancements (part of Lump Sum V14)	Implement a north-south bicycle boulevard, close a sidewalk gap, and provide pedestrian enhancements in National City along M, N, and L Avenues, between 4th Street and 30th Street.		Mar-23
National City, City of	NC40	Bayshore Bikeway - Segment 5 (part of Lump Sum V14)	Construct Class 1 and Class 4 protected bicycle facilities with enhanced intersection treatments for people walking and biking.		Nov-23
National City, City of	NC41	8th Street and Roosevelt Ave. Active Transportation Corridor, National City (part of Lump Sum V14)	Constructs .4 miles of a one-way 7' cycle track (.8 miles counting both sides), .75 miles of a 14' wide multi-use path and various intersection adjustments for safety improvements.		May-23

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LEAD AGENCY	**PROJECT ID**	**PROJECT TITLE**	**PROJECT DESCRIPTION / STATUS**	**Open to Traffic Date[1]**	**Expected Close Out Date[1]**
North County Transit District	NCTD02	Preventive Maintenance	This project funds preventive maintenance for the District bus fixed route, paratransit, rail, facilities, maintenance of way and signals.		Dec-25
North County Transit District	NCTD03	ADA Paratransit Services	This project supports the operations of the District ADA/paratransit services.		Dec-25
North County Transit District	NCTD05	Bus Revenue Vehicle Purchases & Related Equipment	This project funds the programmatic replacement of fixed route buses that have reached the end of their service life, and the programmatic rebuild of fixed route buses engines and transmissions. FY19-23 funding includes the purchase of ten (10) 35 ft. CNG buses and six (6) zero-emission battery-electric buses and chargers.		Dec-25
North County Transit District	NCTD06	Bus/Rail Support Equipment & Facilities	This project funds District state of good repair projects, including the repair, replacement and upgrade of fixed route and rail operations facilities and equipment, including information technology and fare revenue equipment.		Dec-25

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LEAD AGENCY	**PROJECT ID**	**PROJECT TITLE**	**PROJECT DESCRIPTION / STATUS**	**Open to Traffic Date[1]**	**Expected Close Out Date[1]**
North County Transit District	NCTD18	Rail-Right-of-Way State of Good Repair & Improvements	This project funds various District state of good repair projects and programs for the rail right of way, grade crossing replacement, right-of-way (ROW) drainage improvement, and programmatic replacement of rail ties and rail grinding. This project also funds the bridge replacement projects for BR.257.2, BR 207.6, BR 207.8 and BR 209.9.		Dec-25
North County Transit District	NCTD20	Rail Vehicles & Related Equipment	This project funds the District state of good repair projects and programs replacing, repairing and rehabilitating the District COASTER and SPRINTER rail fleets, which includes the purchase of replacement locomotives, and Diesel Multiple Unit (DMU) rehabilitation and component overhauls. This project also includes the construction of a series of tasks to improve signal optimization on the San Diego Subdivision of the LOSSAN corridor.		Dec-25
North County Transit District	NCTD34	Transit Service Operating Support	This project funds operating costs for existing fixed route and rail transit service, including rural services.		Dec-25
North County Transit District	NCTD113	NCTD Vehicle Procurement (part of Lump Sum SAN214)	Purchase of 9 Class V Vehicles and 5 Class C Vehicles.		Dec-21

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LEAD AGENCY	**PROJECT ID**	**PROJECT TITLE**	**PROJECT DESCRIPTION / STATUS**	**Open to Traffic Date[1]**	**Expected Close Out Date[1]**
Oceanside, City of	O18	Neighborhood Sidewalk/ADA/Traffic Improvements	Slurry sealing of streets, sidewalk repair, parkway and median landscape maintenance, minor storm drain culvert maintenance, and streetlight repairs. The work is scheduled each year by neighborhood.		Jun-27
Oceanside, City of	O25	Traffic Management Center and Adaptive Traffic Signals	Includes traffic signal interconnect in Mission Avenue between Airport Road and Mesa Drive. Also includes reconstruction of the traffic signals at S Coast Hwy and Vista Way, and Mission Ave and Mesa Drive for new pedestrian push buttons and remote camera and signal timing control. This includes 'smart city' fiber-optic cable infrastructure in the downtown coastal area for remote streetlight operation and public internet service.		Dec-21
Oceanside, City of	O33	Coast Highway Corridor Study	In Oceanside, on Coast Highway from the bridge over the San Luis Rey River to the southerly city limit: perform study to reduce the four-lane roadway to two lanes with bike lanes, on-street parking and roundabouts at the following cross-streets: SR-76, Surfrider, Civic Center, Pierview, Michigan, Wisconsin, Oceanside Blvd, Morse Street, and Cassidy Street.		Jun-24

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Oceanside, City of	O34	Oceanside Senior Shuttle Program (part of Lump Sum V16)	Provide seniors with the following transportation options: curb-to-curb taxi scrip subsidies, door-to-door shuttle services, and doorthrough-door volunteer driver services.		Jun-21
Oceanside, City of	O35	Regional Arterial Management System (RAMS)	Oceanside cost-share for the Regional Arterial Management System.		Sep-27
Oceanside, City of	O37	Bicycle Master Plan and Bicycle Safety Improvement	In the City of Oceanside, construction of curb "pop-outs", bike lanes, sharrows and crosswalks for improved bicycle and pedestrian safety.		Dec-27
Oceanside, City of	O38	Road Safety and Access Improvements	In the City of Oceanside, construction of new curb access ramps, new sidewalk for pedestrian access, traffic signal safety modifications, neighborhood speed control devices, school safety improvement and new pavement delineation.		Dec-26
Oceanside, City of	O41	Lot 23 Transit Parking Structure	Oceanside, at the intersection of Cleveland Street and the Pier View Way pedestrian undercrossing, construction of parking structure making 325 public parking spaces available for bus and train commuters at the Oceanside Transit Center.		Oct-20

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LEAD AGENCY	**PROJECT ID**	**PROJECT TITLE**	**PROJECT DESCRIPTION / STATUS**	**Open to Traffic Date[1]**	**Expected Close Out Date[1]**
Oceanside, City of	O42	Seagaze Drive Downtown Mobility Project (part of Lump Sum V10)	This project will enhance the quality of Seagaze Drive and provide much needed continuity with Mission Avenue through innovative smart growth supporting infrastructure including: pedestrian bulb-outs, ADA ramps with truncated domes, rectangular rapid flashing beacons, enhanced crosswalks, and a raised pork-chop median.		Jun-19
Oceanside, City of	O46	Coastal Rail Trail	Environmental study and design for a class 1 bikeway along the coastal railroad right-of-way from Oceanside Blvd to Morse St..		Dec-25
Oceanside, City of	O47	Pier View Pedestrian Bridge Study and Renovation	Engineering study for permanent structural repairs to the Pier View Way pedestrian bridge with CON funds to provide for temporary repairs.		Dec-21
Oceanside, City of	O48	Enclosed Bike Parking Facility (Bike Station) (part of Lump Sum V17)	Project will construct and enclosed bike parking facility to support City Hall and downtown business employees. Facility would provide secured 24 hour bike parking for City and local business employees. An enclosed secured bike storage facility is considered critical to increasing the number of bike commuters.		Jun-20

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LEAD AGENCY	**PROJECT ID**	**PROJECT TITLE**	**PROJECT DESCRIPTION / STATUS**	**Open to Traffic Date[1]**	**Expected Close Out Date[1]**
Oceanside, City of	O49	Coastal Rail Trail Extension (part of Lump Sum V10)	The project will extend the existing Coastal Rail Trail limits in the City of Oceanside by creating a Class 1 bicycle and pedestrian path that spans across the Alta Loma Marsh between Oceanside Boulevard and Morse Street. This connection will improve pedestrian and bicycle mobility and create a safe route for pedestrians and bicyclists between North and South Oceanside.		Dec-21
Poway, City of	POW29	Citywide Traffic Signal Improvements	In Poway, Citywide traffic signal improvements for Regional Arterial Management System (RAMS).		Dec-23
Poway, City of	POW33	Poway Road Pedestrian and Bicycle Project	In Poway; reconstruct and raise the center raised medians on Poway Road from Garden Road to Oak Knoll Road; Phase 1.		Dec-23
Poway, City of	POW36	Neighborhood Sidewalk Project	In Poway - Construct new sidewalks on Garden Rd and Powers Rd, 19/20, Powers Rd, 21/22 and Springvale Street 22/23.		Dec-25
Poway, City of	POW37	Espola Road Bicycle and Pedestrian Widening	In Poway - Widen Espola Rd from Range Park to Poway Rd to accommodate pedestrian and bicycle access.		Dec-20

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LEAD AGENCY	**PROJECT ID**	**PROJECT TITLE**	**PROJECT DESCRIPTION / STATUS**	**Open to Traffic Date[1]**	**Expected Close Out Date[1]**
San Diego Association of Governments	SAN03A	Freeway Service Patrol	Provides rapid removal of disabled vehicles; joint project between SANDAG, Caltrans and California Highway Patrol to alleviate traffic congestion associated with non-recurring incidents, including oversight of weekend services.		Dec-25
San Diego Association of Governments	SAN04	I-15 FasTrak®	Expansion of FasTrak® system on I-15 in San Diego and Escondido to include electronic tolling equipment, operating system, toll operations office and customer service center.		Jul-19
San Diego Association of Governments	SAN11A	Regional Rideshare Program	Component of overall regional Transportation Demand Management.		Dec-25
San Diego Association of Governments	SAN13	Joint Transit Operations Center	Operations facility/control center to coordinate and integrate several Intelligent Transportation System (ITS) deployments; part of ITS regional architecture.		Dec-25
San Diego Association of Governments	SAN23	Mid-Coast LRT Corridor Project	Construct new 10.9-mile extension of the Trolley Blue Line with stations at Tecolote Road, Clairemont Drive, Balboa Avenue, Nobel Drive, Veterans Administration Medical Center, Pepper Canyon and Voigt Drive on the UC San Diego campus, Executive Drive, and Westfield UTC.	Sep-21	

Table N-6 TCM REPORT - SANDAG 2018 RTIP					
LEAD AGENCY	**PROJECT ID**	**PROJECT TITLE**	**PROJECT DESCRIPTION / STATUS**	**Open to Traffic Date[1]**	**Expected Close Out Date[1]**
San Diego Association of Governments	SAN26B	Downtown BRT Stations	Construct new and modify existing transit stations in downtown San Diego for Bus Rapid Transit (BRT) services.	Oct-16	
San Diego Association of Governments	SAN26C	SR 15 Bus Rapid Transit (BRT) Mid-City Centerline Stations	Construct two new BRT transit stations in the median of SR-15.	Feb-18	
San Diego Association of Governments	SAN29	Sorrento to Miramar Double Track/Realign	Realign curve and construct second main track; fully funds PE and design for both Phase 1 and Phase 2; construction for Phase 1 only.		Jun-25
San Diego Association of Governments	SAN30	San Dieguito Lagoon Double Track and Platform (part of Lump Sum SAN114)	Prepare final environmental document and design for 2.1 miles of second track and San Dieguito Bridge replacement Project includes construction of a special event platform at the Del Mar Fairgrounds.		Dec-25
San Diego Association of Governments	SAN46	Super Loop	New Rapid bus service, traffic signal priority measures, signalized intersections, street modifications, rapid bus vehicles, and enhanced transit stops.	Jun-12	

Table N-6 TCM REPORT - SANDAG 2018 RTIP					
LEAD AGENCY	**PROJECT ID**	**PROJECT TITLE**	**PROJECT DESCRIPTION / STATUS**	**Open to Traffic Date[1]**	**Expected Close Out Date[1]**
San Diego Association of Governments	SAN47	South Bay BRT	Rapid transit service from the I-805/Palomar Direct Access Ramp (DAR) to the Otay Mesa Border, including the construction of a guideway on East Palomar over SR 125, around Otay Ranch Town Center Mall and through the new Millenia development; construction of 7 new Rapid transit stations.	Mar-19	
San Diego Association of Governments	SAN54	ITS Operating	Implementation and deployment of Intelligent Transportation System (ITS) projects such as Intermodal Transportation Management System (IMTMS), 511 Advanced Traveler Information System; activities include data collection, dissemination, software upgrades.		Dec-25
San Diego Association of Governments	SAN64	Eastbrook to Shell Double Track	In Oceanside, design to add a new 0.6 mile section of double track, add new signals and replace the San Luis Rey River Bridge over San Luis Rey River.		Dec-19
San Diego Association of Governments	SAN70	Jewish Family Services - OTG Operating (part of Lump Sum SAN213)	Volunteer driver program that offers personal transportation to seniors and disabled in the North County Inland (NCI), Northern San Diego (NSD) and Eastern San Diego (ESD) areas - 3 projects.		Dec-25

Table N-6 TCM REPORT - SANDAG 2018 RTIP					
LEAD AGENCY	**PROJECT ID**	**PROJECT TITLE**	**PROJECT DESCRIPTION / STATUS**	**Open to Traffic Date[1]**	**Expected Close Out Date[1]**
Major Transit - LOSSAN Corridor	SAN73	San Elijo Lagoon Double Track	Install 1.5 miles of new double track, replace Bridge 240.4, reconfigure Control Point (CP) Cardiff with double crossovers, install new signals and drainage structures.		Oct-20
San Diego Association of Governments	SAN73A	Chesterfield Drive Crossing Improvements	Complete final design and construct at-grade crossing improvements including bike and pedestrian facilities, double track rail, signals, and safety improvements at Chesterfield Drive.		Oct-20
San Diego Association of Governments	SAN78	Mid-City Rapid Bus	Provide new Rapid Bus service including: consolidated transit stops, SR 15 transit plaza, synchronized traffic signals with extended green lights for buses, new low-floor vehicles, new shelters, improved waiting areas, real-time next-bus arrival signs, service frequency upgrade to every 10 minutes in the peak period, and every 15 minutes off-peak.	Oct-14	
San Diego Association of Governments	SAN80	TransNet Major Transit Corridor Operations	I-15 BRT, SuperLoop, Mid-City, South Bay BRT, Otay Mesa BRT and Mira Mesa BRT operating and maintenance costs.		Dec-25
San Diego Association of Governments	SAN90	Peninsula Shepherd Senior Center - Volunteer Drive Program (part of Lump Sum V16)	Provides door-through-door service and local shuttle van service for seniors living in the Peninsula communities.		Dec-21

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LEAD AGENCY	PROJECT ID	PROJECT TITLE	PROJECT DESCRIPTION / STATUS	Open to Traffic Date[1]	Expected Close Out Date[1]
San Diego Association of Governments	SAN92	Travelers Aid Society - SenioRide (part of Lump Sum V16)	Provides a menu of free transportation options to low-income clients ages 60 and up throughout San Diego County. This includes senior bus passes, taxicab vouchers, MTS Access and NCTD LIFT vouchers, and rides with volunteer drivers in private cars.		Jun-21
TSM - ITS/Traffic Signals	SAN94	I-15 Integrated Corridor Management Project (ICM)	I-15 Corridor in San Diego region is one of eight pioneer sites selected throughout the nation by US Department Of Transportation (DOT) for the ICM initiative; I-15 ICM project establishes an operational platform that will allow the transportation network to be operated in a more coordinated and integrated manner; project includes the integration of existing Intelligent Transportation System (ITS) platforms, development of a Decision Support System, and upgrades to the traffic signal synchronization network to a responsive system; provide for better management of traffic conditions along the I-15 corridor.		Jun-21

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LEAD AGENCY	**PROJECT ID**	**PROJECT TITLE**	**PROJECT DESCRIPTION / STATUS**	**Open to Traffic Date[1]**	**Expected Close Out Date[1]**
San Diego Association of Governments	SAN116	Oceanside Station Pass Through Track (part of Lump Sum SAN114)	Install third track at station to facilitate train passing and improve operations.		Dec-19
San Diego Association of Governments	SAN117	Poinsettia Station Improvements (part of Lump Sum SAN114)	Includes track reconfiguration, intertrack fence, reconstruction of pedestrian loading platforms, signals, and a new grade separated pedestrian crossing.		Jun-21
San Diego Association of Governments	SAN119	Sorrento Valley Double Track	Convert 1.1 miles of single-track to double-track, raise tracks to minimize flooding during storms, construct two new bridges, expand parking lot at Sorrento Valley Station, and install new signals - does not add additional transit service.		Jul-19
San Diego Association of Governments	SAN123	University Town Center (UTC) Transit Center	Off street transit center for existing Metropolitan Transit System (MTS) and North County Transit District (NCTD) for local and express service for SuperLoop, Mid-Coast and Bus Rapid Transit (BRT).		Dec-20
San Diego Association of Governments	SAN129	Downtown Multiuse and Bus Stopover Facility	Environmental certification and land acquisition for bus stopover facility and potentially a multi-use facility that could include office, residential and retail development.		Dec-23

Table N-6 TCM REPORT - SANDAG 2018 RTIP					
LEAD AGENCY	**PROJECT ID**	**PROJECT TITLE**	**PROJECT DESCRIPTION / STATUS**	**Open to Traffic Date[1]**	**Expected Close Out Date[1]**
San Diego Association of Governments	SAN130	Carlsbad Village Double Track (part of Lump Sum SAN114)	Conduct feasibility study of two rail trench alternatives; prepare final environmental document and 30 percent design for 1.0 miles of double track, a new bridge across Buena Vista Lagoon, and new signals.		Dec-20
San Diego Association of Governments	SAN131	Mira Mesa Blvd. Bus Rapid Transit Priority Treatments	Bus rapid transit priority treatments on Mira Mesa Blvd.		Dec-20
San Diego Association of Governments	SAN132	Elvira to Morena Double Track	Convert 2.6 miles of single-track to double-track and install new signals. Replace 1 mile of double track. Construct new/replacement bridges at MP 260.4, 259.6, 259.1, 258.6, and 257.2. Construct new water/sewer facilities for the City of San Diego between Friars Road and SR 52 - does not add additional transit service.		Jul-21
San Diego Association of Governments	SAN138	Renewing Life (part of Lump Sum V16)	Class D vehicle procurement.		Dec-19
San Diego Association of Governments	SAN144	Bayshore Bikeway Segments 4 and 5 (part of Lump Sum SAN147)	Construct 2.8 miles of new bike path with project design and construction separated into two phases consisting of Segment 4 from 32nd Street in San Diego to Vesta Street and Segment 5 from Vesta Street to National City Marina.		Jul-21

Table N-6 TCM REPORT - SANDAG 2018 RTIP					
LEAD AGENCY	**PROJECT ID**	**PROJECT TITLE**	**PROJECT DESCRIPTION / STATUS**	**Open to Traffic Date[1]**	**Expected Close Out Date[1]**
San Diego Association of Governments	SAN149	Coaster PE (part of Lump Sum SAN114)	Preliminary engineering and environmental studies for prioritization of Coaster improvement projects to better define future projects.		Dec-21
San Diego Association of Governments	SAN153	The Inland Rail Trail	Construct seven miles of new bike path. Construction is funded through phase 3 (3.0 miles in Vista). Phase 4 (Oceanside) will be constructed when funding is identified.		Jun-28
San Diego Association of Governments	SAN154	Bayshore Bikeway - Segment 8B (part of Lump Sum SAN147)	Design and construct 0.4 miles of new bikeway.		Aug-23
San Diego Association of Governments	SAN155	Coastal Rail Trail San Diego - Rose Creek (part of Lump Sum SAN148)	Construct 2.1 miles Class 1 shared use path.		Jan-24
San Diego Association of Governments	SAN156	Coastal Rail Trail - Encinitas (part of Lump Sum SAN148)	Environmental clearance, design and construction for 1.3 miles of bicycle facility.		Jul-22
San Diego Association of Governments	SAN158	North Park/Mid-City Bikeways: Robinson Bikeway (part of Lump Sum SAN227)	Complete final design and construct a 0.2-mile bikeway that consists of on-street bike facilities, traffic calming improvements, and an elevated shared-use path.		Dec-22
San Diego Association of Governments	SAN160	Uptown Bikeways: Fourth and Fifth Avenue Bikeways (part of Lump Sum SAN228)	Construct 4.5 miles of new on-street bikeways on Fourth and Fifth Avenues between B Street and Washington Street in the City of San Diego.		May-23

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LEAD AGENCY	**PROJECT ID**	**PROJECT TITLE**	**PROJECT DESCRIPTION / STATUS**	**Open to Traffic Date[1]**	**Expected Close Out Date[1]**
San Diego Association of Governments	SAN168	FACT Mobility Management (part of Lump Sum SAN214)	Maintain and expand FACT's existing mobility management services throughout San Diego County.		Dec-21
San Diego Association of Governments	SAN182	San Diego River Bridge (part of Lump Sum SAN114)	Construct 0.9 miles of double track and new bridge over the San Diego River.		Sep-21
San Diego Association of Governments	SAN183	Batiquitos Lagoon Double Track (part of Lump Sum SAN114)	Construct 0.8 miles of double-track and a new bridge over Batiquitos Lagoon - Construction funds are for first phase of project.		Sep-25
San Diego Association of Governments	SAN185	FACT - RideFact (part of Lump Sum V16)	Provide a "one stop" transportation solution for seniors and persons with disabilities to reach medical appointments and other related services through operating trip reimbursement.		Dec-21
San Diego Association of Governments	SAN189	St. Madeline Sophie's Center (SMSC) (part of Lump Sum SAN214)	Capital purchases of paratransit vehicles.		Dec-20
San Diego Association of Governments	SAN194	Mountain Health and Community (part of Lump Sum V16)	Volunteer driver program assists seniors and individuals with disabilities in accessing vital services and resources.		Dec-18
San Diego Association of Governments	SAN195	Bayshore Bikeway: Barrio Logan (part of Lump Sum SAN147)	Final design and construction of a new 2.1 mile bike path.		Jul-24

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LEAD AGENCY	**PROJECT ID**	**PROJECT TITLE**	**PROJECT DESCRIPTION / STATUS**	**Open to Traffic Date[1]**	**Expected Close Out Date[1]**
San Diego Association of Governments	SAN197	San Diego River Trail - Stadium Segment (part of Lump Sum SAN196)	Design and construct one mile of new bike path.		Dec-22
San Diego Association of Governments	SAN198	San Diego River Trail: Carlton Oaks Segment (part of Lump Sum SAN196)	Design 2 miles of new bike path including connection to Mast Park along San Diego River from West Hills to Carlton Hills Boulevard.		Dec-22
San Diego Association of Governments	SAN201	Airport Connection	Pedestrian improvements connecting the Middletown light rail station and the planned airport shuttle stop; includes street and sidewalk improvements, landscaping, lighting, signal modification, and curb return improvements.		Dec-18
San Diego Association of Governments	SAN203	Border to Bayshore Bikeway (part of Lump Sum SAN147)	Construct 8.5 miles of bikeway.		Jan-25
San Diego Association of Governments	SAN204	Central Avenue Bikeway (part of Lump Sum V12)	Design and construction of 1 mile of new bike path.		Jul-23
San Diego Association of Governments	SAN205	Pershing Bikeway (part of Lump Sum V12)	Design and construct 3 miles of new bike and pedestrian facilities.		Jul-23
San Diego Association of Governments	SAN206	Downtown to Imperial Avenue Bikeway (part of Lump Sum V12)	Design and construct 3.8 miles of urban on-street bikeways.		Jan-25
San Diego Association of Governments	SAN207	Coastal Rail Trail Encinitas: Chesterfield Drive to Solana Beach (part of Lump Sum SAN148)	Prepare final environmental document for 1.3 miles of bike facilities - on Highway 101 from Chesterfield Drive to north of Ocean Street (Solana Beach City Limit) in Encinitas.		Dec-20

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LEAD AGENCY	**PROJECT ID**	**PROJECT TITLE**	**PROJECT DESCRIPTION / STATUS**	**Open to Traffic Date[1]**	**Expected Close Out Date[1]**
San Diego Association of Governments	SAN208	Clairemont Mesa Blvd BRT Stations	traffic Signal Priority on Clairemont Mesa Boulevard and transit station improvements at eastbound Ruffin Road stop.		Dec-20
San Diego Association of Governments	SAN215	San Ysidro Health Center (SYHC) (part of Lump Sum SAN214)	TOP-HS is designed to provide demand-response transportation services for registered SYHC patients. Services are provided using in-house resources. Expansion of their existing fleet of paratransit vehicles.		Dec-20
San Diego Association of Governments	SAN217	Sharp Healthcare Foundation (part of Lump Sum SAN214)	Healthcare Patient Transportation Services - vehicle procurement.		Dec-20
San Diego Association of Governments	SAN218	Jewish Family Services (part of Lump Sum SAN214)	Vehicle Procurement.		Dec-20
San Diego Association of Governments	SAN224	I-805/SR 94 Bus on Shoulder Demonstration Project	Design and construct new freeway shoulder infrastructure on East Palomar, I-805 and SR 94; implement technology improvements within the corridor to support freeway bus operation; procurement of 16 new Compressed Natural Gas (CNG) buses. - no additional lanes.		Dec-23
San Diego Association of Governments	SAN229	North Park/Mid-City Bikeways: Landis Bikeway (part of Lump Sum SAN227)	Final design for 3 miles of bikeway consisting of on-street bike facilities and traffic calming improvements.		Jul-21

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LEAD AGENCY	**PROJECT ID**	**PROJECT TITLE**	**PROJECT DESCRIPTION / STATUS**	**Open to Traffic Date[1]**	**Expected Close Out Date[1]**
San Diego Association of Governments	SAN230	North Park/Mid-City Bikeways: Howard-Orange Bikeway (part of Lump Sum SAN227)	Final design for 3.7 miles of bikeway consisting of on-street bike facilities and traffic calming improvements.		Dec-20
San Diego Association of Governments	SAN232	North Park/Mid-City Bikeways: University Bikeway (part of Lump Sum SAN227)	Final design and construction for 2.5 miles of on-street protected bikeway, including multi-modal ADA accessible transit islands.		Dec-22
San Diego Association of Governments	SAN233	North Park/Mid-City Bikeways: Georgia-Meade Bikeway (part of Lump Sum SAN227)	Design 3.5 miles and construct 6.5 miles of urban bikeways including traffic calming improvements.		Jul-24
San Diego Association of Governments	SAN234	Uptown Bikeways: Eastern Hillcrest Bikeways (part of Lump Sum SAN228)	Design of 1.3 miles of on-street bikeway, including design and construction of the Normal Street Promenade.		Feb-22
San Diego Association of Governments	SAN235	Uptown Bikeways: Washington Street and Mission Valley Bikeways (part of Lump Sum SAN228)	Final design for 3.3 miles of on street bikeways.		Dec-20
San Diego Association of Governments	SAN236	Uptown Bikeways: Mission Hills and Old Town Bikeways (part of Lump Sum SAN228)	Final design of 1.8 miles of on-street bikeways.		Jul-21
San Diego Association of Governments	SAN237	Uptown Bikeways: Park Boulevard Bikeway (part of Lump Sum SAN228)	Design 0.4 miles of bikeway for Park and Robinson Intersection and connections to existing and future on-street bikeways.		Jul-23

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LEAD AGENCY	**PROJECT ID**	**PROJECT TITLE**	**PROJECT DESCRIPTION / STATUS**	**Open to Traffic Date[1]**	**Expected Close Out Date[1]**
San Diego Association of Governments	SAN238	North Park/Mid-City Bikeways: Monroe Bikeway (part of Lump Sum SAN227)	Complete Environmental Clearance for 1.3 miles of urban bikeways, including traffic calming improvements.		Dec-20
San Diego Association of Governments	SAN243	Travelers Aid Society - RideFinder (part of Lump Sum SAN213)	Provides Mobility Training.		Dec-21
San Diego Association of Governments	SAN244	MTS Vehicle Purchase (part of Lump Sum SAN214)	Purchasing Class B Vehicle.		Dec-21
San Diego Association of Governments	SAN251	The ARC of San Diego (part of Lump Sum SAN213)	Contracted transportation.		Dec-21
San Diego Association of Governments	SAN252	San Diego Center for the Blind (part of Lump Sum SAN214)	Class B vehicle procurement.		Dec-20
San Diego Association of Governments	SAN253	Comprehensive Multimodal Corridor Plan (CMCP) - Central Mobility Connections (part of Lump Sum V20)	In the San Diego Region a comprehensive integrated management plan for increasing transportation options, decreasing congestion, and improving travel times in the Central Mobility Station/I-5/Coronado & Downtown Connections Corridor. A CMCP includes all travel modes in a defined corridor - highways and freeways, parallel and connection roadways, public transit (bus, bus rapid transit, light rail, intercity rail) and bikeways.		Jun-24

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LEAD AGENCY	**PROJECT ID**	**PROJECT TITLE**	**PROJECT DESCRIPTION / STATUS**	**Open to Traffic Date[1]**	**Expected Close Out Date[1]**
San Diego Association of Governments	SAN254	Corridor System Management Plan - High Speed Transit/I-8 (part of Lump Sum V20)	In the San Diego Region, a comprehensive integrated management plan for increasing transportation options, decreasing congestion, and improving travel times in the High Speed Transit/I-8 Corridor. A CSMP includes all travel modes in a defined corridor - highways and freeways, parallel and connection roadways, public transit (bus, bus rapid transit, light rail, intercity rail) and bikeways.		Jun-24
San Diego Association of Governments	SAN255	Corridor System Management Plan (CSMP) - High Speed Transit/SR 56 (part of Lump Sum V20)	In the San Diego Region a comprehensive integrated management plan for increasing transportation options, decreasing congestion, and improving travel times in the SR 56 Corridor from I-5 to I-15. A CSMP includes all travel modes in a defined corridor - highways and freeways, parallel and connection roadways, public transit (bus, bus rapid transit, light rail, intercity rail) and bikeways.		Jun-24

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LEAD AGENCY	**PROJECT ID**	**PROJECT TITLE**	**PROJECT DESCRIPTION / STATUS**	**Open to Traffic Date[1]**	**Expected Close Out Date[1]**
San Diego Association of Governments	SAN256	Corridor System Management Plan - High Speed Transit/SR 125 (part of Lump Sum V20)	In the San Diego Region a comprehensive integrated management plan for increasing transportation options, decreasing congestion, and improving travel times along the SR 125 corridor from SR 905/SR 11 to SR 52. A CSMP includes all travel modes in a defined corridor - highways and freeways, parallel and connection roadways, public transit (bus, bus rapid transit, light rail, intercity rail) and bikeways.		Jun-24
San Diego Association of Governments	SAN258	Central Mobility Station	Environmental Analysis and Preliminary Engineering for Central Mobility Station and Airport Connectivity.		Jun-26
San Diego Association of Governments	SAN259	LOSSAN Corridor Improvements (part of Lump Sum SAN114)	Includes preliminary engineering, Project Study Reports (PSRs), design criteria and funding applications for complete corridor projects.		Jun-24
San Diego Association of Governments	SAN260	COASTER Train Sets	Two additional train sets to provide more frequent commuter rail service, including 30-minute peak period service.	May-24	
San Diego Association of Governments	SAN261	Palomar Street Rail Grade Separation	Final design for Rail Grade Separation.		Jun-25
San Diego Association of Governments	SAN262	Low-Floor Light Rail Transit Vehicles	Procurement of 47 LRVs to replace existing SD100 fleet to support minor service enhancements.		Jun-26

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LEAD AGENCY	**PROJECT ID**	**PROJECT TITLE**	**PROJECT DESCRIPTION / STATUS**	**Open to Traffic Date[1]**	**Expected Close Out Date[1]**
San Diego Association of Governments	SAN263	Smart Center - Concept of Operations	In San Diego - develop and implement an overall strategy and operational concept defining how SANDAG acquires, manages, analyzes and uses data to enhance operations, improve analytic capabilities for planning and policy development, and to inform critical business decisions.		Jun-23
San Diego Association of Governments	SAN264	Regional Electric Vehicle Charging Incentive Program	Partner with State and regional agencies to provide incentives to businesses, shopping centers, housing complexes, or local agencies to install electric vehicle charging stations with the goal of expanding the network of charging stations in the San Diego region and reducing greenhouse gas emissions from passenger vehicles.		Jun-28
San Diego Association of Governments	SAN265	Flexible Fleet Pilots	Plan, deploy, operate, and monitor flexible fleet pilot projects aimed to test new shared mobility services enabled by new technologies. Pilot areas will be identified that are an optimal testing environment for flexible fleet services, and different options such as microtransit and ridehailing will be considered.		Jun-23

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LEAD AGENCY	**PROJECT ID**	**PROJECT TITLE**	**PROJECT DESCRIPTION / STATUS**	**Open to Traffic Date[1]**	**Expected Close Out Date[1]**
San Diego Association of Governments	SAN269	Comprehensive Multi-Modal Corridor Plan (CMCP) - Region Wide Plan (part of Lump Sum V20)	In the San Diego Region, a comprehensive integrated management plan for increasing transportation options, decreasing congestion, and improving travel times in all corridors in the San Diego Region. A CMCP includes all travel modes - highways and freeways, parallel and connection roadways, public transit (bus, bus rapid transit, light rail, intercity rail) and bikeways. This project is focused on scoping efforts and developing work plans for all of the CMCPs in the grouped listing		Dec-22
San Diego Association of Governments	SAN270	Comprehensive Multimodal Corridor Plan (CMCP) - Airport to Airport Connection (part of Lump Sum V20)	In San Diego County, a comprehensive integrated management plan for increasing transportation options, decreasing congestion, and improving travel times between the San Diego International Airport and the Cross-Border Express. A CMCP includes all travel modes in a defined corridor - highways and freeways, parallel and connecting roadways, public transit (bus, bus rapid transit, light rail, intercity rail) and bikeways.		Dec-26

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LEAD AGENCY	**PROJECT ID**	**PROJECT TITLE**	**PROJECT DESCRIPTION / STATUS**	**Open to Traffic Date[1]**	**Expected Close Out Date[1]**
San Diego County	CNTY24	Cole Grade Road	Widen to accommodate 14-ft traffic lane in both direction, 12-ft center 2-way left turn, 6-ft bike lane & 10-ft pathway.	Jul-23	
San Diego County	CNTY81	Regional Traffic Signal Management	County of San Diego cost-share for the Regional Arterial Management System.		Jun-23
Active Transportation - Bike/Ped	CNTY87	County of San Diego - Active Transportation Plan (part of Lump Sum V12)	Prepare a comprehensive master plan and policy document for the unincorporated county area to guide the development and maintenance of active transportation infrastructure and supportive programs.		Dec-18
San Diego County	CNTY89	East Vista Way At Gopher Canyon Intersection Improvements	In the unincorporated Bonsall: this is a congested intersection leading into the Bonsall community and this improvement is on the Community Sponsor Group's priority list; adding turn lanes at this intersection.		Dec-19

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LEAD AGENCY	**PROJECT ID**	**PROJECT TITLE**	**PROJECT DESCRIPTION / STATUS**	**Open to Traffic Date[1]**	**Expected Close Out Date[1]**
San Diego County	CNTY93	Rock Springs Road SRTS Sidewalks and Bike Lanes (part of Lump Sum V14)	The project proposes to construct walkway and class II bicycle lane along the north side of Rock Springs Road from Highland Heights to Rock Springs Elementary School. The proposed walkways will be constructed of asphalt concrete. The project includes modifying the pedestrian ramps to ADA Standards Traffic signal and drainage facilities. The project proposes class III bike route on the south side of Rock Springs Road.		Dec-21
San Diego County	CNTY96	Casa De Oro - Campo Road Specific Plan (part of Lump Sum V10)	This project would develop a Specific Plan for the Campo Road corridor, including a form-based-code and design guidelines, would establish a framework to guide future private investment to transform the area into an inviting, compact, walkable and bikeable environment.		Dec-20
San Diego Metropolitan Transit System	MTS23A	Transit Service Operations	Operating support for Americans with Disabilities Act (ADA) and Paratransit bus service as well as Network Integration funding from TIRCP to create operating plans for new bus routes.		Dec-25

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LEAD AGENCY	**PROJECT ID**	**PROJECT TITLE**	**PROJECT DESCRIPTION / STATUS**	**Open to Traffic Date[1]**	**Expected Close Out Date[1]**
San Diego Metropolitan Transit System	MTS28	Bus & Rail Rolling Stock purchases and Rehabilitations	Purchase replacement buses, Replace Light Rail Vehicles, Procurement of materials and services for the rehabilitation or retrofit of mechanical components, electrical components, and coach bodies of Light Rail Vehicles and buses. MTS plans to use FY20 funding to purchase 7 40 foot buses in FY20, 43 40 foot buses in FY21, and 26 articulated buses in FY21. The FY20 funding will also go towards the SD100 LRV replacement, in which the 51 SD100 high-floor LRVs will be replaced with new Low-floor LRVs. It will also replace 30 ADA paratransit vehicles, as well as go towards the funding for the New MTS Transit Facility. There are also various state of good repair projects funded in FY20, such as the CPC Substations replacement, and rehabilitation/improvement of the Old Town Transit Center.		Dec-25

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LEAD AGENCY	PROJECT ID	PROJECT TITLE	PROJECT DESCRIPTION / STATUS	Open to Traffic Date[1]	Expected Close Out Date[1]
San Diego Metropolitan Transit System	MTS29	Bus and Fixed Guideways Station Stops and Terminals	Maintenance, improvements, upgrades, and retrofits of bus and trolley stations and stops throughout the MTS Service Area. FY20 projects include funding for an expansion of the Imperial Avenue transit center, pedestrian enhancements at American Plaza, and other improvements at the Rio vista trolley station.		Dec-26
San Diego Metropolitan Transit System	MTS30	Bus/Rail Support Facilities and Equipment	Projects Include an overhaul and replacement of the MTS fare system, other misc. capital equipment for transit maintenance; design and procurement of materials and services for support equipment such as hoists, fall protections, and building improvements/re-models for various MTS facilities.		Dec-26
San Diego Metropolitan Transit System	MTS31	Rail Electrification and Power	Programmed projects include Centralized Protection and Control (CPC) Substation Replacement.		Dec-26
San Diego Metropolitan Transit System	MTS32A	Preventive Maintenance	Maintenance of equipment, rolling stock, and facilities for bus and rail systems.		Dec-26
San Diego Metropolitan Transit System	MTS33A	Senior Disabled Program	Subsidy for senior and disabled as required by TransNet.		Dec-23

Table N-6 TCM REPORT - SANDAG 2018 RTIP					
LEAD AGENCY	**PROJECT ID**	**PROJECT TITLE**	**PROJECT DESCRIPTION / STATUS**	**Open to Traffic Date[1]**	**Expected Close Out Date[1]**
San Diego Metropolitan Transit System	MTS34	Bus Signal and Communications Equipment	Projects Include the overhaul and upgrade of the Regional Transit Management system for MTS vehicles. The bus and light rail communication hardware will be replaced, maintained, and upgraded.		Dec-26
San Diego Metropolitan Transit System	MTS35	Fixed Guideway Transitways/Lines	Bus and Rail infrastructure maintenance and upgrades including rail tie replacement, Beyer Blvd. track and slope repair, Track/hill work at the Enterprise wall. MTS was also awarded TIRCP discretionary funding for double crossovers on the blue line at Beech St, Middletown, and a double tracking at Imperial Avenue on the green line.		Dec-26
San Diego Unified Port District	PORT02	NCMT Rail Track Extension Project Design and Engineering Study	Perform a planning study for design and engineering work for the National City Marine Terminal Rail Track Extension Project.		Dec-21
San Diego, City of	SD09	Sidewalks - Citywide	Install new sidewalks (CIP 52-700/715, 59-002.0,37-064.0/ABE00001, AIK00001, AIK00003), including the addition of RTCIP funding to this project for the installation of sidewalks on streets included in the RAS: Genesee Ave, University Ave, and Balboa Ave.		Dec-25

Table N-6
TCM REPORT - SANDAG 2018 RTIP

LEAD AGENCY	PROJECT ID	PROJECT TITLE	PROJECT DESCRIPTION / STATUS	Open to Traffic Date[1]	Expected Close Out Date[1]
San Diego, City of	SD15	Street Lights	In San Diego, install new street lights. A-IH.00001(CIP 52-293.0, 61-201.0, 68-012.0)		Dec-25
San Diego, City of	SD16A	Traffic Signals - Citywide	Install new traffic signals with intersection street lighting systems, upgrade/modernize traffic signals, install protected/permissive traffic signal systems; traffic signal interconnect systems and upgrades Citywide (CIP A-IL.00003, A-IL.00002, A-IL.00004, A-IL.00005).		Dec-25
San Diego, City of	SD18	Traffic Control Measures	Traffic control and traffic calming measures (CIP 61-001.0 / AIL00001) including electronic speed signs, pedestrian hybrid beacons, rectangular rapid flashing beacons, traffic circles, and road humps.		Dec-25
San Diego, City of	SD97	School Traffic Safety Improvements	In San Diego, provide traffic control devices and pedestrian improvements. (AIK00002/L00010/L00011)		Dec-21
San Diego, City of	SD108	Bayshore Bikeway	In San Diego at the borders of Imperial Beach (13th Street) and Chula Vista (Main Street, design/construct Class I bike path. (581400,S-00944)		Jun-20

Table N-6 TCM REPORT - SANDAG 2018 RTIP					
LEAD AGENCY	**PROJECT ID**	**PROJECT TITLE**	**PROJECT DESCRIPTION / STATUS**	**Open to Traffic Date[1]**	**Expected Close Out Date[1]**
San Diego, City of	SD120	San Diego River Multi-Use Bicycle and Pedestrian Path	In San Diego on Hazard Center Drive under SR 163 - construct bicycle and pedestrian path on north side of San Diego River. (CIP 58-191.0; S00958)		Jun-19
San Diego, City of	SD129	University Avenue Mobility Project Phase 1	In San Diego, environmental studies, design and construction of improvement to University Avenue transit corridor in North Park improvements include installation of new medians for safety improvements, restriping, pedestrian popouts, new traffic signals, traffic signal modifications, enhanced pedestrian crossings and installation of a transit/bicycle/right turn only lane (augments Smart Growth Funding for this project in V10). (CIP S-00915)		Dec-20
San Diego, City of	SD141	Poway Road Bike Lane (part of Lump Sum V12)	In San Diego, install Class I bicycle lane along the south side. (CIP S-00943)		Jun-25
San Diego, City of	SD166	Minor Bicycle Facilities	Install Bicycle Facilities. (AIA00001)		Dec-25

Table N-6 TCM REPORT - SANDAG 2018 RTIP					
LEAD AGENCY	**PROJECT ID**	**PROJECT TITLE**	**PROJECT DESCRIPTION / STATUS**	**Open to Traffic Date[1]**	**Expected Close Out Date[1]**
San Diego, City of	SD188	Congestion Relief/Traffic Engineering Operations	Congestion relief efforts to include intersection lighting, traffic signal coordination, centrally controlled traffic signal optimization system, traffic data collection for performance monitoring; traffic calming in Smart Growth areas; and project development/preliminary engineering/corridor studies.		Jun-25
San Diego, City of	SD226	Old Otay Mesa Road Improvements	In San Diego on Old Otay Mesa Road between Crescent Bay Drive and Hawken Drive - provides for pedestrian improvements to include new sidewalks, curb, gutter, street lighting, traffic calming facilities. (S00870)		Jun-20
San Diego, City of	SD227	Morena Boulevard Station Area Study Phase 2 (part of Lump Sum V10)	This Project will support the Mid-Coast Trolley Line and the future development of the Project Area by encouraging mixed-use transit-oriented development surrounding the existing and planned trolley stations, and enhancing multi-modal connectivity and access for pedestrians, bicyclists, and transit riders.		Dec-18

Table N-6 TCM REPORT - SANDAG 2018 RTIP					
LEAD AGENCY	**PROJECT ID**	**PROJECT TITLE**	**PROJECT DESCRIPTION / STATUS**	**Open to Traffic Date[1]**	**Expected Close Out Date[1]**
San Diego, City of	SD234	Chollas Creek-Bayshore Bikeway (part of Lump Sum V14)	Final design and construction plans for 0.75 mile segment of multi-use path connecting from Southeastern San Diego along the Chollas Creek to the Bayshore Bikeway in Barrio Logan.		Jun-25
San Diego, City of	SD235	Torrey Pines Road Improvement Phase 2	In San Diego, on Torrey Pines Road between Hillside Drive and Amalfi Street, provides path of travel for pedestrians and bicyclists. (S15023)		Jun-20
San Diego, City of	SD237	Coastal Rail Trail	The Coastal Rail Trail (CRT) is a multi-jurisdictional project among the coastal cities of Oceanside, Del Mar, Carlsbad, Encinitas, Solana Beach and San Diego.(City CIP S00951)		May-28
San Diego, City of	SD238	San Ysidro Wayfinding Signs (part of Lump Sum V10)	The project includes the design and installation of wayfinding signs in the San Ysidro Port of Entry District to improve the area's mobility and respond to changes in the configuration of the Port of Entry.		Dec-19

Table N-6 TCM REPORT - SANDAG 2018 RTIP					
LEAD AGENCY	**PROJECT ID**	**PROJECT TITLE**	**PROJECT DESCRIPTION / STATUS**	**Open to Traffic Date[1]**	**Expected Close Out Date[1]**
San Diego, City of	SD241	Pacific Beach Greenways, Parks and Transit (part of Lump Sum V10)	The study effort will include the creation of public open spaces, multi-modal infrastructure improvements that improve safety for all modes of travel and expand beach access, improvements to the beach boardwalk, and integration of arts and culture in urban design.		Dec-19
San Diego, City of	SD243	14th Street Pedestrian Promenade Demonstration Block (part of Lump Sum V10)	Design and construction of the first block of the 14th Street Promenade adjacent to the San Diego Police Headquarters. The promenade would create an approximately 30-foot wide pedestrian promenade/linear park by eliminating a parking lane and narrowing two travel lanes.		Dec-18
San Diego, City of	SD245	Euclid+ Market Complete Streets project (part of Lump Sum V14)	Final design and construction of new and expanded sidewalks, new bike facilities, and added crosswalks, medians, and curb extensions to slow and calm traffic. (S16061)		Jun-25
San Diego, City of	SD246	Chollas Creek, Oak Park Branch Trail (part of Lump Sum V14)	Preliminary Engineering and Construction for a 2.3 mile multi-use recreation and active transportation trail with two bridges, informational kiosks, and stairs and fencing where needed.		Jun-25

Table N-6 TCM REPORT - SANDAG 2018 RTIP					
LEAD AGENCY	**PROJECT ID**	**PROJECT TITLE**	**PROJECT DESCRIPTION / STATUS**	**Open to Traffic Date[1]**	**Expected Close Out Date[1]**
San Diego, City of	SD249	Streamview Drive Improvements Phase 2	In San Diego on Streamview Drive from 54th and Lynn/Michael Street and Streamview Drive between Gayle Street and College Avenue- installation of new raised median, new sidewalk including curb and gutter, and traffic circles (CIP S-18000)		Jun-22
San Diego, City of	SD251	Market Street - Euclid to Pitta - Improvements	This project provides for sidewalks, curb ramps, bicycle facility improvements, and additional streetlights on Market Street between Euclid Avenue and Pitta Street. (S-16022)		Jun-23
San Diego, City of	SD252	University Avenue Complete Street Phase 1	Implement Complete Street measures including raised medians with pedestrian refuges, roundabouts, and wider sidewalks. (S-18001)		Jun-22
San Diego, City of	SD253	Clairemont Transit Oriented Development Design Concepts (part of Lump Sum V10)	Would create draft design concepts and draft policies for potential Transit Oriented Development (TOD) at SGOAs within Clairemont. Would illustrate potential streetscape designs, pedestrian, bicycle and transit improvements, transit hubs, and building form through 2D and 3D renderings and illustrations.		Dec-20

Table N-6
TCM REPORT - SANDAG 2018 RTIP

LEAD AGENCY	PROJECT ID	PROJECT TITLE	PROJECT DESCRIPTION / STATUS	Open to Traffic Date[1]	Expected Close Out Date[1]
San Diego, City of	SD254	College Area Smart Growth Study (CASGS) (part of Lump Sum V10)	Would identify, analyze and provide recommendations for nodes and corridors with smart growth development potential within the College Area community. Would result in draft land use scenarios for these smart growth opportunity areas (SGOAs), as well as mobility improvement concepts, urban design concepts, recommendations, and policies.		Dec-20
San Diego, City of	SD255	E Street Greenway Master Plan (part of Lump Sum V10)	Would develop a master plan for E Street Greenway, a linear park that will expand much needed open space in the City of San Diego's densest community and provide a safe pedestrian connection from the Gaslamp Quarter through the East Village neighborhood. The Greenway would contain widened pedestrian paths, enhanced landscaping and place-making opportunities.		Dec-20

Table N-6 TCM REPORT - SANDAG 2018 RTIP					
LEAD AGENCY	**PROJECT ID**	**PROJECT TITLE**	**PROJECT DESCRIPTION / STATUS**	**Open to Traffic Date[1]**	**Expected Close Out Date[1]**
San Diego, City of	SD256	Mira Mesa Transit Oriented Development Concept Plan (MMTOD CP) (part of Lump Sum V10)	Would produce a land use strategy to support transit/mobility hubs within the Sorrento Mesa and Miramar Road employment areas and the SGOAs along Mira Mesa Blvd./Black Mountain Road. Would consider higher densities, formulate policies, and provide urban design illustrations within the SGOAs.		Dec-20
San Diego, City of	SD257	University Community Smart Growth Concept Study (part of Lump Sum V10)	The University Community Smart Growth Concept Study will be used to support the basic principles of smart growth by building upon the community's role as a major employment, retail, education and housing center interconnected by an expanding regional transportation system. The project area includes many existing transit routes and the Mid Coast trolley to support a mix of higher intensity land uses including industrial and commercial employment and mid high density residential.		Dec-20
San Diego, City of	SD259	Move Free SD Education, Encouragement and Awareness Campaign (part of Lump Sum V17)	Move Free SD is an Education, Encouragement and Awareness Campaign to increase pedestrian, transit, and bicycle mode share in the City of San Diego.		Dec-19

Table N-6 TCM REPORT - SANDAG 2018 RTIP					
LEAD AGENCY	**PROJECT ID**	**PROJECT TITLE**	**PROJECT DESCRIPTION / STATUS**	**Open to Traffic Date[1]**	**Expected Close Out Date[1]**
San Diego, City of	SD260	Downtown Mobility Cycle Way Improvement Phase I and II (part of Lump Sum V10)	This project will improve bicycle infrastructure in downtown San Diego. The project scope includes street resurfacing, traffic striping, construction of 2.67 miles of Class IV (Cycle Track) which include curb ramps, raised median, angled parking conversion, and signal modification for bicycle signals		Dec-21
San Diego, City of	SD261	Downtown San Diego Wayfinding Signage - Cycle Network (part of Lump Sum V10)	The project includes the installation new wayfinding signs that complements the recently completed downtown wayfinding system. It will include adding signage for the new cycle network to be installed throughout downtown. The Project will facilitate an experience that will promote cycling and provide directional and destination signage for residents, visitors, and workers to access the new cycle network.		Dec-22

Table N-6
TCM REPORT - SANDAG 2018 RTIP

LEAD AGENCY	PROJECT ID	PROJECT TITLE	PROJECT DESCRIPTION / STATUS	Open to Traffic Date[1]	Expected Close Out Date[1]
San Diego, City of	SD262	East Village Green Park Phase 1 (part of Lump Sum V10)	East Village Green Park is a proposed 4.1 acre multi-block community park located in the East Village Neighborhood of Downtown. Phase 1 improvements consist of 1.2 acres of new parkland including a community center, 2 cafes, children's play area, performance pavilion, open lawn, games area, interactive fountain, dog park and the relocation of two locally historic buildings.		Dec-22
San Marcos, City of	SM49	Palomar Station Pedestrian Bridge #88511	Design and construction of a 100 foot long pedestrian bridge over West Mission Road: bridge will link the Palomar Sprinter station with the Palomar College Transit Center.		Dec-21
San Marcos, City of	SM54	Citywide Traffic Signals - RAMS	RAMS Traffic Signals.		Jul-26
San Marcos, City of	SM63	Rancho Santa Fe & Grandon Traffic Signal Modification	This project will modify traffic signals at the intersection of Rancho Santa Fe and Grandon by replacing traffic signal poles and mast arms. ADA improvements include the installation of a new crosswalk, an APS system, pedestrian signal heads, push buttons and pedestrian ramps. New vehicle detection loops.		Jan-23

Table N-6 TCM REPORT - SANDAG 2018 RTIP					
LEAD AGENCY	**PROJECT ID**	**PROJECT TITLE**	**PROJECT DESCRIPTION / STATUS**	**Open to Traffic Date[1]**	**Expected Close Out Date[1]**
San Marcos, City of	SM64	San Marcos Blvd. Reconstruction #ST005	This project includes the reconstruction of San Marcos Blvd. from Grand Ave. to Rancho Santa Fe Rd., including the removal and replacement of deteriorated pavement, removal of pavers at intersections, the installation of new signals throughout the corridor, updated pedestrian ramps for ADA compliance, and the repair and replacement of damaged and uplifted curbs, gutters and uplifted sidewalks.		Jun-25
San Marcos, City of	SM66	San Marcos Blvd. Intersection Improvements	The project includes level of service improvements to San Marcos Blvd. at the intersections of Twin Oaks Valley Rd. and Via Vera Cruz to decrease the wait times at each signal.		Oct-19
Santee, City of	SNT04	Pavement Repair and Rehabilitation	Reconstruction and rehabilitation in the form of removal and replacement of existing pavement sections 2 inches minimum, 1.5 inch minimum overlay, pedestrian ramps, sidewalk improvements, and drainage improvements as part of the rehabilitation improvements.		Sep-25

Table N-6 TCM REPORT - SANDAG 2018 RTIP					
LEAD AGENCY	**PROJECT ID**	**PROJECT TITLE**	**PROJECT DESCRIPTION / STATUS**	**Open to Traffic Date[1]**	**Expected Close Out Date[1]**
Santee, City of	SNT20	Regional Arterial Management System	The project gives the ability to coordinate signal plan development across jurisdictional boundaries with a common time source and a common platform to build an integrated corridor management system; this will include software maintenance, hardware maintenance, and communication infrastructure through the Regional Arterial Management System (RAMS).		Jun-25
Santee, City of	SNT23	Transportation Improvement Master Plan Implementation; CIP 2013-54	Citywide improvements to existing traffic signals, communication systems, surveillance cameras and other improvements pursuant to the recommendations of the City's Transportation Improvement Master Plan; includes upgrading the existing obsolete signal traffic controllers and installation of traffic signal inter-connection cabling in order to conform to the San Diego Regional Standards thereby improving signal operations.		Jun-24

Table N-6 TCM REPORT - SANDAG 2018 RTIP					
LEAD AGENCY	**PROJECT ID**	**PROJECT TITLE**	**PROJECT DESCRIPTION / STATUS**	**Open to Traffic Date[1]**	**Expected Close Out Date[1]**
Santee, City of	SNT24	Riverwalk Crossing (part of Lump Sum V17)	The project will install new concrete bulbouts, pedestrian ramps, pedestrian warning signage, a new ladder crosswalk and enhanced area lighting. It will also add parking lanes to narrow the lanes and add sharrows down the length of the project.		Apr-18
Santee, City of	SNT26	SR-67 Improvements/Woodside Avenue Interchange Improvements	This project proposes to improve traffic circulation at the intersection of Woodside Avenue at State Route 67 and make a sidewalk connection to North Woodside Avenue. It includes replacing the stop sign controlled intersection with medians, sidewalks, roundabout and/or other traffic signal improvements. The project will also require improvements within the Caltrans right-of-way on the State Route 67 off-ramp.		Dec-21
Santee, City of	SNT29	Prospect Avenue and Mesa Road Intersection Improvements (part of Lump Sum V17)	This project will modify the intersection by rebuilding the northeast, southeast, and southwest corners of the intersection. It will improve visibility, reduce pedestrian crossing distance, add a bicycle connection, and improve safety at the school crossing.		Dec-22

Table N-6 TCM REPORT - SANDAG 2018 RTIP					
LEAD AGENCY	**PROJECT ID**	**PROJECT TITLE**	**PROJECT DESCRIPTION / STATUS**	**Open to Traffic Date[1]**	**Expected Close Out Date[1]**
Solana Beach, City of	SB19	Lomas Santa Fe Active Transportation Improvements (part of Lump Sum V17)	The project provides enhanced bicycle, pedestrian, and traffic calming improvements including: bulb-outs, ADA push buttons, curb ramps, high visibility crosswalks, sidewalks, pedestrian scale lighting, pocket park, multi-use path, roundabouts, buffered bicycle lanes, green bike lanes through conflict zones, landscaped medians, increased on - street parking and parking buffers.		Dec-20

Table N-6 TCM REPORT - SANDAG 2018 RTIP					
LEAD AGENCY	**PROJECT ID**	**PROJECT TITLE**	**PROJECT DESCRIPTION / STATUS**	**Open to Traffic Date[1]**	**Expected Close Out Date[1]**
Solana Beach, City of	SB20	Glencrest Drive at Lomas Santa Fe Reconstruction	In Solana Beach, this is a reconstruction of Glencrest Drive at the intersection with Lomas Santa Fe Drive to eliminate the abrupt descent at the cross gutter and within the crosswalk, which will improve the operation and safety for pedestrians and vehicles. The reconstruction will upgrade the pedestrian crossing to meet ADA requirements, including new pedestrian ramps. Sidewalks will be extended approx. 50 ft. on each side up Glencrest Drive. The roadway approaching Lomas Santa Fe Drive will be reconstructed and overlaid with 1" to improve safety and operation of vehicles entering the intersection. The project ends approximately 90-feet north of Lomas Santa Fe Drive.		Sep-19

Table N-6
TCM REPORT - SANDAG 2018 RTIP

LEAD AGENCY	PROJECT ID	PROJECT TITLE	PROJECT DESCRIPTION / STATUS	Open to Traffic Date[1]	Expected Close Out Date[1]
Vista, City of	VISTA46	Annual Street Construction and Overlay CIP8225	Repair/rehabilitate distressed pavement and resurface streets identified as high priority in Pavement Management System; improvements include replacement of damaged curb & gutter, sidewalk, storm drain culverts; all required upgrades such as installation or replacement of curb ramps and traffic signs; all surface preparation such as dig-outs, crack sealing, cold milling, and leveling course; all adjustments such as shoulder grading, traffic signal loop replacement, manhole adjustments, striping, and survey monuments.		Dec-25
Vista, City of	VISTA54	Paseo Santa Fe Phase II (part of Lump Sum V10)	A complete and livable streets revitalization project that includes a road diet that will reduce the street width from five lanes to two lanes; install new curbs, gutters, and enhanced sidewalks; construction of roundabouts at key intersections; and, install decorative elements such as landscaping, street lights, street signs, and pedestrian furniture; SANDAG approved TransNet/ATP swap on October 23, 2015.		Dec-20

Table N-6 TCM REPORT - SANDAG 2018 RTIP					
LEAD AGENCY	**PROJECT ID**	**PROJECT TITLE**	**PROJECT DESCRIPTION / STATUS**	**Open to Traffic Date[1]**	**Expected Close Out Date[1]**
Vista, City of	VISTA55	Pedestrian Mobility Sidewalks - CIP 8290	Construct sidewalks along streets that are improved with curb and gutter and missing sections of sidewalk; priority will be given to areas with high pedestrian traffic or ADA-access issues		Dec-25
Vista, City of	VISTA56	Traffic Congestion Management Program - CIP 8294	The Traffic Congestion Management Plan identifies congested streets and intersections and recommended short-term and long-term/large scale projects to target traffic congestion relief. The short-term projects include traffic signal retiming, traffic signal interconnect in the northern half of the City and the implementation of a traffic measurement system to monitor congestion on City streets.		Dec-25
Vista, City of	VISTA57	Vista Village Drive Pedestrian Overpass Study CIP8305	Study examines a potential pedestrian bridge that would connect the Vista Village Shopping Center to the Vista Transit Center. The bridge would provide an alternate route for pedestrians to minimize traffic congestion at the existing intersection in the are of Olive Avenue/Vista Village Drive/Santa Fe Avenue.		Jun-25

Table N-6 TCM REPORT - SANDAG 2018 RTIP					
LEAD AGENCY	**PROJECT ID**	**PROJECT TITLE**	**PROJECT DESCRIPTION / STATUS**	**Open to Traffic Date[1]**	**Expected Close Out Date[1]**
Vista, City of	VISTA58	Paseo Santa Fe Phase III (part of Lump Sum V10)	Paseo Santa Fe Phase III is an infrastructure and street scape project located in Vista's Town Center on South Santa Fe Avenue. It is a complete and livable streets revitalization project that includes a road diet removing 3 lanes of traffic to reduce speeds and improve multi-modal mobility with enhanced sidewalks and new curbs and gutters; a roundabout; and pedestrian elements such as lighting, furniture, and street signs.		Dec-21
Vista, City of	VISTA59	Townsite Complete Street Project (part of Lump Sum V14)	This project will transform Townsite Drive and W. Los Angeles Drive to a complete street accommodating all users by constructing sidewalks, traffic circles, curb extensions, bike lanes, Sharrows and high visibility crosswalks. The project will also construct curb extensions, high visibility crosswalk, green bike lane extensions through intersections and two mid block pedestrian traffic signals on N. Santa Fe Avenue between California Avenue and Bobier Drive.		Jul-22
Vista, City of	VISTA60	City of Vista Vehicle Procurement (part of Lump Sum SAN214)	Procurement of 1 Class A, 1 Class B and 1 Class C Vehicles for Senior Transportation.		Dec-21

Table N-6 TCM REPORT - SANDAG 2018 RTIP					
LEAD AGENCY	**PROJECT ID**	**PROJECT TITLE**	**PROJECT DESCRIPTION / STATUS**	**Open to Traffic Date[1]**	**Expected Close Out Date[1]**
Endnotes:					
1- Open to traffic dates are shown for non-exempt projects and project close-out dates are shown for exempt projects.					

ATTACHMENT O
CONTINGENCY MEASURES FOR SAN DIEGO COUNTY

O.1 BACKGROUND

Clean Air Act sections 172(c)(9) and 182(c)(9) require attainment plans to provide for contingency measures, defined in section 172(c)(9) as "specific measures to be undertaken if the area fails to make reasonable further progress, or to attain the national primary ambient air quality standard by the attainment date…" U.S. EPA guidance[189] has stated that contingency measures should represent approximately one-year's worth of progress, amounting to reductions of approximately three percent of the baseline emissions inventory for the nonattainment area. That said, U.S. EPA has accepted a smaller amount of reductions in certain circumstances, where warranted.

The September 2016 decision by the U.S. Court of Appeals for the Ninth Circuit in *Bahr v. U.S. Environmental Protection Agency*[190] (*Bahr*) determined that the U.S. EPA had erred in approving an already-implemented contingency measure for a nonattainment area in Arizona, thereby rejecting U.S. EPA's longstanding interpretation of CAA Section 172(c)(9) that states may rely on already-implemented measures. U.S. EPA staff has interpreted this decision to mean that contingency measures must include a future action triggered by a failure to attain or failure to meet an RFP milestone.

For San Diego County, the following two complementary elements fully address the contingency measure requirements of the CAA as interpreted by U.S. EPA in response to *Bahr*:

1. A contingency measure that specifies new actions that the State and/or District will take if triggered by a finding that San Diego County failed to meet an RFP milestone or failed to attain the standard by the applicable attainment date. (Section O.2)

2. Demonstration of how surplus VOC and NOx emissions reductions that are expected to occur due to ongoing State mobile source control programs in San Diego County, together with the emissions reductions from the District's triggered contingency measure, provide for approximately one year's worth of progress in the years following RFP milestone and attainment years. (Section O.4)

O.2 DISTRICT CONTINGENCY MEASURE

The District's contingency measure for this Attainment Plan is listed Table O-1 and addresses the existing exemption for small containers (volume of one liter or less) in District Rule 67.0.1 (Architectural Coatings). Specifically, the District will pursue rule amendments to add a contingency provision that, if triggered, would remove or otherwise nullify the exemption for certain coatings sold in small containers. This rule provision would be implemented only if the EPA were to issue a final rulemaking that triggers the requirement for contingency measure implementation in the San Diego region. Should this contingency measure be triggered, an estimated 0.72 tons per day of VOC emission reductions would be realized in the region.

TABLE O-1
District Contingency Measure,
2008 and 2015 Ozone NAAQS

Contingency Measure and Trigger Mechanism	Adoption Date	Dates where applicable
Remove Exemption (b)(4) in APCD Rule 67.0.1. ***Summary:*** APCD would require architectural coatings sold in containers with volumes of one liter (1.057 quart) or less, to comply with Rule 67.0.1 emission standards, if the contingency measure is triggered. ***Process:*** The proposed amendment will be subject to a public review process and subsequent Air Pollution Control Board for approval. Upon adoption, the amended rule will be submitted to the EPA (through CARB) for inclusion into the SIP. ***Applicability:*** The measure will concurrently satisfy the contingency measure requirement for the District's 2016 San Diego County Moderate Attainment Plan for the 2008 ozone NAAQS, as well as foregoing 2020 San Diego County Severe Attainment Plan for the 2008 and 2015 ozone NAAQS.	No later than December 31, 2020	If and only when the EPA makes a finding that San Diego County has failed to satisfy a regulatory requirement necessitating implementation of the measure (e.g. failure to attain either ozone standard by 2026 or 2032.) The applicable section will be triggered without additional Board action needed.

O.2.1 District Contingency Measure Emission Reductions

On April 16, 2020, the San Joaquin Valley APCD Governing Board unanimously approved an amendment to Rule 4601 (Architectural Coatings), incorporating a triggered contingency measure to satisfy CAA requirements in their 2016 Attainment Plan for the 2008 ozone NAAQS. Among other revisions, Rule 4601's contingency measure would, upon being triggered, remove the exemption for certain architectural coating categories in containers smaller than one liter. The provision is triggered should the EPA issue a final rulemaking necessitating implementation of the contingency measure for the 2008 ozone NAAQS, at which point specified coatings sold in small containers must then have to meet VOC emission limits for applicable coating categories. San Joaquin Valley APCD estimated the contingency measure would achieve 0.65 tons per day of VOC emission reductions in their region if triggered.[191]

The District envisions adopting a similar contingency measure to the San Joaquin Valley APCD contingency measure now found in Rule 4601. Similar to the coating categories included in Rule 4601's contingency measure, the District is preliminarily focusing on the following coating categories in Rule 67.0.1, as found in Table O-2:

TABLE O-2
Architectural Coating Categories In Rule 67.0.1 That May Be Subject To District Contingency Measure

Architectural Coating Categories		
Bituminous Roof Coatings	Pre-Treatment Wash Primers	Swimming Pool Coatings
Flat and Nonflat Coatings sold in containers greater than eight fluid ounces	Reactive Penetrating Sealers	Tub and Tile Refinishing Coatings
Magnesite Cement Coatings	Shellacs (Clear and Opaque)	Wood Coatings, including Lacquers, Varnishes, and Sanding Sealers
Multi-color Coatings	Stone Consolidants	Wood Preservatives

The District utilized the same methodology as San Joaquin Valley APCD in determining the possible emission reductions from this contingency measure. In 2014, CARB conducted an Architectural Coating Survey. The results of this survey were included in CARB's 2019 Staff Report for Proposed Updates to the Suggested Control Measure for Architectural Coatings.[192] This survey determined that 23.8% of statewide VOC emissions from Architectural Coatings come from coatings packaged in containers with a volume of one liter (1.057 quarts) or less. In San Diego County, the emissions inventory for architectural coatings is 9.24 tons of VOC per day in 2020,[193] and is projected to increase in the future along with expected population increases in the region. Of the total 9.24 tons of VOC per day, an estimated 23.8%, or 2.20 tons of VOC per day, originate from coatings sold in small containers.

Based on the information available from the 2014 CARB survey, the statewide small container emissions from coating categories for which the District envisions proposing to remove the small container exemption account for a minimum 31.6% of total small container emissions, as outlined in Table O-3 below:

(CONTINUED ON NEXT PAGE)

TABLE O-3
CARB Architectural Coatings Survey Data

Coating Category District Targeting to Include in Rule 67.0.1 Contingency	Statewide VOC Emissions (tons per day)	Percentage of Small Container Emissions
Wood Coatings	1.64	23%
Bituminous Roof Coatings	Protected Data	-
Magnesite Cement Coatings	Protected Data	-
Multi-Color Coatings	Protected Data	-
Pre-Treatment Wash Primers	Protected Data	-
Stone Consolidants	Protected Data	-
Swimming Pool Coatings	Protected Data	-
Wood Preservatives	Protected Data	-
Flat Coatings	0.05	1%
Non-Flat Coatings	0.58	8%
Total of statewide small container emissions	**2.27**	**31.6%**

Therefore, if triggered, the contingency measure would reduce emissions from architectural coatings by at least 7.5% (23.8% VOC emissions from small containers multiplied by 31.6% reduction from contingency measure) from the baseline emissions inventory. It is important to note that this is a conservative calculation, as many coating categories emissions information is unavailable due to being protected data.

O.2.1.1 2008 Ozone NAAQS

The District's predicted attainment year for the 2008 ozone NAAQS is 2026. The projected emissions inventory for architectural coatings in 2026 in San Diego County is 9.63 tons of VOC per day (see Attachment A, Table A-3). Consequently, should the District fail to attain the 2008 ozone NAAQS, this contingency measure would reduce VOC emissions from Architectural Coatings in the District by at least 0.72 tons of VOC per day (9.64 tons of VOC per day multiplied by 7.5%).

O.2.1.2 2015 Ozone NAAQS

The District's predicted attainment year for the 2015 ozone NAAQS is 2032. The projected emissions inventory for architectural coatings in 2032 in San Diego County is 9.98 tons of VOC per day (see Attachment A, Table A-3). Consequently, should the District fail to attain the 2015 ozone NAAQS, this contingency measure would reduce VOC emissions from Architectural Coatings in the District by at least 0.74 tons of VOC per day (9.98 tons of VOC per day multiplied by 7.5%). However, because this Attainment Plan applies to two ozone standards, the District will utilize the most conservative analysis for contingency measure reductions, and assume the measure will reduce 0.72 tons of VOC per day (as calculated in Section O.2.1.1, if triggered for either ozone standard.

O.3 POSSIBLE FUTURE LOCAL CONTINGENCY MEASURE(S) UNDER EVALUATION

Because of concurrent ozone standards, it is possible that additional contingency measures might be necessary in the future. If so, the District commits to work with CARB and EPA to ensure the adoption and submittal of an additional feasible contingency measure as a SIP revision to ensure Clean Air Act requirements are met. Potential selection of an additional local contingency measure (if necessary) would be based on considerations such as emission reduction potential, cost-effectiveness, and other environmental, economic, legal, social, technological, and energy factors prevailing in the region.

O.4 Emissions Reductions from the State Mobile Source Control Program

The final element for San Diego County is a demonstration of the surplus emissions reductions benefits from implementing California's mobile source program. An inventory analysis serves the purposes of demonstrating there are emissions reductions in the baseline mobile source inventory beyond what is needed for RFP and attainment that, together with anticipated reductions from newly adopted regulatory measures and the District's triggered contingency measure, provide for approximately one year of progress.

Included in Tables O-4 and O-5 are calculations demonstrating that there are emissions reductions from mobile sources in the baseline inventory for San Diego County, surplus to those needed for RFP in all milestone years for the 2008 ozone standard (75 ppb) and 2015 ozone standard (70 ppb).

TABLE O-4
San Diego County 2008 Ozone NAAQS (75 ppb) RFP Contingency Reductions
(tons per day, reductions calculated on summer planning inventory)

	2017	2020	2023	2026
VOC Reductions Used for RFP	17.4%	21.7%	25.1%	27.0%
NOx Reductions Used for RFP	0.6%	5.3%	10.9%	18.0%
Total NOx Reductions since 2011	30.5%	39.3%	48.7%	51.6%
Surplus NOx Reductions Available for RFP Contingency	29.8%	34.0%	37.8%	33.6%

Note: Numbers may not add up due to rounding

TABLE O-5
San Diego County 2015 Ozone NAAQS (70 ppb) RFP Contingency Reductions
(tons per day reductions calculated on summer planning inventory)

	2023	2026	2029	2032
VOC Reductions Used for RFP	9.3%	11.7%	13.0%	13.9%
NOx Reductions Used for RFP	8.7%	15.3%	23.0%	31.1%
Total NOx Reductions since 2017	26.3%	30.4%	33.3%	35.5%
Surplus NOx Reductions Available for RFP Contingency	17.6%	15.1%	10.3%	4.3%

Note: Numbers may not add up due to rounding

Tables O-6 and O-7 document the emissions reductions that occur after the relevant attainment years due to implementation of California's mobile source program.

TABLE O-6
San Diego County 2008 Ozone NAAQS (75 ppb) Attainment Contingency Reductions
(tons per day reductions calculated on summer planning inventory)

	2011: Total Emissions	2026: Mobile Source Emissions	2027: Mobile Source Emissions	2026 to 2027 Mobile Source Emissions Reductions	Mobile Source Reductions as Percent of 2011 Total Emissions
VOC	136.6	37.5	36.6	0.8	0.6%
NOx	110.7	47.8	47.0	0.8	0.7%
Percent Reductions in Post-Attainment Year Available for Attainment Contingency					1.4%

TABLE O-7
San Diego County 2015 Ozone NAAQS (70 ppb) Attainment Contingency Reductions
(tons per day reductions calculated on summer planning inventory)

	2017: Total Emissions	2032: Mobile Source Emissions	2033: Mobile Source Emissions	2032 to 2033 Mobile Source Emissions Reductions	Mobile Source Reductions as Percent of 2017 Total Emissions
VOC	112.9	33.1	32.7	0.4	0.4%
NOx	77.0	44.0	43.7	0.3	0.4%
Percent Reductions in Post-Attainment Year Available for Attainment Contingency					0.8%

In addition to the reductions detailed in Tables O-6 and O-7, emissions reductions will also occur from recently – and soon-to-be-adopted – CARB SIP measures that are not yet reflected in the emissions inventory. These regulatory efforts include: (1) the Advanced Clean Trucks Regulation, (2) the Heavy-Duty Low-NOx Standard, and (3) the Heavy-Duty

Inspection and Maintenance Program. Together, these new regulations are expected to contribute an additional 2 tons per day of NOx reductions in 2027, and 3 tons per day of NOx reductions in 2033.

O.5 SUMMARY

Reductions from CARB's mobile source program, coupled with the reductions expected from the Architectural Coatings District measure, if triggered, provide for approximately one year of progress in the years following the attainment years. These ongoing reductions from CARB's mobile source program provide the context in which the triggered District contingency measure is adequate to meet RFP and attainment contingency requirements for the 2008 and 2015 ozone NAAQS and correct any violation that might prompt their implementation. Therefore, the District concludes that the contingency measure element included in these Attainment Plans for the 2008 and 2015 ozone NAAQS satisfies CAA Sections 172(c)(9) and 182(c)(9) for San Diego County.

ATTACHMENT P
FEDERAL CLEAN AIR ACT REQUIREMENTS AND REFERENCE IN ATTAINMENT PLAN

Table P-1
Federal Clean Air Act Requirements and Reference in Attainment Plan

Requirement	Federal CAA Section	Applicability 2008 Ozone NAAQS (Severe)	Applicability 2015 Ozone NAAQS (Severe)
Emission Inventory	Subpart 1 §172(c)(3) Subpart 2 §182(a)(1)	Sections 2.1, 3.1, and Attachment A	Sections 2.1, 4.1, and Attachment A
Reasonably Available Control Measures (RACM)	Subpart 1 §172(c)(1) Subpart 2 §182(b)(2)	Section 3.2.1 and Attachments G, H, I, and J	Section 4.2.1 and Attachments G, H, I, and J
Control Strategy & Other Measures	Subpart 1 §172(c)(6)	Section 1.2, 2.4 and Attachments D and E	Section 1.2, 2.4 and Attachments D and E
Attainment Demonstration	Subpart 2 §182(c)(2)(A) Subpart 2 §182(d)	Section 3.3 and Attachments K, L, and M	Section 4.3 and Attachments K, L, and M
Reasonably Further Progress (RFP) & Milestones	Subpart 1 §172(c)(2) Subpart 2 §182(c)(2)(B) Subpart 2 §182(g)	Section 3.2.2	Section 4.2.2
Contingency Measures	Subpart 1 §172(c)(9)	Section 3.4 and Attachment O	Section 4.4 and Attachment O
General Conformity	Subpart 1 §176(c)	Sections 2.1.3.1 and 2.1.3.2	Sections 2.1.3.1 and 2.1.3.2
Transportation Conformity	Subpart 1 §176(c)	Section 3.1.2	Section 4.1.2
Vehicle Miles Traveled (VMT) Offset	Subpart 2 §182(d)(1)(A)	Section 3.1.3 and Attachment N	Section 4.1.3 and Attachment N
New Source Review (NSR)	Subpart 1 §172(c)(5) Subpart 1 §173 Subpart 2 §182(d)(2)	Section 2.3	Section 2.3
Emission Statements	Subpart 2 §182(a)(3)(B)	Section 2.2	Section 2.2
Vehicle Inspection / Maintenance (I/M) Programs	Subpart 2 §182(b)(4) Subpart 2 §182(c)(3)	Section 3.1	Section 4.1
Clean Fuels Fleet Program	Subpart 2 §182(c)(4)	Section 3.1	Section 4.1

Requirement	Federal CAA Section	Applicability 2008 Ozone NAAQS (Severe)	Applicability 2015 Ozone NAAQS (Severe)
Enhanced (Ambient) Monitoring	Subpart 2 §182(c)(1)	Section 3.1	Section 4.1
Transportation Controls	Subpart 2 §182(c)(5)	Section 3.1.2 and Attachment N	Section 4.1.2 and Attachment N
NOx Requirements	Subpart 2 §182(f)	Encompassed with Sections 1.2, 2.1, 2.3, 2.4, 3.1, 3.2.1, and Attachments A, D, G, H, I, and J	Encompassed with Sections 1.2, 2.1, 2.3, 2.4, 4.1, 4.2.1, and Attachments A, D, G, H, I, and J
Penalty Fee Program Requirements	Subpart 2 §185	Section 3.2.3	Section 4.2.3
Reasonably Available Control Technology (RACT)	Subpart 2 §182(b)(2)	See *"2020 Reasonably Available Control Technology Demonstration for the National Ambient Air Quality Standards for Ozone in San Diego County"* under separate cover	See *"2020 Reasonably Available Control Technology Demonstration for the National Ambient Air Quality Standards for Ozone in San Diego County"* under separate cover

ATTACHMENT Q
ENDNOTES

[1] Federal Clean Air Act requirements are codified, as amended, in the U.S. Code at 42 U.S.C. Sections 7401, et seq.
[2] An attainment year is the latest calendar year to achieve the requisite emission reductions to attain the standard, and not the statutory attainment date. For example, the statutory attainment date for the 2008 ozone NAAQS is July 20, 2021, but attainment must be demonstrated with projected emissions reductions in the prior year (2020).
[3] A comprehensive overview of State regulations is provided in Attachments C and D.
[4] A comprehensive listing of District rules is included under separate cover in the *"2020 Reasonably Available Control Technology Demonstration for the National Ambient Air Quality Standards for Ozone in San Diego County."*
[5] A temperature inversion is a natural phenomenon where, uncertain weather conditions, a layer of warm air is situated on top of a layer of cooler air (typically, the atmosphere gets cooler as altitude increases). This occurs under very stable atmospheric conditions. The warm air layer acts like a lid on the atmosphere, trapping air pollution in the lower, cooler layer of air below it.
[6] 73 FR 16483
[7] 77 FR 30160
[8] 80 FR 12264
[9] 83 FR 62998
[10] 80 FR 65291
[11] 83 FR 62998
[12] 40 CFR 81.305, "Designation of Areas for Air Quality Planning Purposes – California."
[13] 81 FR 26697
[14] "2008 Eight-Hour Ozone Attainment Plan for San Diego County" December 2016.
[15] In light of this Attainment Plan addressing the more stringent requirements applicable to a Severe Nonattainment Area, the District hereby requests (through CARB) to withdraw consideration of the Moderate SIP Plan and RACT Demonstration submitted to the EPA on April 12, 2017.
[16] 84 FR 44238
[17] 83 FR 25776
[18] RACT requirements are addressed under separate cover in the *"2020 Reasonably Available Control Technology Demonstration for the National Ambient Air Quality Standards for Ozone in San Diego County."*
[19] Based on the 2019 CARB California Emissions Projection Analysis Model (CEPAM) emissions inventory, Version 1.00.
[20] 40 CFR Part 58, "Ambient Air Quality Surveillance."
[21] A design value is a statistic that describes the air quality status of a given location relative to the level of the NAAQS. Design values are typically used to designate and classify nonattainment areas, as well as to assess progress towards meeting the NAAQS.
[22] The South Coast air basin includes Orange County and the metropolitan portions of Los Angeles, Riverside, and San Bernardino Counties.
[23] "Ozone Transport Mitigation in California" CARB Status and Staff Report, April 8, 2004.

[24] California Code of Regulations, Section 70500

[25] "Final 2016 Air Quality Management Plan," South Coast Air Quality Management District. March 2017.

[26] See 80 FR 18120 pertaining to the Pechanga Reservation. As a result of this exception, the Pechanga reservation has been excluded for assessment and attainment planning purposes for San Diego County in this Attainment Plan, with the exception of emissions presented in Attachment A, which encompass all of San Diego County.

[27] 80 FR 12263

[28] 83 FR 62998

[29] The 2017 base year inventory was forecasted and backcasted for all previous and future years for mobile and area sources. For point sources, future years are forecasted, but the original historical point source emissions that were reported in 2011 are retained "as-is" in their original form. For Reasonable Further Progress purposes, the 2008 ozone NAAQS requires an RFP-specific emission inventory with a baseline year of 2011 (see *South Coast vs. EPA* ("South Coast II"), February 2018). For area sources, the 2011 baseline year used for Reasonable Further Progress for the 2008 ozone NAAQS is consistent with the 2017 base year inventory, since both utilize the same data and are backcasted.

[30] Revisions to all District NSR rules are made effective upon the date EPA finalizes approval of such rules into the SIP. The 2016 revisions were effective November 5, 2018. The 2019 revisions were submitted to the EPA on July 18, 2019.

[31] 2019 CARB CEPAM emissions inventory, Version 1.00.

[32] 2012-2016 data was interpolated, as needed.

[33] 2019 CARB CEPAM emission inventory, Version 1.00, includes regulatory control estimates received through April 2019.

[34] 40 CFR 51, Subpart W ("Determining Conformity of General Federal Actions to State or Federal Implementation Plans").

[35] District Rule 1501, "Conformity of General Federal Actions," approved by the EPA on April 23, 1999 (64 FR 19916).

[36] 40 CFR 51.858(a)(1).

[37] "Department of Navy 2017 Mobile Source Baseline and Emissions Growth Increment Request for Submittal to the San Diego Air Pollution Control District," Naval Facilities Engineering Command Southwest, San Diego, California, November 2018.

[38] Modeling results indicate that the planned military projects result in slightly higher ozone concentrations but no additional ozone exceedances.

[39] See Attachment C - LeighFisher. *Emissions Inventory of Airport-Related Sources*. Report. 2016. Print.

[40] SDIA is San Diego County's largest commercial service airport, handling more than 190,000 aircraft operations annually. Owned by the Authority, it is considered to be the busiest single-runway airport in the United States. It is located on a 661-acre constrained site in downtown San Diego, three miles west of the downtown business district. In addition to commercial service, SDIA also accommodates the majority of regional cargo demand via passenger airlines (belly cargo) and dedicated all-cargo air carriers.

[41] The Authority's Airport Development Plan concludes that substantial site modifications will be necessary to meet expected travel demand and geographical constraints by 2035.

[42] Attachment C - LeighFisher. *Emissions Inventory of Airport-Related Sources*. Report. 2016. Print.

[43] Table 7-2 of the SDIA inventory identifies 15 major projects targeted for completion by 2040. These include but are not limited to: (1) demolition and replacement of Terminal 1, (2) construction of additional parking plazas, (3) construction of a temporary runway, and (4) complete reconstruction of the existing runway.

[44] These categories include aircraft, roadway/parking garage, construction, and selected stationary sources including boilers, emergency generators, and traffic marking paints. The District compared the regionwide emission inventory (Attachment A) against the SDIA emission inventory (Attachment C) to identify discrepancies and overlaps. For example, the regionwide estimate for aircraft emissions in Attachment A already contains an estimate for all aircraft within San Diego County, which includes SDIA as well as other County general aviation airports. Similarly, roadways and parking garage emission estimates identified in the SDIA inventory are already encompassed within the regionwide emission inventory in the on-road vehicle category.

[45] 2019 CARB CEPAM emissions inventory, Version 1.00.

[46] Modeling results indicate that the projected increase in SDIA emissions results in slightly higher ozone concentrations but no additional ozone exceedances.

[47] In Fall 2019, the District and the Authority met to discuss if potential revisions to the Airport's emissions inventory were needed, in response to modifications to the Authority's Draft Airport Development Plan EIR. The Authority concluded that all proposed revisions within the recirculated EIR would not result in any change to projected emissions growth documented for conformity purposes. All proposed project revisions are still within the scope of SDIA growth emissions already incorporated into 2019 CEPAM emissions inventory (Version 1.00) and no revisions were needed.

[48] 70 FR 71676

[49] Facilities emitting less than 25 tons per year of VOC or NOx typically report emission/ usage data on an annual basis to the District. The data is entered into the District's emission inventory, where emissions are then estimated using calculation procedures, methods, and emission factors established by the District, EPA (such as AP-42), or CARB. The calculation procedures can be found on the District's website The calculated emissions are then described in an Emissions Inventory Report that is sent to the facility.

[50] 80 FR 12263

[51] 83 FR 62998

[52] 65 FR 12472

[53] Guidance on the Implementation of an Emission Statement Program – Draft. July, 1992. "Emission Statement Requirement Under 8-hour Ozone NAAQS Implementation" Memorandum. March 14, 2006.

[54] United States Environmental Protection Agency, Region IX Air Division. Technical Support Document for EPA's Notice of Proposed Rulemaking for the California State Implementation Plan. San Diego County Air Pollution Control District. David Albright, January 24, 2000. Page 4.

[55] In circumstances where a region has two different classification levels for the ozone NAAQS, the region must demonstrate that the respective NSR rules incorporate the most conservative applicability threshold and offset ratio.

[56] Pursuant to existing federal law and District rules, certain large facilities that propose large increases in air pollutant emissions must mitigate or offset those increases with emissions reductions achieved on site or elsewhere in the region. This requirement is designed to protect air quality while allowing for regional economic growth. Furthermore, facilities may offset their increased emissions of one air pollutant by reducing the emissions of another air pollutant, at prescribed ratios, where both pollutants (e.g. VOC and NOx) contribute to the same air quality nonattainment problem (e.g. ozone). These two pollutants can be "traded" during the permitting process to satisfy offset requirements. Amended Rule 20.3 is consistent with 40 CFR Part 51 Appendix S, Section IV.G.5, requiring permit applicants to conduct a thorough technical analysis following federal guidelines before IPT will be allowed for a project (i.e. "case-specific"). The analysis will determine the appropriate ratios for IPT that will provide an equivalent or greater ozone benefit in the region, compared to non-traded emissions offsets. IPT has been used three times in San Diego County over the past ten years to satisfy offset requirements, and only by new large emitters of air pollutants. Because new or modified large emitters are proposed infrequently, the IPT provisions now included in Rule 20.3 are not anticipated to have a substantive impact.

[57] Rules 20.1 and 20.4 will be proposed for amendment by June 2021 to ensure both rules are consistent with relevant CAA and ozone NAAQS requirements.

[58] Effective November 26, 2019, the EPA finalized the "Safer Affordable Fuel-Efficient (SAFE) Vehicles Rule Part One: One National Program." The CAA generally preempts State regulation of motor vehicles, however, California has historically been empowered to apply for, and receive, a waiver from this preemption via Section 209 of the CAA. Historically, this has been done in recognition of California's unique air quality concerns. In 2019, the EPA formally withdrew California's 2013 waiver, whereupon the federal government will provide nationwide uniform greenhouse gas emission standards for motor vehicles. On September 20, 2019, a lawsuit contesting the rulemaking was filed by California and 22 other states. This lawsuit is pending in the courts.

[59] "Revised Proposed 2016 State Strategy for the State Implementation Plan." March 7, 2017.

[60] "2018 Updates to the California State Implementation Plan." October 25, 2018.

[61] CARB 2020 Draft Mobile Source Strategy

[62] "California Air Resources Board (CARB) Staff: Update on Concepts to Minimize the Community Health Impacts from Large Freight Facilities – Advance Materials (Revised)" March 14, 2018.

[63] "Implementation of March 2017 Board Direction on Reducing the Community Health Impacts from Freight Facilities" CARB Discussion Paper, September 6, 2017.

[64] CAA Section 209(b)

[65] 78 FR 2112

[66] 84 FR 51310

[67] 85 FR 24174

[68] CARB submitted comments as part of the SAFE Vehicles rulemaking. Page 69 of those comments identified the anticipated impacts that the South Coast air basin might experience as a result of the SAFE Vehicles rule being adopted. CARB estimated about 1.24 tons of NOx per day would be added to the South Coast air basin and that 90% of those emissions would stem from “upstream fuel activity increases” (i.e. increased refinery emissions). In other words, about 10% (or 0.12 tons of NOx per day) would be expected from less stringent motor vehicles between 2021-2025. Given that San Diego County has fewer vehicles operating in the region, the emissions impact stemming from vehicles alone is likely to be less than the 0.12 tons projected in the South Coast air basin. Furthermore, San Diego County does not have any refineries, thus, additional refinery emissions in the region will be limited only to transported emissions from South Coast air basin on certain transport days, though the actual amount is unknown.

[69] 40 CFR 51.912(a)

[70] RACT compliance options include (1) certifying that ongoing RACT rules for one-hour ozone implementation represent RACT for eight-hour ozone purposes; or (2) making a new RACT determination and any associated rule revisions.

[71] The 2017 base year inventory was backcasted and forecasted for all previous and future years for mobile and area sources. For point sources, future years are forecasted, but the original historical point source emissions that were reported in 2011 are retained “as-is” in their original form. For Reasonable Further Progress purposes, the 2008 ozone NAAQS requires an RFP-specific emissions inventory with a baseline year of 2011 (see South Coast vs. EPA, 2018). For area sources, the 2011 baseline year used for Reasonable Further Progress for the 2008 ozone NAAQS is consistent with the 2017 base year inventory, since both utilize the same data and are backcasted.

[72] 40 CFR 51.910(a)(i).

[73] San Diego County’s ozone season (i.e. when exceedances of the eight-hour ozone standard can be expected) has long been specified in federal regulation (40 CFR Part 58, Appendix D, Section 2.5) as January through December. However, based on eight-hour ozone levels in recent years, the region’s ozone season is more likely May through September. For purposes of this Attainment Plan, the full ozone season remains January through December.

[74] 40 CFR 51.908(d).

[75] Subpart 2/Serious area nonattainment provisions were fully satisfied in San Diego County pursuant to the 1994 One- Hour Ozone Attainment Plan, approved by EPA (62 FR 1150). Compliance with Subpart 2 was reaffirmed by EPA when it redesignated the region to a Maintenance Area for the one-hour ozone standard (68 FR 13653).

[76] Effective August 2, 2010 (75 FR 38023). Under California law, the Bureau of Automotive Repair (BAR) is responsible for development and implementing the smog check program. The regulations establish minimum performance standards for “basic” and “enhanced” inspection and maintenance programs as well as various testing requirements.

[77] Effective July 13, 1993 (58 FR 28354)

[78] CAA §182(c)(4) and §246 require California to implement a Clean Fuels Fleet (CFF) program or opt-out of the CFF program by submitting a program or programs that will result in at least equivalent long-term reductions in ozone precursors and toxic air contaminant emissions. On November 15, 1994, CARB submitted its Low Emission Vehicle (LEV) program with enhancements to the EPA as a SIP revision to opt-out of the CFF program (e.g. 1994 California SIP Volume II, CARB Executive Order G-125-145). The submittal included a demonstration that California's LEV program achieved emission reductions equivalent to the reductions that would be achieved by the CFF program. The EPA approved the SIP revision to opt-out of the CFF program effective September 27, 1999 (64 FR 46849). California has continued to strengthen the emission requirements in its LEV program, adopting LEV II in 1998 and LEV III in 2012. On December 31, 2012, the EPA approved the waiver of CAA preemption for CARB's LEV III program. California's LEV program qualifies as a substitute for the CFF program and satisfies CAA §182(c)(4) and CAA §246 for the 2008 and 2015 ozone NAAQS.

[79] Effective May 8, 2000 (65 FR 12472)

[80] Effective October 30, 2017 (82 FR 45191)

[81] Table A-1 is for all of San Diego County (same as the air district) and includes marine emissions out to 100 nautical miles.

[82] Table A-3 is for the San Diego Air Basin and includes marine emissions out to three nautical miles. The three nautical mile extent is used for RFP purposes.

[83] Budgets were calculated by: (1) Calculating the on-road motor vehicle emissions totals for VOC and NOx using EMFAC2017 (Version 1.0.2) and activity data from SANDAG, (2) To reflect the impact of SAFE Vehicle Rule Part One, applying the EMFAC off-model adjustment factors to emissions from gasoline light-duty vehicles, and (3) Summing each pollutant and rounding the totals up to the nearest one-tenth of a ton (e.g. 0.1 ton per day).

[84] The VMT and speed distribution data for the San Diego region are from the most recently adopted 2019 Federal Regional Transportation Plan by SANDAG.

[85] EMFAC2017 was approved for use in SIPs and transportation conformity by U.S. EPA on August 15, 2019 (84 FR 41717).

[86] 40 CFR 93 ("Determining Conformity of Federal Actions to State or Federal Implementation Plans").

[87] 40 CFR 93.118 ("Criteria and Procedures: Motor Vehicle Emissions Budget").

[88] 82 FR 54339

[89] Also see Attachment H

[90] All nonattainment areas remain subject to CAA Subpart 1, however, in most cases, requirements found in CAA Subpart 2 supersede what is found within CAA Subpart 1.

[91] CAA §172(c)(1)

[92] This amount includes full implementation of Measure G.10 (Natural Gas-Fired Fan-Type Central Furnaces), which has an implementation deadline that goes beyond the 2025-2026 analysis years.

[93] In the 1982 SIP, TCMs 3 and 8 were combined into one comprehensive TCM, the "Ridesharing" TCM.

[94] "Transportation Control Measures for the Air Quality Plan," San Diego Association of Governments, 1992.

[95] CARB's authority to regulate greenhouse gas emissions from light-duty vehicles has been preempted by federal law and is being litigated in *Union of Concerned Scientists et al. v. NHTSA* (No. 19-1230 and consolidated cases) in the U.S. Court of Appeals for the District of Columbia Circuit. Other light-duty vehicle regulatory authority remains intact and unaltered.

[96] 80 FR 12264

[97] 62 FR 1150

[98] San Diego County's emission inventory base year is 2017. However, for RFP purposes, the District must utilize a 2011 baseline year solely for the purposes of demonstrating RFP so as to comply with CAA requirements. Consequently, RFP must be demonstrated for the six-year period between 2011-2017, as well as milestone years in 2020, 2023, and 2026.

[99] 40 CFR 51.910(b)(2)(ii).

[100] 62 FR 1150

[101] Includes Emission Reduction Credits in the District bank as of May 3, 2018, and adjustments for the EPA's Safer Affordable Fuel-Efficient (SAFE) Vehicles Rule Part One. Therefore, numbers may differ slightly from those in Table K-4.

[102] Ibid.

[103] An example of a finding could include, but may not be limited to, failure of San Diego County to attain the 2008 ozone NAAQS by the CAA-mandated deadline of August 3, 2033 (i.e. 2032 attainment year).

[104] 84 FR 44238

[105] The 2008 ozone NAAQS SIP requirements rule did not explicitly refer to the requirement for milestone compliance demonstrations. However, because the requirement is based upon requirements found in the CAA, the District and CARB interpret the requirement to also apply to 2008 ozone NAAQS implementation.

[106] Should the District attain the 2008 ozone NAAQS via submittal of a Maintenance Plan prior to the modeled attainment year (2026), the final MCD report for the 2008 ozone NAAQS would not be required to be submitted to the EPA.

[107] CAA Section 182(d)(3)

[108] For San Diego County, baseline emissions for major stationary sources would be established by using actual facility VOC and NOx emissions, as reported through the District's emission inventory, during the modeled attainment year for the 2008 ozone NAAQS (2026).

[109] Mathias, Scott. "Clean Air Act Section 185 Fee Rates Effective for Calendar Year 2018" Memorandum. December 21, 2018.

[110] Page, Stephen D. "Guidance on Developing Fee Programs required by Clean Air Act Section 185 for the 1-hour Ozone NAAQS" Memorandum. Attachment B. January 5, 2010.

[111] The Attainment Demonstration follows EPA's Modeling Guidance for Demonstrating Attainment of Air Quality Goals for Ozone, PM2.5, and Regional Haze (November 2018).

[112] The Modeled Attainment Test relies on the ability of the photochemical modeling system to simulate the change in ozone due to emission reductions, rather than considering the modeling results to represent exact values for future-year ozone concentrations. The model is run for both the 2017 baseline conditions and future 2026 scenario. The results of the baseline and future scenario model runs are compared to derive "Relative Response Factors" (RRFs) which predict the relative reduction in ozone concentrations between 2017 and 2026 resulting from control strategy implementation in the future year. The RRFs are then applied to monitored base-year (2017) design values to produce predicted future-year (2026) design values. The Modeled Attainment Test is "passed" if the predicted future-year design values at each site fall at or below 75.9 parts per billion (ppb).

[113] "Modeling Guidance for Demonstrating Attainment of Air Quality Goals for Ozone, PM2.5, and Regional Haze."

[114] As with other predictive tools, photochemical modeling has inherent uncertainties in predicting future design values due to variability in the year-to-year weather patterns,historical trends, and predictions of growth; all of which can change. Previous EPA modeling guidance estimated model uncertainty may range between 2-4 ppb for future ozone design values.

[115] 70 FR 71612 and 80 FR 12264

[116] 83 FR 61346

[117] Bahr v. EPA, 836 F.3d 1218, at 1235-1237 (9th Cir. 2016).

[118] 40 CFR 51.1312

[119] RACT compliance options include (1) certifying that ongoing RACT rules for one-hour ozone implementation represent RACT for eight-hour ozone purposes, or (2) making a new RACT determination and any associated rule revisions.

[120] 40 CFR 51.1310.

[121] San Diego County's ozone season (i.e. when exceedances of the eight-hour ozone standard can be expected) has long been specified in federal regulation (40 CFR Part 58, Appendix D, Section 2.5) as January through December. However, based on eight-hour ozone levels in recent years, the region's ozone season is more likely May through September. For purposes of this Attainment Plan, the full ozone season remains January through December.

[122] 40 CFR 51.1308.

[123] Subpart 2/Serious area nonattainment provisions were fully satisfied in San Diego County pursuant to the 1994 One- Hour Ozone Attainment Plan, approved by EPA (62 FR 1150). Compliance with Subpart 2 was reaffirmed by EPA when it redesignated the region to a Maintenance Area for the one-hour ozone standard (68 FR 13653).

[124] Effective August 2, 2010 (75 FR 38023). Under California law, the Bureau of Automotive Repair (BAR) is responsible for development and implementing the smog check program. The regulations establish minimum performance standards for "basic" and "enhanced" inspection and maintenance programs as well as testing requirements.

[125] Effective July 13, 1993 (58 FR 28354)

[126] CAA §182(c)(4) and §246 require California to implement a Clean Fuels Fleet (CFF) program or opt-out of the CFF program by submitting a program or programs that will result in at least equivalent long-term reductions in ozone precursors and toxic air contaminant emissions. On November 15, 1994, CARB submitted its Low Emission Vehicle (LEV) program with enhancements to the EPA as a SIP revision to opt-out of the CFF program (e.g. 1994 California SIP Volume II, CARB Executive Order G-125-145). The submittal included a demonstration that California's LEV program achieved emission reductions equivalent to the reductions that would be achieved by the CFF program. The EPA approved the SIP revision to opt-out of the CFF program effective September 27, 1999 (64 FR 46849). California has continued to strengthen the emission requirements in its LEV program, adopting LEV II in 1998, and LEV III in 2012. On December 31, 2012, the EPA approved the waiver of CAA preemption for CARB's LEV III program. California's LEV program qualifies as a substitute for the CFF program and satisfies CAA §182(c)(4) and CAA §246 for the 2008 and 2015 ozone NAAQS.

[127] Effective May 8, 2000 (65 FR 12472)

[128] Effective October 30, 2017 (82 FR 45191)

[129] Budgets were calculated by: (1) Calculating the on-road motor vehicle emissions totals for VOC and NOx using EMFAC2017 (Version 1.0.2) and activity data from SANDAG, (2) To reflect the impact of SAFE Vehicle Rule Part One, applying the EMFAC off-model adjustment factors to emissions from gasoline light-duty vehicles, and (3) Summing each pollutant and rounding the totals up to the nearest one-tenth of a ton (e.g. 0.1 ton per day).

[130] The VMT and speed distribution data for the San Diego region are from the most recently adopted 2019 Federal Regional Transportation Plan by SANDAG.

[131] EMFAC2017 was approved for use in SIPs and transportation conformity by U.S. EPA on August 15, 2019 (84 FR 41717).

[132] 40 CFR 93 ("Determining Conformity of Federal Actions to State or Federal Implementation Plans").

[133] 40 CFR 93.118 ("Criteria and Procedures: Motor Vehicle Emissions Budget").

[134] 82 FR 54339

[135] Also see Attachment H

[136] All nonattainment areas remain subject to CAA Subpart 1, however, in most cases, requirements found in CAA Subpart 2 supersede what is found within CAA Subpart 1.

[137] CAA §172(c)(1)

[138] In the 1982 SIP, TCMs 3 and 8 were combined into one comprehensive TCM, the "Ridesharing" TCM.

[139] "Transportation Control Measures for the Air Quality Plan," San Diego Association of Governments, 1992.

[140] CARB's authority to regulate greenhouse gas emissions from light-duty vehicles has been preempted by federal law and is being litigated in *Union of Concerned Scientists et al. v. NHTSA* (No. 19-1230 and consolidated cases) in the U.S. Court of Appeals for the District of Columbia Circuit. Other light-duty vehicle regulatory authority remains intact and unaltered.

[141] 83 FR 62998

[142] 62 FR 1150

[143] San Diego County's emission inventory and RFP base year is 2017. Consequently, RFP must be demonstrated for the six-year period between 2017-2013, as well as milestone years in 2026, 2029, and 2032.

[144] 40 CFR 51.910(b)(2)(ii).

[145] 62 FR 1150

[146] Includes Emission Reduction Credits in the District bank as of May 3, 2018, and adjustments for the EPA's Safer Affordable Fuel-Efficient (SAFE) Vehicles Rule Part One. Therefore, numbers may differ slightly from those in Table K-4.

[147] Ibid.

[148] An example of a finding could include, but may not be limited to, failure of San Diego County to attain the 2008 ozone NAAQS by the CAA-mandated deadline of August 3, 2033 (i.e. 2032 attainment year).

[149] Unlike the 2008 ozone NAAQS SIP requirements rule, the 2015 ozone NAAQS SIP requirements rule does explicitly refer to the requirement for milestone compliance demonstrations, in reference to CAA requirements.

[150] Should the District attain the 2015 ozone NAAQS via submittal of a Maintenance Plan prior to the modeled attainment year (2032), the final MCD report for the 2015 ozone NAAQS would not be required to be submitted to the EPA.

[151] CAA Section 182(d)(3)

[152] For San Diego County, baseline emissions for major stationary sources would be established by using actual facility VOC and NOx emissions, as reported through the District's emission inventory, during the modeled attainment year for the 2015 ozone NAAQS (2032).

[153] Mathias, Scott. "Clean Air Act Section 185 Fee Rates Effective for Calendar Year 2018" Memorandum. December 21, 2018.

[154] Page, Stephen D. "Guidance on Developing Fee Programs required by Clean Air Act Section 185 for the 1-hour Ozone NAAQS" Memorandum. Attachment B. January 5, 2010.

[155] The Attainment Demonstration follows EPA's Modeling Guidance for Demonstrating Attainment of Air Quality Goals for Ozone, PM2.5, and Regional Haze (November 2018).

[156] The Modeled Attainment Test relies on the ability of the photochemical modeling system to simulate the change in ozone due to emission reductions, rather than considering the modeling results to represent exact values for future-year ozone concentrations. The model is run for both the 2017 baseline conditions and future 2032 scenario. The results of the baseline and future scenario model runs are compared to derive "Relative Response Factors" (RRFs) which predict the relative reduction in ozone concentrations between 2017 and 2032 resulting from control strategy implementation in the future year. The RRFs are then applied to monitored base-year (2017) design values to produce predicted future-year (2032) design values. The Modeled Attainment Test is "passed" if the predicted future-year design values at each site fall at or below 70.9 parts per billion (ppb).

[157] The 2017-2019 design value at San Diego-Kearny Villa Road is 71 ppb. A third monitoring site (Escondido) exhibited a design value over 70 ppb at the time it was evicted from its historic location in 2015, and therefore may still have a design value in violation of the 2015 ozone NAAQS until three years of data are procured from its new location. The District is in the process of re-locating the Escondido monitor.

[158] "Modeling Guidance for Demonstrating Attainment of Air Quality Goals for Ozone, PM2.5, and Regional Haze."

[159] As with other predictive tools, photochemical modeling has inherent uncertainties in predicting future design values due to variability in the year-to-year weather patterns, historical trends, and predictions of growth; all of which can change. Previous EPA modeling guidance estimated model uncertainty may range between 2-4 ppb for future ozone design values..

[160] 70 FR 71612 and 80 FR 12264

[161] 83 FR 61346

[162] Bahr v. EPA, 836 F.3d 1218, at 1235-1237 (9th Cir. 2016).

[163] An example of a finding could include, but may not be limited to, failure of San Diego County to attain the 2008 ozone NAAQS by the CAA-mandated deadline of July 20, 2027 (i.e. 2026 attainment year).

[164] Practically speaking, the percent of vacuum trucks operating in San Diego County is likely to be far less than 10% of all Heavy-Duty Trucks operating in the County, since the trucks are not ubiquitous.

[165] A 2001 study sponsored by CARB estimated that of a restaurant's total VOC emissions, 13% emanate from chain-driven charbroilers, 13% emanate from griddles, and 69% emanate from underfired charbroilers.

[166] Per Appendix A, Table 3.

[167] The District obtained a list of all restaurants with active permits from the San Diego County Department of Environmental Health. Of the 8,000+ restaurant facilities listed, the District only counted restaurants that are well-known to use charbroilers in their operations.

[168] Ventura County APCD's Rule 74.31 Final Staff Report noted the Independent Lubricant Manufacturers Association (ILMA), as well as the leading manufacturer of metalworking fluid, supported the adoption of SCAQMD Rule 1144 in 2009, as well as Rule 74.31 in 2013.

[169] Revenue (car) miles are the total distance that a fleet travels while available for passenger service.

[170] The San Diego Trolley is currently a 54-mile light rail transit system serving southern San Diego County.

[171] The COASTER is a 42-mile passenger rail line between Oceanside and downtown San Diego that began service in 1996.

[172] Metropolitan Transit Service (MTS) and North County Transit District (NCTD)

[173] Variable tolls for solo drivers based on traffic congestion in the general lanes.

[174] 40 CFR 51.150 et seq.

[175] SDAPCD Compliance Advisory for District Enforcement of Mobile Source Regulations

[176] CARB State SIP Strategy.

[177] CARB Technology and Fuel Assessments webpage.

[178] CARB 2016 Mobile Source Strategy webpage.

[179] EPA One National Program Rule webpage.

[180] Executive Order B-16-2012.

[181] EPA Approval of South Coast Eight-Hour Ozone Plan webpage https://www.regulations.gov/document?D=EPA-R09-OAR-2019-0051-0001

[182] EPA Approval of South Coast 24-hour PM2.5 Plan webpage https://www.regulations.gov/document?D=EPA-R09-OAR-2017-0490-0003

[183] EPA Approval of San Joaquin Valley 2003 PM10 Plan https://www.govinfo.gov/content/pkg/FR-2004-02-04/pdf/04-2264.pdf

[184] The Alpine monitor is primarily affected by pollution transported from upwind sources, so in order to accurately simulate ozone at Alpine it is most critical to capture the upwind emissions sources, transport patterns, and chemistry within the polluted air mass during transport. The ozone model performance at Alpine suggests that those three components are reasonable captured within the modeling system. The under prediction of NO2 at Alpine, particularly during nighttime in summer months, is likely due to multiple factors. First, the primary NOx emissions source near the Alpine monitor is on-road emissions from Highway 8. Given that there are few other NOx emissions sources in the region, grid cell averaging will result in simulated NOx levels that are lower than what is observed at Alpine. Figure K-14 shows hourly ozone at Alpine between June 15, 2017 and July 22, 2017. Although the modeling system is able to capture peak daytime ozone on most days, it does not capture the nighttime lows. This is consistent with NO being too low due to grid cell averaging such that the modeling system does not have sufficient NO to titrate the nighttime ozone to the observed levels. This is likely exacerbated by low nighttime mixing heights that are difficult to simulate in the mountainous terrain where the Alpine monitor is located.

[185] U.S. Environmental Protection Agency [EPA]: Office of Transportation and Air Quality. (2012, August). *Implementing Clean Air 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* (EPA-420-B-12-053). Retrieved from http://www.epa.gov/otaq/stateresources/policy/general/420b12053.pdf

[186] More information on data sources can be found in the EMFAC technical support documentation at: https://ww2.arb.ca.gov/our-work/programs/mobile-source-emissions-inventory/msei-road-documentation

[187] 84 FR 41717 https://www.federalregister.gov/d/2019-17476

[188] EMFAC Off-Model Adjustment Factors to Account for the SAFE Vehicle Rule Part One, https://ww3.arb.ca.gov/msei/emfac_off_model_adjustment_factors_final_draft.pdf

[189] 80 FR 12264

[190] *Bahr v. U.S. Environmental Protection Agency,* (9th Cir. 2016) 836 F.3d 1218.

[191] "Proposed Amendments to District Rule 4601 (Architectural Coatings)" San Joaquin Valley APCD Staff Presentation. April 16, 2020. Slide 5. https://www.valleyair.org/Board_meetings/GB/agenda_minutes/Agenda/2020/April/presentations/11.pdf

[192] "Staff Report for Proposed Updates to the Suggested Control Measure for Architectural Coatings" California Air Resources Board. April 19, 2019. https://ww3.arb.ca.gov/coatings/arch/2019_scm_staff_report.pdf

[193] 2019 CARB CEPAM emissions inventory, Version 1.00. See Attachment A (Table A-3).